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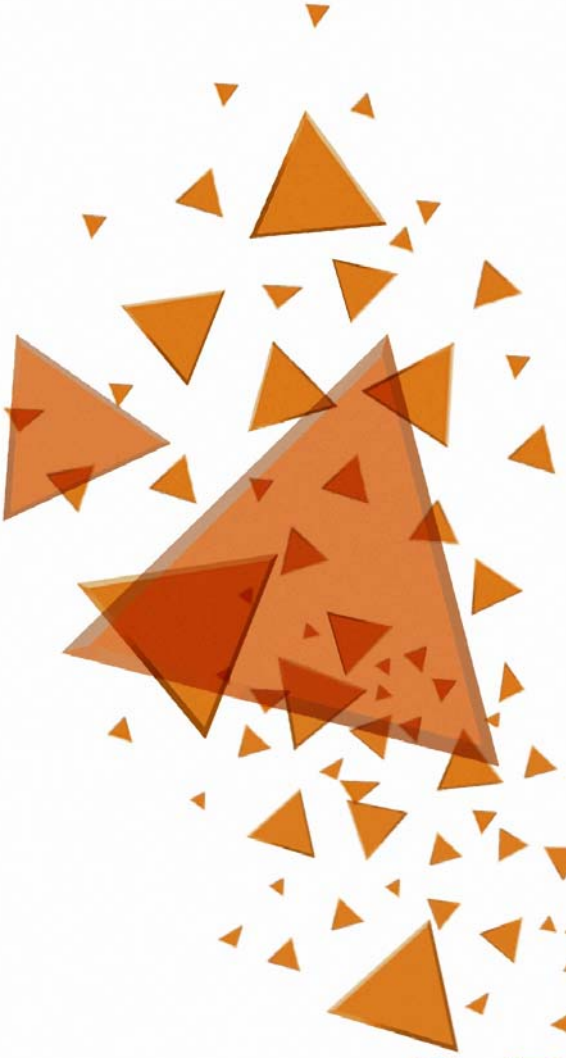

VORTEX
OPENSPLICE

C++ Reference Guide

Release 6.x

Vortex OpenSplice

C++ Reference Guide

PRISMTECH™
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About the C++ Reference Guide

The *C++ Reference Guide* provides a detailed explanation of the Vortex OpenSplice (***S**ubscription **P**aradigm for the **L**ogical **I**nterconnection of **C**oncurrent **E**ngines*) Application Programming Interfaces for the C++ language.

This reference guide is based on the OMG's *Data Distribution Service Specification* and *C++ Language Mapping Specification*.

The C++ Reference Guide describes the Data Centric Publish Subscribe (DCPS) layer. The purpose of the DCPS is the distribution of data (publish/subscribe). The structure of the DCPS is divided into five modules. Each module consists of several classes, which in turn generally contain several operations.

Intended Audience

The *C++ Reference Guide* is intended to be used by C++ programmers who are using Vortex OpenSplice to develop applications.

Organisation

The C++ Reference Guide is organised as follows:

An *Introduction* describes the details of the document structure.

Chapter 1, *DCPS API General Description*, is a general description of the DCPS API and its error codes.

Chapter 2, *DCPS Modules*, provides the detailed description of the DCPS modules.

Chapter 3, *DCPS Classes and Operations*, provides the detailed description of the DCPS classes, structs and operations.

The following appendices are included, as well as a *Bibliography* containing references material and *Glossary*:

Appendix A, *Quality Of Service*

Appendix B, *API Constants and Types*

Appendix C, *Platform Specific Model IDL Interface*

Appendix D, *SampleStates, ViewStates and InstanceStates*

Appendix E, *Class Inheritance*

Appendix F, *Listeners, Conditions and Waitsets*

Appendix G, *Topic Definitions*

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Conventions

The conventions listed below are used to guide and assist the reader in understanding the C++ Reference Guide.


Item of special significance or where caution needs to be taken.

i Item contains helpful hint or special information.

WIN Information applies to Windows (*e.g.* XP, 2003, Windows 7) only.

UNIX Information applies to Unix based systems (*e.g.* Solaris) only.

C C language specific

C++ C++ language specific

Java Java language specific

Hypertext links are shown as *blue italic underlined.*

On-Line (PDF) versions of this document: Cross-references, such as 'see *Contacts* on page 5', act as hypertext links: click on the reference to go to the item.

```
%  Commands or input which the user enters on the
   command line of their computer terminal
```

`Courier` fonts indicate programming code and file names.

Extended code fragments are shown in shaded boxes:

```
NameComponent newName[] = new NameComponent[1];

// set id field to "example" and kind field to an empty string
newName[0] = new NameComponent ("example", "");
```

Italics and ***Italic Bold*** are used to indicate new terms, or emphasise an item.

Sans-serif Bold is used to indicate user actions, *e.g.* **File > Save** from a menu.

Step 1: One of several steps required to complete a task.

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Introduction

About the C++ Reference Guide

Document Structure

The C++ Reference Guide document structure is based on the structure of the DCPS Platform Independent Model (DCPS PIM) of the Data Distribution Service Specification. The detailed description is subdivided into the PIM Modules, which are then subdivided into classes.

Some of the classes are implemented as structs in the DCPS Platform Specific Model (DCPS PSM) of the Data Distribution Service Specification, as indicated in the Interface Description Language (IDL) chapter of the PSM (see Appendix C, *Platform Specific Model IDL Interface*. These structs are described in the respective chapters.

- In the classes as described in the PIM, which are implemented as a class in the PSM, the operations are described in detail.
- In the classes as described in the PIM, which are implemented as a struct in the PSM, the struct contents are described in detail.
- The order of the modules and classes is conform the PIM part.
- The order of the operations or struct contents is alphabetical.
- Each description of a class or struct starts with the API description header file.

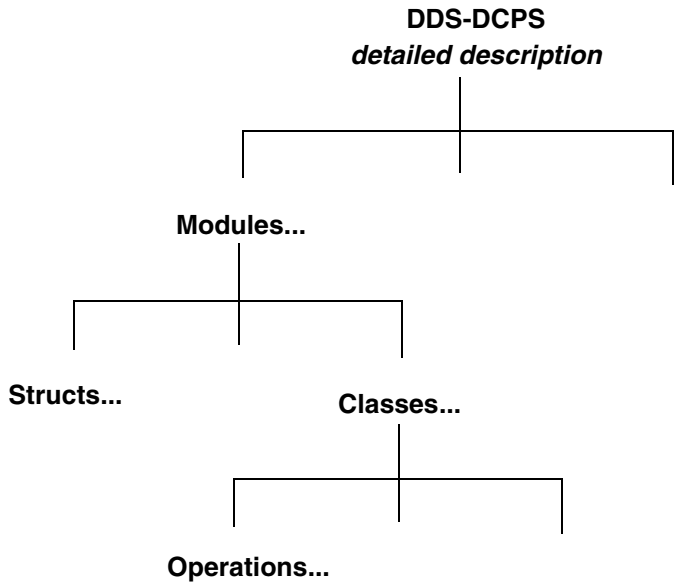

Figure 1 C++ Reference Guide Document Structure

Operations

Several types of operations are described in this manual. The different types of operations are: basic, inherited, abstract and abstract interface. All operations of any type can be found in their respective class. The details of their description depends on the type of operation.

Basic operations are described in detail in the class they are implemented in.

- Inherited operations only refer to the operation in the class they are inherited from. The detailed description is not repeated.
- Abstract operations only refer to the type specific implementations in their respective derived class. The detailed description is not repeated.
- Abstract operations which are implemented as an interface (`Listeners`), are described in detail in their class. These operations must be implemented in the application.

API Reference

CHAPTER

1 DCPS API General Description

The structure of the DCPS is divided into modules, which are described in detail in the next chapter. Each module consists of several classes, which in turn may contain several operations.

Some of these operations have an operation return code of type `ReturnCode_t`, which is defined in the next table:

Table 1 Return Codes

ReturnCode_t	Return Code Description
`RETCODE_OK`	Successful return
`RETCODE_ERROR`	Generic, unspecified error
`RETCODE_BAD_PARAMETER`	Illegal parameter value
`RETCODE_UNSUPPORTED`	Unsupported operation or `QosPolicy` setting. Can only be returned by operations that are optional or operations that uses an optional `<Entity>QoS` as a parameter
`RETCODE_ALREADY_DELETED`	The object target of this operation has already been deleted
`RETCODE_OUT_OF_RESOURCES`	Service ran out of the resources needed to complete the operation
`RETCODE_NOT_ENABLED`	Operation invoked on an `Entity` that is not yet enabled
`RETCODE_IMMUTABLE_POLICY`	Application attempted to modify an immutable `QosPolicy`
`RETCODE_INCONSISTENT_POLICY`	Application specified a set of policies that are not consistent with each other
`RETCODE_PRECONDITION_NOT_MET`	A pre-condition for the operation was not met
`RETCODE_TIMEOUT`	The operation timed out
`RETCODE_ILLEGAL_OPERATION`	An operation was invoked on an inappropriate object or at an inappropriate time (as determined by QosPolicies that control the behaviour of the object in question). There is no precondition that could be changed to make the operation succeed. ⚠ This code can not be returned in C++.
`RETCODE_NO_DATA`	Indicates a situation where the operation did not return any data

The name scope (name space) of these return codes is `DDS`. The operation return codes `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_BAD_PARAMETER`, `RETCODE_UNSUPPORTED` and `RETCODE_ALREADY_DELETED` are default for operations that return an operation return code and are therefore not explicitly mentioned in the DDS specification. However, in this manual they are mentioned along with each operation.

Some operations are not implemented. These operations are mentioned including their synopsis, but not described in this manual and return `RETCODE_UNSUPPORTED` when called from the application. See Appendix B, *API Constants and Types*.

The return code `RETCODE_ILLEGAL_OPERATION` can never be returned in C++: it indicates that you tried to invoke an operation on the wrong class, which in a real Object Oriented language like C++ is never possible.

1.1 Thread Safety

All operations are thread safe.

1.2 Signal Handling

UNIX

Every application that participates in a domain should register signal-handlers in order to protect the data distribution service in case of an exception or termination request. This is done automatically when the application calls the `DDS::DomainParticipantFactory::get_instance` operation. The data distribution service distinguishes between two kinds of signals: synchronous (*i.e.* exceptions) and asynchronous signals (*i.e.* termination requests).

1.2.1 Synchronous Signals

The data distribution service registers a signal-handler for the following synchronous signals: `SIGILL`, `SIGTRAP`, `SIGABRT`, `SIGFPE`, `SIGBUS`, `SIGSEGV` and `SIGSYS`. If a signal-handler is already registered for any of these signals it will be chained by the handlers registered by the data distribution service. Upon receiving any of the mentioned signals, the signal-handler will synchronously detach the application from the domain and call any chained handler if available. This allows core dumps to be created when an error occurs in application-code, without sacrificing the integrity of the data distribution service. Because the signal is processed synchronously, the offending thread will not be able to continue.

Synchronous signals can also be received asynchronously from another process (*i.e.* '`kill -ABRT <pid>`'). This is handled by the signal-handlers registered by the data distribution service and the behaviour will mimic the behaviour of a regular synchronous signal, occurring at the point in the application when the signal is received. A log message will be recorded stating that an asynchronously received synchronous signal occurred, including the source of the signal.

1.2.2 Asynchronous Signals

The asynchronous signal-handlers are only registered by the data distribution service if the application did not already register a handler, nor set the ignore-flag for these signals. If the data distribution service handlers are registered, the default handlers are chained. The signels that are handled are: `SIGINT`, `SIGQUIT`, `SIGTERM`, `SIGHUP` and `SIGPIPE`. When receiving any of these signals, the handlers of the data distribution service will ensure a disconnection from the domain. The default handler will in turn cause the application to terminate immediately.

1.3 Memory Management

When objects are being created, they will occupy memory space. To avoid memory leaks when they are not used any more, these objects will have to be deleted in order to release the memory space. However, when using pointers, it is difficult to keep track of which object has been released and which has not. When objects are not being released, the memory leak will finally use up all the resources and the application will fail.

1.3.1 Reference Count

The DDS API is described as a collection of IDL interfaces in the PSM. According to the IDL to C++ language mapping these interfaces must be mapped onto C++ classes that inherit from a `CORBA::Object` class. OpenSplice can currently *borrow* this class from any ORB installed on your system, but it also provides its own implementation libraries: which library is used depends on whether you use the Corba C++ API (CCPP) or the standalone C++ API (SACPP).

In order to cope with the memory management problems described above, CORBA objects keep some internal administration. In this administration, a reference count is included. This reference count holds the number of references to the object (assuming ownership). In other words, when a second reference is being made to the same object, the reference count in the internal administration of the object, must be increased. This way, both references may assume ownership of the same object. When one of the references runs out of scope, the reference count must be decreased by one. In this case the object must not be released because the reference count has not reach zero yet. Only when the second reference runs out of scope, the reference count reaches zero and the object must be released.

1.3.2 Reference Types

CORBA defines two types of references. The first one is the basic `<class>_ptr` type. When this type is used, the application must explicitly increase or decrease the reference count. The second one is the `<class>_var` type. This type is a smart pointer, which automatically updates the reference count of an object when that object is assigned to it and also updates the reference of the previous assigned

object. When this type is used, the application does not have to increase or decrease the reference count. Best practice is to use these <class>_var types instead of the <class>_ptr types. However, under certain conditions a <class>_ptr type must be used (refer to Section 1.3.2.2, *Var Reference Types*).

1.3.2.1 Pointer Types

When using <class>_ptr types the application must explicitly increase or decrease the reference count, by using the CORBA defined functions:

- *_duplicate* - creates another reference to the object. The object is not being copied but only the reference count in the internal administration of the object is increased and a new <class>_ptr type is returned. Both references have ownership. In other words, when one of them runs out of scope, the reference count must be decreased by calling _release. Only when _release is called for both of them, the object is removed;
- *_release* - informs the CORBA object that the application will not be using the reference any more. As a result, the operation will explicitly decrease the reference count of an object. After releasing, the application must not use the reference because from this moment on, it is unknown whether the object still exists.

When more references to <class>_ptr type are made by assignment, the reference count is not increased. When more references to <class>_ptr type are made by _duplicate, the reference count is increased on every call. Therefore _release must be called once for every _duplicate to decrease the reference count.

1.3.2.2 Var Reference Types

To prevent errors, CORBA defines the <class>_var types which assumes ownership of the object it is referring to. An _var type is considered to be a smart pointer, which not only includes the reference to the object but also automatically updates the internal reference count of the object.

1.3.2.3 Assignment

Assignment for <class>_ptr types and <class>_var types is defined for:

```
<class>_ptr types to <class>_var types
<class>_var types to <class>_var types
<class>_var types to <class>_ptr types
```

For instance, the result of a create_publisher (which returns a Publisher_ptr) can directly be assigned to a Publisher_var type. This assignment would transfer ownership of the Publisher object to the reference of Publisher_var type.

```
My_Publisher_var = create_publisher(PUBLISHER_QOS_DEFAULT,
```

```
                PublisherListener::_nil());
```

This assignment will wrap the return type `Publisher_ptr` in type Publisher_var and transfer ownership to My_Publisher_var. In other words, when My_Publisher_var runs out of scope, the `Publisher` is automatically removed.

The next assignment does not concern `<class>_var` types, but is only presented to show what will happen when a `<class>_var` type is not used.

```
My_Publisher_ptr = create_publisher(PUBLISHER_QOS_DEFAULT,
                                    PublisherListener::_nil());
```

This assignment will not wrap, but only makes a copy of the return type `Publisher_ptr`. The reference count is not automatically updated and the application has to make sure to release the object. In other words, when `My_Publisher_ptr` runs out of scope, the `Publisher` is not automatically removed and can not be removed any more since there is no reference available (not even by `delete_contained_entities`).

```
Another_Publisher_var = My_Publisher_var;
```

This assignment will create another reference to the `Publisher`. The object is not being copied but only the reference count in the internal administration of the `Publisher_var` type is increased. Both `Another_Publisher_var` and `My_Publisher_var` have ownership. In other words, when one of them runs out of scope, the reference count is decreased. Only when both of them run out of scope, the `Publisher` is removed.

```
Another_Publisher_ptr = My_Publisher_var;
```

This assignment will type cast the type `Publisher_var` to type `Publisher_ptr` and only makes a copy of the reference `My_Publisher_var`. The ownership is not transferred and the application may not release the object on account of `Another_Publisher_ptr` because the internal reference count was not increased. However, the application must be careful not to use `Another_Publisher_ptr` when `My_Publisher_var` runs out of scope because in that case, the `Publisher` is automatically removed and the `Another_Publisher_ptr` variable is invalid.

Var Reference Types Side Effect

As mentioned, under certain conditions a `<class>_ptr` type must be used, because the `<class>_var` type will cause a problem when a type cast is being done on an object. For example, the cast of an object of class `DataWriter` to the class `<type>DataWriter`.

When creating a `DataWriter`, the `create_datawriter` operation returns a generic `DataWriter_ptr` type (which we assign to `DataWriter_var`). However, an object of the `DataWriter` class does not have a `write` operation. To be able to use

such a typed operation, the application must perform a dynamic cast to the <type>DataWriter_ptr type. For example, when we have a DataWriter for the type Foo, it looks like:

```
GenericWriter_var = create_datawriter(MyTopic,
   MyWriterQos, _nil);
My_Writer_var = dynamic_cast<FooDataWriter_ptr>
   GenericWriter_var.in());
```

The problem here is that there are two DataWriter_var type references to the object without a duplication. This is because a cast only copies the same information and does not increase the internal counter. In other words, both DataWriter_var types considers to be the sole owner of the object, and therefore do not increase its reference counter. When one of the DataWriter_var types run out of scope, the entire object is removed, because the internal administration only had one reference accounted for. Therefore, when the second DataWriter_var type runs out of scope, the behaviour of your application has become undefined (most probably the application will eventually crash). This problem can be solved by using an explicit call to the DataWriter::_duplicate operation before assigning it to the second _var type, or by using a DataWriter_ptr type instead of a DataWriter_var type because a DataWriter_ptr type does not automatically decrease the reference counter when it runs out of scope.

```
GenericWriter_ptr = create_datawriter(MyTopic,
   MyWriterQos, _nil);
My_Writer_var =
 dynamic_cast<FooDataWriter_ptr>(GenericWriter_ptr.in());
```

Note in this case that GenericWriter_ptr must not be used after the assignment, since it will not be valid as soon as My_Writer_var runs out of scope.

1.4 Listener Interfaces

The Listener provides a generic mechanism (actually a callback function) for the Data Distribution Service to notify the application of relevant asynchronous communication status change events, such as a missed deadline, violation of a QosPolicy setting, etc.

The Listener interfaces are designed as an interface at PIM level. In other words, such an interface is part of the application which must implement the interface operations. A user-defined class for these operations must be provided by the application which must extend from the *specific* Listener class (according to the IDL-to-C++ specification an interface in IDL is mapped on a class in the C++ programming language). *All* Listener operations *must* be implemented in the user-defined class, it is up to the application whether an operation is empty or contains some functionality.

Each DCPS `Entity` supports its own specialized kind of `Listener`. Therefore, the following `Listeners` are available:

- `DomainParticipantListener`
- `ExtDomainParticipantListener`
- `TopicListener`
- `ExtTopicListener`
- `PublisherListener`
- `DataWriterListener`
- `SubscriberListener`
- `DataReaderListener`

Since a `DataReader` an `Entity`, it has the ability to have a `Listener` associated with it. In this case, the associated `Listener` must be of type `DataReaderListener`. A user-defined class must be provided by the application (for instance `My_DataReaderListener`) which must extend from the `DataReaderListener` class. *All* `DataReaderListener` operations *must* be implemented in the user-defined class, it is up to the application whether an operation is empty or contains some functionality.

As an example, one of the operations in the `DataReaderListener` is the `on_liveliness_changed`. This operation (implemented by the application) will be called by the Data Distribution Service when the liveliness of the associated `DataWriter` has changed. In other words, it serves as a callback function to the event of a change in liveliness. The parameters of the operation are supplied by the Data Distribution Service. In this example, the reference to the `DataReader` and the status of the liveliness are provided.

1.5 Inheritance of Abstract Operations

The information provided in this guide is based on:

- the PIM part of the DDS-DCPS specification for module descriptions
- the PSM part of the DDS-DCPS specification for class and operation descriptions.

Refer to the OMG's *Data Distribution Service Revised Final Adopted Specification, ptc/04-03-07,* for additional information.

At PIM level, inheritance is used to define abstract classes and operations. The OMG IDL PSM defines the interface for an application to interact with the Data Distribution Service (see Appendix C, *Platform Specific Model IDL Interface*). The DCPS API for the C++ language is as specified in the OMG's *C++ Language Mapping Specification*.

Inheritance of operations is not implemented when different type parameters for the same operation are used. In this case operations are implemented in their respective derived class (e.g. `get_qos` and `set_qos`). These operations are commented out in the IDL PSM.

CHAPTER

2 DCPS Modules

DCPS is divided into five modules, which are described briefly in this chapter. Each module consists of several classes as defined at PIM level in the DDS-DCPS specification. Some of the classes as described in the PIM are implemented as a struct in the PSM; these classes are treated as a class in this chapter according to the PIM with a remark about their implementation (struct). In the next chapter their actual implementations are described.

Each class contains several operations, which may be abstract. Those classes, which are implemented as a struct do not have any operations. The modules and the classes are ordered conform the DDS-DCPS specification. The classes, interfaces, structs and operations are described in the next chapter.

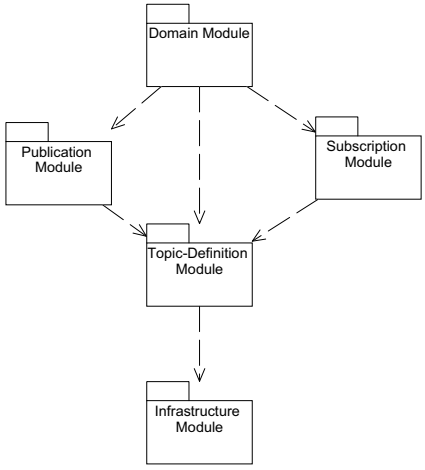

Figure 2 DCPS Module Composition

2.1 Functionality

The modules listed below provide the associated functions in the Data Distribution Service:

Infrastructure Module - This module defines the abstract classes and interfaces, which are refined by the other modules. It also provides the support for the interaction between the application and the Data Distribution Service (event-based and state-based);

Domain Module - This module contains the `DomainParticipant` class, which is the entry point of the application and `DomainParticipantListener` interface;

Topic-Definition Module - This module contains the `Topic`, `ContentFilteredTopic` and `MultiTopic` classes. It also contains the `TopicListener` interface and all support to define `Topic` objects and assign `QosPolicy` settings to them;

Publication Module - This module contains the `Publisher` and `DataWriter` classes. It also contains the `PublisherListener` and `DataWriterListener` interfaces;

Subscription Module - This module contains the `Subscriber`, `DataReader`, `ReadCondition` and `QueryCondition` classes. It also contains the `SubscriberListener` and `DataReaderListener` interfaces.

2.2 Infrastructure Module

This module defines the abstract classes and interfaces, which, in the PIM definition, are refined by the other modules. It also provides the support for the interaction between the application and the Data Distribution Service (event-based and state-based). The event-based interaction is supported by `Listeners`, the state-based interaction is supported by `WaitSets` and `Conditions`.

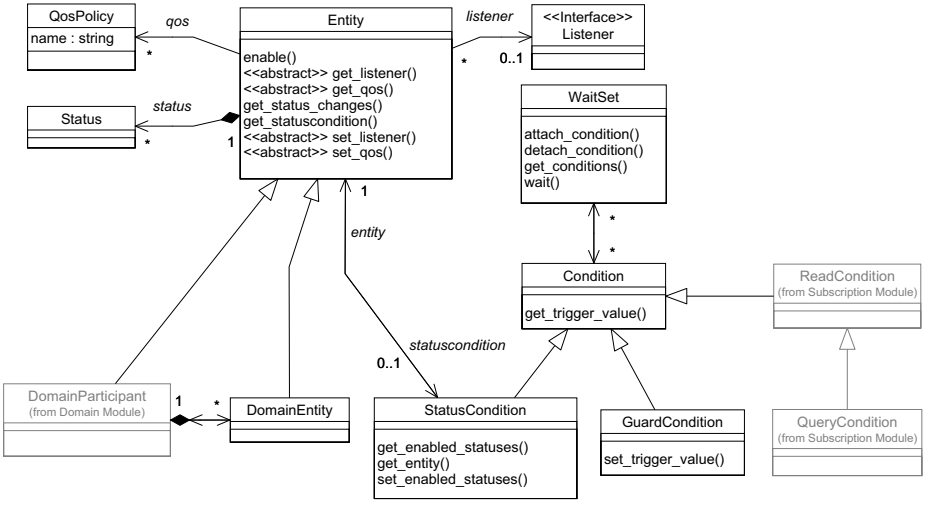

Figure 3 DCPS Infrastructure Module's Class Model

This module contains the following classes:

- `Entity` (abstract)
- `DomainEntity` (abstract)

- `QosPolicy` (abstract, struct)
- `Listener` (interface)
- `Status` (abstract, struct)
- `WaitSet`
- `Condition`
- `GuardCondition`
- `StatusCondition`

2.3 Domain Module

This module contains the class `DomainParticipant`, which acts as an entry point of the Data Distribution Service and acts as a factory for many of the classes. The `DomainParticipant` also acts as a container for the other objects that make up the Data Distribution Service. It isolates applications within the same `Domain` from other applications in a different `Domain` on the same set of computers. A `Domain` is a "virtual network" and applications with the same `domainId` are isolated from applications with a different `domainId`. In this way, several independent distributed applications can coexist in the same physical network without interfering, or even being aware of each other.

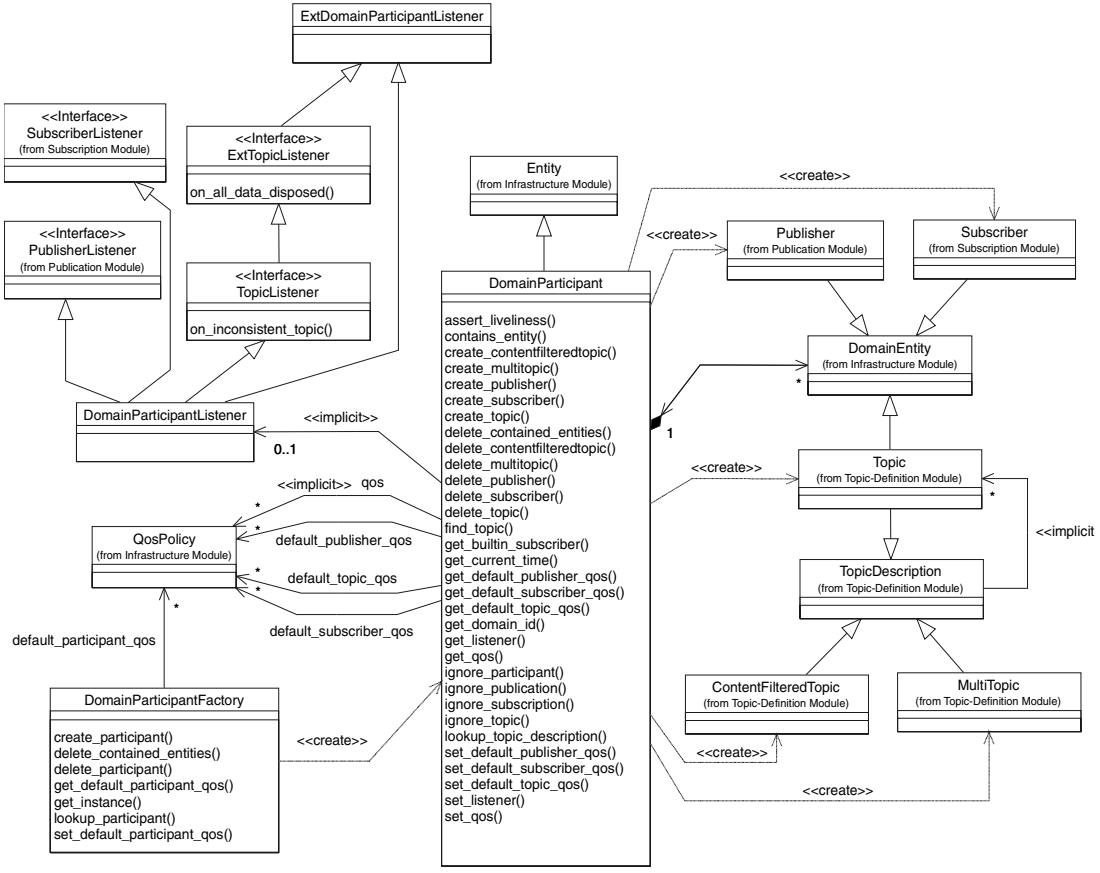

Figure 4 DCPS Domain Module's Class Model

This module contains the following classes:

- `DomainParticipant`
- `DomainParticipantFactory`
- `DomainParticipantListener` (interface)
- `Domain` (*not depicted*)

2.4 Topic-Definition Module

This module contains the `Topic`, `ContentFilteredTopic` and `MultiTopic` classes. It also contains the `TopicListener` interface and all support to define `Topic` objects and assign `QosPolicy` settings to them.

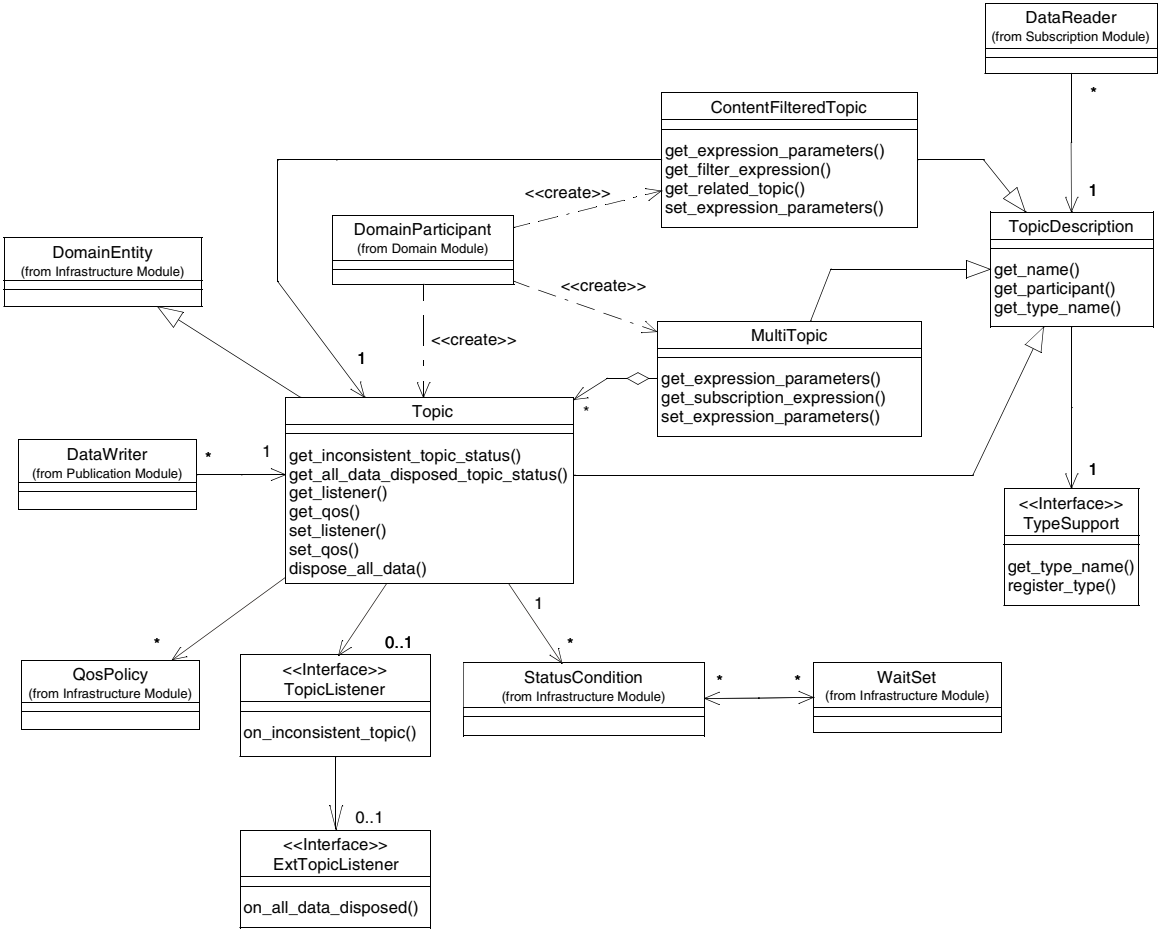

Figure 5 DCPS Topic-Definition Module's Class Model

This module contains the following classes:

- `TopicDescription` (abstract)
- `Topic`
- `ContentFilteredTopic`
- `MultiTopic`
- `TopicListener` (interface)
- Topic-Definition type specific classes

"Topic-Definition type specific classes" contains the generic class and the generated data type specific classes. In case of data type `Foo` (this also applies to other types); "Topic-Definition type specific classes" contains the following classes:

- `TypeSupport` (abstract)

- `FooTypeSupport`

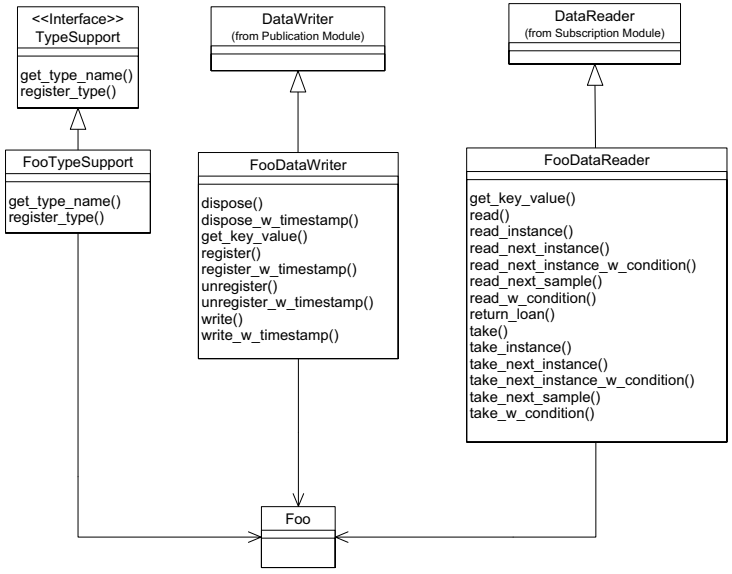

Figure 6 Data Type "Foo" Typed Classes for Pre-processor Generation

2.5 Publication Module

This module supports writing of the data, it contains the `Publisher` and `DataWriter` classes. It also contains the `PublisherListener` and `DataWriterListener` interfaces. Furthermore, it contains all support needed for publication.

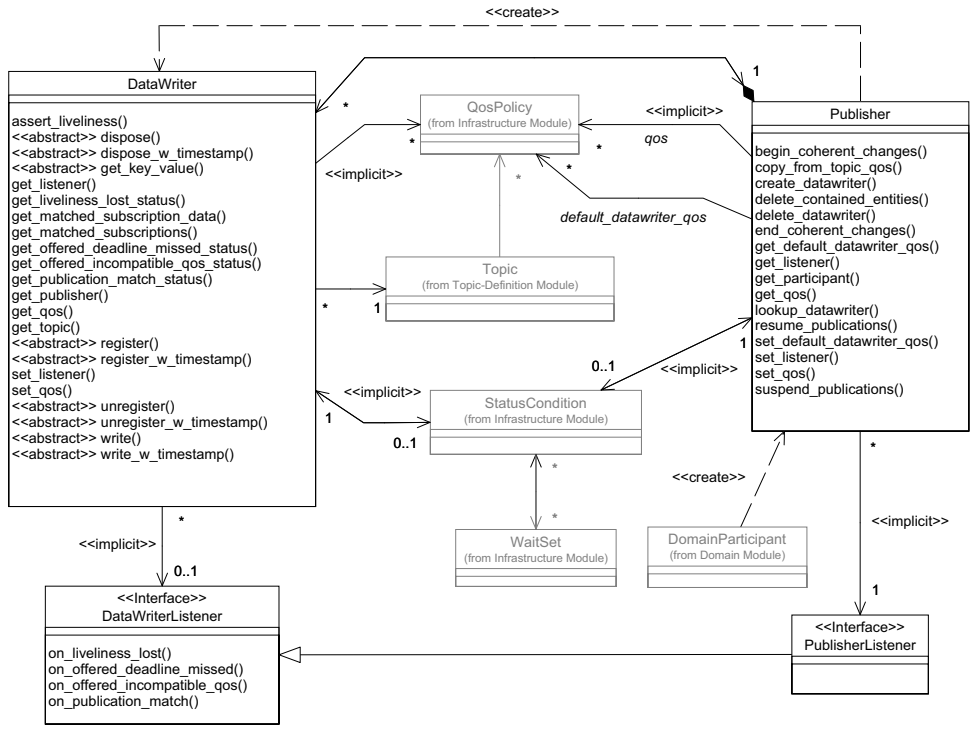

Figure 7 DCPS Publication Module's Class Model

This module contains the following classes:

- `Publisher`
- Publication type specific classes
- `PublisherListener` (interface)
- `DataWriterListener` (interface)

"Publication type specific classes" contains the generic class and the generated data type specific classes. In case of data type `Foo` (this also applies to other types); "Publication type specific classes" contains the following classes:

- `DataWriter` (abstract)
- `FooDataWriter`

2.6 Subscription Module

This module supports access to the data, it contains the `Subscriber`, `DataReader`, `ReadCondition` and `QueryCondition` classes. It also contains the `SubscriberListener` and `DataReaderListener` interfaces. Furthermore, it contains all support needed for subscription.

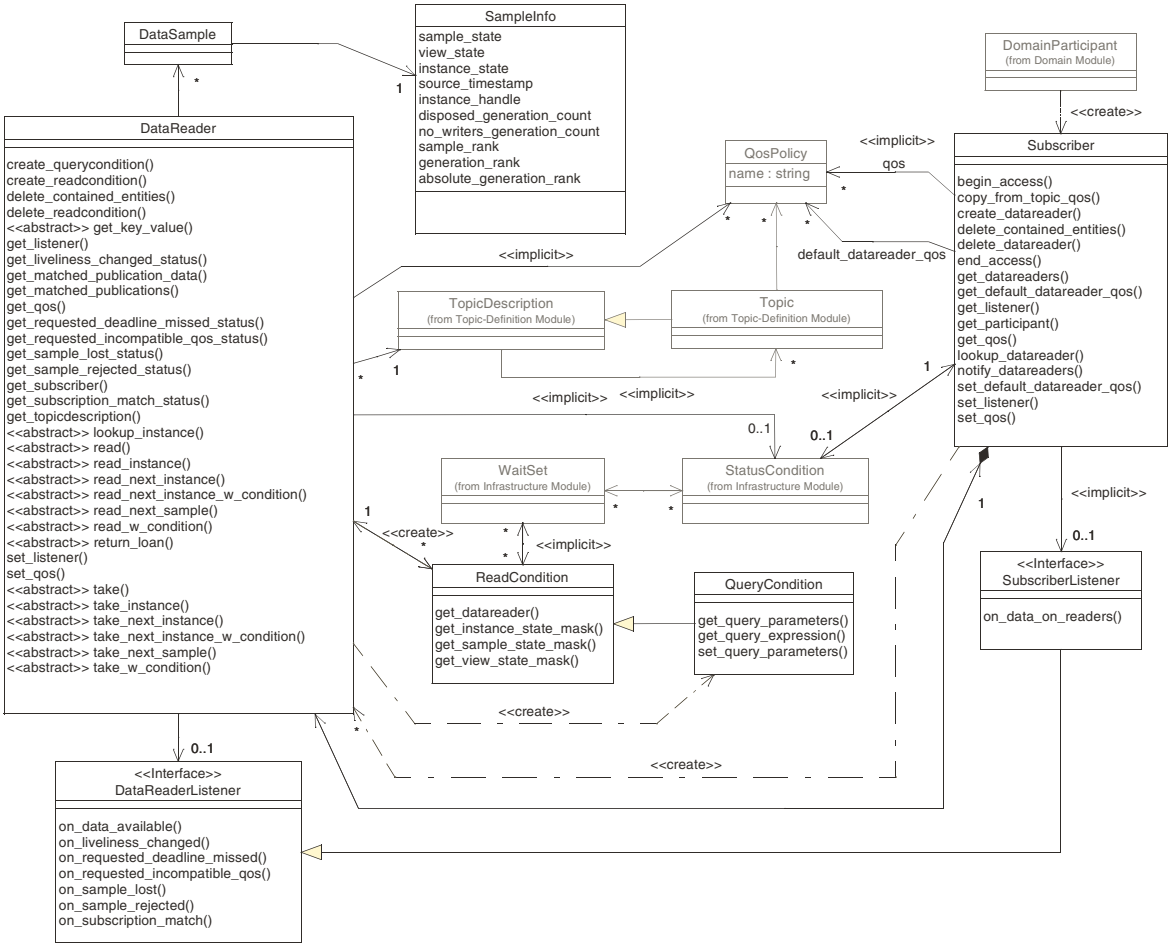

Figure 8 DCPS Subscription Module's Class Model

This module contains the following classes:

- `Subscriber`
- Subscription type specific classes
- `DataSample`
- `SampleInfo` (struct)
- `SubscriberListener` (interface)
- `DataReaderListener` (interface)
- `ReadCondition`
- `QueryCondition`

"Subscription type specific classes" contains the generic class and the generated data type specific classes. In case of data type `Foo` (this also applies to other types); "Subscription type specific classes" contains the following classes:

- `DataReader` (abstract)
- `FooDataReader`

CHAPTER

3 DCPS Classes and Operations

This chapter describes, for each module, its classes and operations in detail. Each module consists of several classes as defined at PIM level in the DDS-DCPS specification. Some of the classes are implemented as a struct in the PSM. Some of the other classes are abstract, which means that they contain some abstract operations.

The `Listener` *interfaces are designed as an interface at PIM level. In other words, the application must implement the interface operations. Therefore, all* `Listener` *classes are abstract. A user-defined class for these operations must be provided by the application which must extend from the specific* `Listener` *class. All* `Listener` *operations must be implemented in the user-defined class. It is up to the application whether an operation is empty or contains some functionality.*

Each class contains several operations, which may be abstract (base class). Abstract operations are not implemented in their base class, but in a type specific class or an application defined class (in case of a `Listener`*). Classes that are implemented as a struct do not have any operations. Some operations are inherited, which means that they are implemented in their base class.*

The abstract operations in a class are listed (including their synopsis), but not implemented in that class. These operations are implemented in their respective derived classes. The interfaces are fully described, since they must be implemented by the application.

3.1 Infrastructure Module

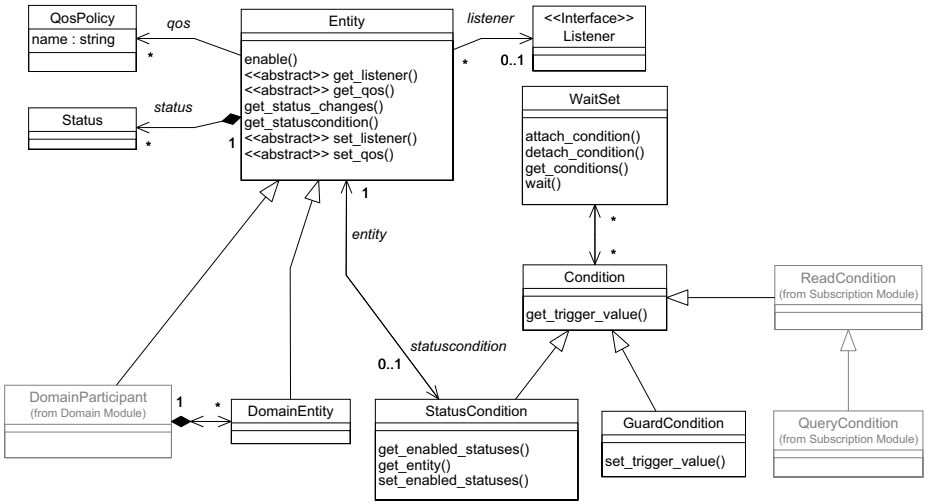

Figure 9 DCPS Infrastructure Module's Class Model

This module contains the following classes:

- `Entity` (abstract)
- `DomainEntity` (abstract)
- `QosPolicy` (abstract, struct)
- `Listener` (interface)
- `Status` (abstract, struct)
- `WaitSet`
- `Condition`
- `GuardCondition`
- `StatusCondition`
- `ErrorInfo`

3.1.1 Class Entity (abstract)

This class is the abstract base class for all the DCPS objects. It acts as a generic class for `Entity` objects.

The interface description of this class is as follows:

```
class Entity
{
//
```

```
    // abstract operations (implemented in class
    // DomainParticipant, Topic,
    // Publisher, DataWriter, Subscriber and DataReader)
    //
    // ReturnCode_t
    //    set_qos
    //       (const EntityQos& qos);
    // ReturnCode_t
    //    get_qos
    //       (EntityQos& qos);
    // ReturnCode_t
    //    set_listener
    //       (EntityListener_ptr a_listener,
    //         StatusMask mask);
    // EntityListener_ptr
    //    get_listener
    //       (void);
    //
    // implemented API operations
    //
       ReturnCode_t
          enable
             (void);
       StatusCondition_ptr
          get_statuscondition
             (void);
       StatusMask
          get_status_changes
             (void);
       InstanceHandle_t
          get_instance_handle
             (void);
    };
```

The next paragraphs list all `Entity` operations. The abstract operations are listed but not fully described because they are not implemented in this specific class. The full description of these operations is given in the subclasses, which contain the type specific implementation of these operations.

3.1.1.1 enable

Scope

`DDS::Entity`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   enable
```

```
(void);
```

Description

This operation enables the `Entity` on which it is being called when the `Entity` was created with the `EntityFactoryQosPolicy` set to `FALSE`.

Parameters

<none>

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_ALREADY_DELETED`, `RETCODE_OUT_OF_RESOURCES` or `RETCODE_PRECONDITION_NOT_MET`.

Detailed Description

This operation enables the `Entity`. Created `Entity` objects can start in either an enabled or disabled state. This is controlled by the value of the `EntityFactoryQosPolicy` on the corresponding factory for the `Entity`. Enabled entities are immediately activated at creation time meaning all their immutable QoS settings can no longer be changed. Disabled Entities are not yet activated, so it is still possible to change there immutable QoS settings. However, once activated the immutable QoS settings can no longer be changed.

Creating disabled entities can make sense when the creator of the `Entity` does not yet know which QoS settings to apply, thus allowing another piece of code to set the QoS later on.

The default setting of `EntityFactoryQosPolicy` is such that, by default, entities are created in an enabled state so that it is not necessary to explicitly call `enable` on newly created `entities`.

The `enable` operation is idempotent. Calling `enable` on an already enabled `Entity` returns `RETCODE_OK` and has no effect.

If an `Entity` has not yet been enabled, the only operations that can be invoked on it are: the ones to set, get or copy the `QosPolicy` settings, the ones that set (or get) the listener, the ones that get the `StatusCondition`, the `get_status_changes` operation (although the status of a disabled entity never changes), and the 'factory' operations that create, delete or lookup[1] other `Entities`. Other operations will return the error `RETCODE_NOT_ENABLED`.

`Entities` created from a factory that is disabled, are created disabled regardless of the setting of the `EntityFactoryQosPolicy`.

1. This includes the lookup_topicdescription, but not the find_topic.

Calling `enable` on an `Entity` whose factory is not enabled will fail and return `RETCODE_PRECONDITION_NOT_MET`.

If the `EntityFactoryQosPolicy` has `autoenable_created_entities` set to `TRUE`, the `enable` operation on the factory will automatically enable all `Entities` created from the factory.

The `Listeners` associated with an `Entity` are not called until the `Entity` is enabled. `Conditions` associated with an `Entity` that is not enabled are "inactive", that is, have a `trigger_value` which is `FALSE`.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the application enabled the `Entity` (or it was already enabled)
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_OUT_OF_RESOURCES`* - the Data Distribution Service ran out of resources to complete this operation.
- *`RETCODE_PRECONDITION_NOT_MET`* - the factory of the `Entity` is not enabled.

3.1.1.2 get_instance_handle

Scope

`DDS::Entity`

Synopsis

```
#include <ccpp_dds_dcps.h>
InstanceHandle_t
   get_instance_handle
      (void);
```

Description

This operation returns the `instance_handle` of the built-in topic sample that represents the specified `Entity`.

Parameters

<none>

Return Value

`InstanceHandle_t` - Result value is the `instance_handle` of the built-in topic sample that represents the state of this `Entity`.

Detailed Description

The relevant state of some `Entity` objects are distributed using built-in topics. Each built-in topic sample represents the state of a specific `Entity` and has a unique `instance_handle`. This operation returns the `instance_handle` of the built-in topic sample that represents the specified `Entity`.

Some `Entities` (`Publisher` and `Subscriber`) do not have a corresponding built-in topic sample, but they still have an `instance_handle` that uniquely identifies the `Entity`. The `instance_handles` obtained this way can also be used to check whether a specific `Entity` is located in a specific `DomainParticipant`. (See Section 3.2.1.2, *contains_entity*, on page 135.)

3.1.1.3 get_listener (abstract)

This abstract operation is defined as a generic operation to access a `Listener`. Each subclass derived from this class, `DomainParticipant`, `Topic`, `Publisher`, `Subscriber`, `DataWriter` and `DataReader` will provide a class specific implementation of this abstract operation.

Synopsis

```
#include <ccpp_dds_dcps.h>
EntityListener_ptr
   get_listener
      (void);
```

3.1.1.4 get_qos (abstract)

This abstract operation is defined as a generic operation to access a struct with the `QosPolicy` settings. Each subclass derived from this class, `DomainParticipant`, `Topic`, `Publisher`, `Subscriber`, `DataWriter` and `DataReader` will provide a class specific implementation of this abstract operation.

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_qos
      (EntityQos& qos);
```

3.1.1.5 get_status_changes

Scope

```
DDS::Entity
```

Synopsis

```
#include <ccpp_dds_dcps.h>
StatusMask
```

```
get_status_changes
   (void);
```

Description

This operation returns a mask with the communication statuses in the `Entity` that are “triggered”.

Parameters

<none>

Return Value

`StatusMask` - a bit mask in which each bit shows which value has changed.

Detailed Description

This operation returns a mask with the communication statuses in the `Entity` that are *triggered*. That is the set of communication statuses whose value have changed since the last time the application called this operation. This operation shows whether a change has occurred even when the status seems unchanged because the status changed back to the original status.

When the `Entity` is first created or if the `Entity` is not enabled, all communication statuses are in the “un-triggered” state so the mask returned by the operation is empty.

The result value is a bit mask in which each bit shows which value has changed. The relevant bits represent one of the following statuses:

- `INCONSISTENT_TOPIC_STATUS`
- `OFFERED_DEADLINE_MISSED_STATUS`
- `REQUESTED_DEADLINE_MISSED_STATUS`
- `OFFERED_INCOMPATIBLE_QOS_STATUS`
- `REQUESTED_INCOMPATIBLE_QOS_STATUS`
- `SAMPLE_LOST_STATUS`
- `SAMPLE_REJECTED_STATUS`
- `DATA_ON_READERS_STATUS`
- `DATA_AVAILABLE_STATUS`
- `LIVELINESS_LOST_STATUS`
- `LIVELINESS_CHANGED_STATUS`
- `PUBLICATION_MATCHED_STATUS`
- `SUBSCRIPTION_MATCHED_STATUS`
- `ALL_DATA_DISPOSED_TOPIC_STATUS`

Each status bit is declared as a constant and can be used in an AND operation to check the status bit against the result of type StatusMask. Not all statuses are relevant to all Entity objects. See the respective Listener interfaces for each Entity for more information.

3.1.1.6 get_statuscondition

Scope

DDS::Entity

Synopsis

```
#include <ccpp_dds_dcps.h>
StatusCondition_ptr
   get_statuscondition
      (void);
```

Description

This operation allows access to the StatusCondition associated with the Entity.

Parameters

<none>

Return Value

StatusCondition - the StatusCondition of the Entity.

Detailed Description

Each Entity has a StatusCondition associated with it. This operation allows access to the StatusCondition associated with the Entity. The returned condition can then be added to a WaitSet so that the application can wait for specific status changes that affect the Entity.

3.1.1.7 set_listener (abstract)

This abstract operation is defined as a generic operation to access a Listener. Each subclass derived from this class, DomainParticipant, Topic, Publisher, Subscriber, DataWriter and DataReader will provide a class specific implementation of this abstract operation.

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   set_listener
      (EntityListener_ptr a_listener,
```

```
                    StatusMask mask);
```

3.1.1.8 set_qos (abstract)

This abstract operation is defined as a generic operation to modify the `QosPolicy` settings. Each subclass derived from this class, `DomainParticipant`, `Topic`, `Publisher`, `Subscriber`, `DataWriter` and `DataReader` will provide a class-specific implementation of this abstract operation.

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   set_qos
      (const EntityQos& qos);
```

3.1.2 Class DomainEntity (abstract)

This class is the abstract base class for the all entities except `DomainParticipant`. The main purpose is to express that `DomainParticipant` is a special kind of `Entity`, which acts as a container of all other `Entity` objects, but cannot contain another `DomainParticipant` within itself. Therefore, this class is not part of the IDL interface in the DCPS PSM description.

The class `DomainEntity` does not contain any operations.

3.1.3 Struct QosPolicy

Each `Entity` provides an `<Entity>Qos` structure that implements the basic mechanism for an application to specify Quality of Service attributes. This structure consists of `Entity` specific `QosPolicy` attributes. `QosPolicy` attributes are structured types where each type specifies the information that controls an `Entity` related (configurable) property of the Data Distribution Service.

All `QosPolicies` applicable to an `Entity` are aggregated in a corresponding `<Entity>Qos`, which is a compound structure that is set atomically so that it represents a coherent set of `QosPolicy` attributes.

Compound types are used whenever multiple attributes must be set coherently to define a consistent attribute for a `QosPolicy`.

A full description of any `<Entity>Qos` is given in Appendix A, *Quality Of Service*. The complete list of individual `QosPolicy` settings and their meaning is described below.

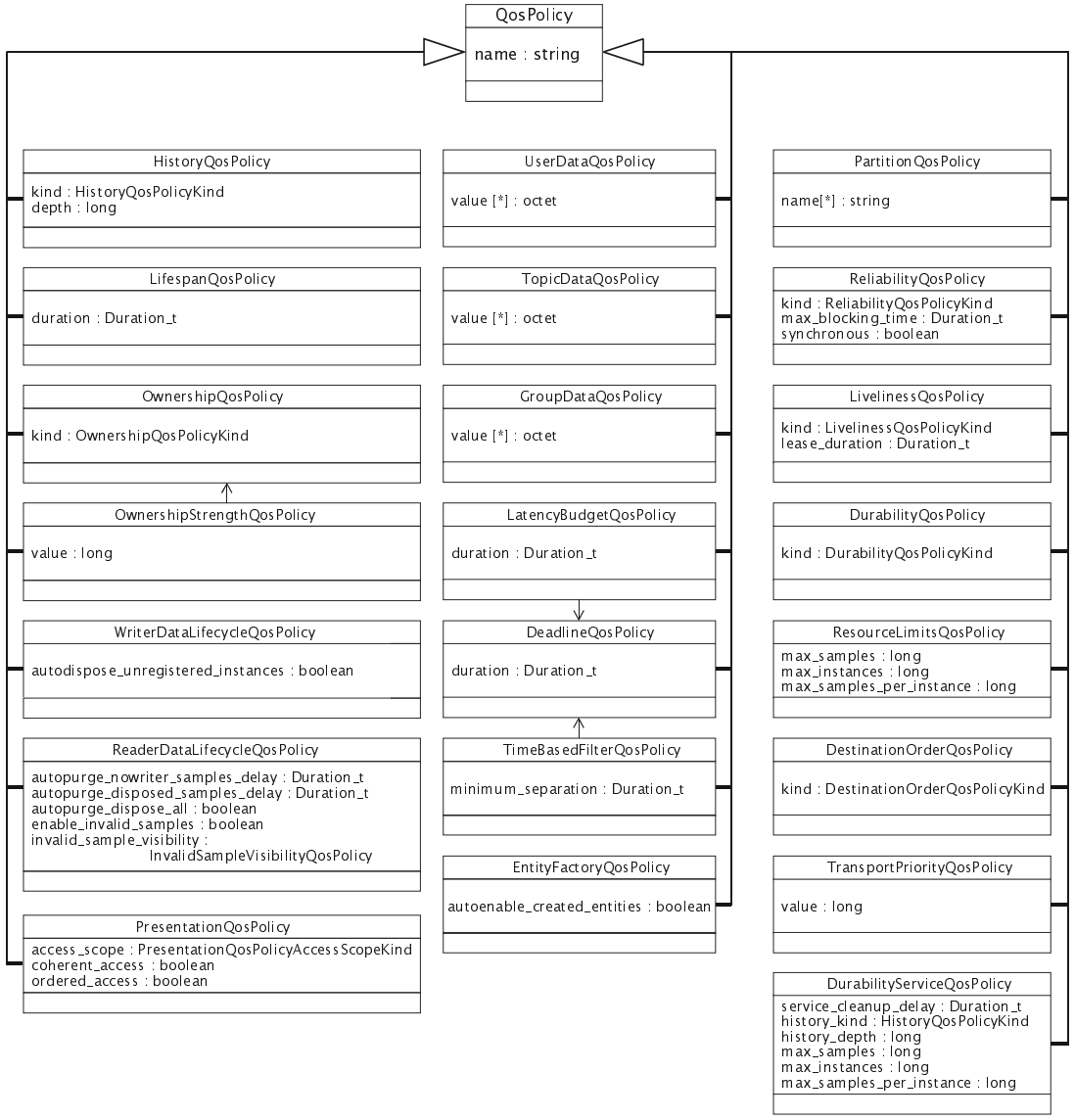

Figure 10 QosPolicy Settings

Requested/Offered

In several cases, for communications to occur properly (or efficiently), a `QosPolicy` on the requesting side must be compatible with a corresponding `QosPolicy` on the offering side. For example, if a `DataReader` requests to receive data reliably while the corresponding `DataWriter` defines a best-effort `QosPolicy`, communication will not happen as requested. This means that the

specification for QosPolicy follows the Requested/Offered (RxO) pattern while trying to maintain the desirable decoupling of publication and subscription as much as possible. When using this pattern:

- the requesting side can specify a *requested* attribute for a particular QosPolicy
- the offering side specifies an *offered* attribute for that QosPolicy

The Data Distribution Service will then determine whether the attribute requested by the requesting side is compatible with what is offered by the offering side. Only when the two QosPolicy settings are compatible, communication is established. If the two QosPolicy settings are not compatible, the Data Distribution Service will not establish communication between the two Entity objects and notify this fact by means of the OFFERED_INCOMPATIBLE_QOS status on the offering side and the REQUESTED_INCOMPATIBLE_QOS status on the requesting side. The application can detect this fact by means of a Listener or Condition.

The interface description of these QosPolicies is as follows:

```
// struct <Entity>Qos
//    see appendix
//
// struct <name>QosPolicy
//
   struct UserDataQosPolicy
      { OctetSeq value; };
   struct TopicDataQosPolicy
      { OctetSeq value; };
   struct GroupDataQosPolicy
      { OctetSeq value; };
   struct TransportPriorityQosPolicy
      { Long value; };
   struct LifespanQosPolicy
      { Duration_t duration; };
   enum DurabilityQosPolicyKind
      { VOLATILE_DURABILITY_QOS,
        TRANSIENT_LOCAL_DURABILITY_QOS,
        TRANSIENT_DURABILITY_QOS,
        PERSISTENT_DURABILITY_QOS };
   struct DurabilityQosPolicy
      { DurabilityQosPolicyKind kind; };
   enum PresentationQosPolicyAccessScopeKind
      { INSTANCE_PRESENTATION_QOS,
        TOPIC_PRESENTATION_QOS,
        GROUP_PRESENTATION_QOS };
   struct PresentationQosPolicy
      { PresentationQosPolicyAccessScopeKind access_scope;
        Boolean coherent_access;
        Boolean ordered_access; };
   struct DeadlineQosPolicy
```

```
   { Duration_t period; };
struct LatencyBudgetQosPolicy
   { Duration_t duration; };
enum OwnershipQosPolicyKind
   { SHARED_OWNERSHIP_QOS,
     EXCLUSIVE_OWNERSHIP_QOS };
struct OwnershipQosPolicy
   { OwnershipQosPolicyKind kind; };
struct OwnershipStrengthQosPolicy
   { Long value; };
enum LivelinessQosPolicyKind
   { AUTOMATIC_LIVELINESS_QOS,
     MANUAL_BY_PARTICIPANT_LIVELINESS_QOS,
     MANUAL_BY_TOPIC_LIVELINESS_QOS };
struct LivelinessQosPolicy
   { LivelinessQosPolicyKind kind;
     Duration_t lease_duration; };
struct TimeBasedFilterQosPolicy
   { Duration_t minimum_separation; };
struct PartitionQosPolicy
   { StringSeq name; };
enum ReliabilityQosPolicyKind
   { BEST_EFFORT_RELIABILITY_QOS,
     RELIABLE_RELIABILITY_QOS };
struct ReliabilityQosPolicy
   { ReliabilityQosPolicyKind kind;
     Duration_t max_blocking_time;
     Boolean synchronous; };
enum DestinationOrderQosPolicyKind
   { BY_RECEPTION_timestamp_DESTINATIONORDER_QOS,
     BY_SOURCE_timestamp_DESTINATIONORDER_QOS };
struct DestinationOrderQosPolicy
   { DestinationOrderQosPolicyKind kind; };
enum HistoryQosPolicyKind
   { KEEP_LAST_HISTORY_QOS,
     KEEP_ALL_HISTORY_QOS };
struct HistoryQosPolicy
   { HistoryQosPolicyKind kind;
     Long depth; };
struct ResourceLimitsQosPolicy
   { Long max_samples;
     Long max_instances;
     Long max_samples_per_instance; };
struct EntityFactoryQosPolicy
   { Boolean autoenable_created_entities; };
struct WriterDataLifecycleQosPolicy
   { Boolean autodispose_unregistered_instances; };
enum InvalidSampleVisibilityQosPolicyKind
  { NO_INVALID_SAMPLES,
    MINIMUM_INVALID_SAMPLES,
```

```
    ALL_INVALID_SAMPLES };
struct InvalidSampleVisibilityQosPolicy
  { InvalidSampleVisibilityQosPolicyKind kind; };
struct ReaderDataLifecycleQosPolicy
  { Duration_t autopurge_nowriter_samples_delay;
    Duration_t autopurge_disposed_samples_delay;
    Boolean autopurge_dispose_all;
    Boolean enable_invalid_samples; /* deprecated */
    InvalidSampleVisibilityQosPolicy
           invalid_sample_visibility; };
struct DurabilityServiceQosPolicy
   { Duration_t service_cleanup_delay;
     HistoryQosPolicyKind history_kind;
     Long history_depth;
     Long max_samples;
     Long max_instances;
     Long max_samples_per_instance; };
enum SchedulingClassQosPolicyKind
   { SCHEDULE_DEFAULT,
     SCHEDULE_TIMESHARING,
     SCHEDULE_REALTIME };
struct SchedulingClassQosPolicy
   { SchedulingClassQosPolicyKind kind; };
enum SchedulingPriorityQosPolicyKind
   { PRIORITY_RELATIVE,
     PRIORITY_ABSOLUTE };
struct SchedulingPriorityQosPolicy
   { SchedulingPriorityQosPolicyKind kind; };
struct SchedulingQosPolicy
   { SchedulingClassQosPolicy scheduling_class;
     SchedulingPriorityQosPolicy scheduling_priority_kind;
     long scheduling_priority; };
struct SubscriptionKeyQosPolicy
   { Boolean use_key_list,
     StringSeq key_list };
struct ReaderLifespanQosPolicy
   { Boolean use_lifespan,
     Duration_t duration };
struct ShareQosPolicy
   { String name,
     Boolean enable };
struct ViewKeyQosPolicy
   { Boolean use_key_list;
     StringSeq key_list };
```

Default Attributes

The default attributes of each `QosPolicy` are listed in *Table 2* below.

Table 2 QosPolicy Default Attributes

QosPolicy	Attribute	Value
user_data	value.length	0
topic_data	value.length	0
group_data	value.length	0
transport_priority	value	0
lifespan	duration	DURATION_INFINITE
durability	kind	VOLATILE_DURABILITY_QOS
presentation	access_scope	INSTANCE_PRESENTATION_QOS
	coherent_access	FALSE
	ordered_access	FALSE
deadline	period	DURATION_INFINITE
latency_budget	duration	0
ownership_strength	value	0
ownership	kind	SHARED_OWNERSHIP_QOS
liveliness	kind	AUTOMATIC_LIVELINESS_QOS
	lease_duration	DURATION_INFINITE
time_based_filter	minimum_separation	0
partition	name.length	0
reliability	kind	BEST_EFFORT_RELIABILITY_QOS
	max_blocking_time	100 ms
	synchronous	FALSE
destination_order	kind	BY_RECEPTION_TIMESTAMP_ DESTINATIONORDER_QOS
history	kind	KEEP_LAST_HISTORY_QOS
	depth	1
resource_limits	max_samples	LENGTH_UNLIMITED
	max_instances	LENGTH_UNLIMITED
	max_samples_per_instance	LENGTH_UNLIMITED
entity_factory	autoenable_ created_entities	TRUE
writer_data_lifecycle	autodispose_ unregistered_instances	TRUE

Table 2 QosPolicy Default Attributes (continued)

QosPolicy	Attribute	Value
reader_data_lifecycle	autopurge_nowriter_samples_delay	DURATION_INFINITE
	autopurge_disposed_samples_delay	DURATION_INFINITE
	autopurge_dispose_all	FALSE
	enable_invalid_samples	TRUE
	invalid_sample_visibility.kind	MINIMUM_INVALID_SAMPLES
durability_service	history_kind	KEEP_LAST
	history_depth	1
	max_samples	LENGTH_UNLIMITED
	max_instances	LENGTH_UNLIMITED
	max_samples_per_instance	LENGTH_UNLIMITED
	service_cleanup_delay	0
watchdog_scheduling, listener_scheduling	scheduling_class.kind	SCHEDULE_DEFAULT
	scheduling_priority_kind.kind	PRIORITY_RELATIVE
	scheduling_priority	0
subscription_keys	use_key_list	FALSE
	key_list.length	0
reader_lifespan	use_lifespan	FALSE
	duration	DURATION_INFINITE
share	name	""
	enable	FALSE
view_keys	use_key_list	FALSE
	key_list.length	0

RxO

The `QosPolicy` settings that need to be set in a compatible manner between the publisher and subscriber ends are indicated by the setting of the "RxO" (Requested/Offered) property. The *RxO* property of each `QosPolicy` is listed in Table 3 on page 40.

Please note:

- A `RxO` setting of *Yes* indicates that the `QosPolicy` can be set at both ends (publishing and subscribing) and the attributes must be set in a compatible manner. In this case the compatible attributes are explicitly defined.

- A RxO setting of *No* indicates that the QosPolicy can be set at both ends (publishing and subscribing) but the two settings are independent. That is, all combinations of attributes are compatible.
- A RxO setting of *Not applicable* indicates that the QosPolicy can only be specified at either the publishing or the subscribing end, but not at both ends. So compatibility does not apply.

Changeable

The *changeable* property determines whether the QosPolicy can be changed after the Entity is enabled. In other words, a QosPolicy with changeable setting of *No* is considered "immutable" and can only be specified either at Entity creation time or prior to calling the enable operation on the Entity.

When the application tries to change a QosPolicy with changeable setting of No, the Data Distribution Service will notify this by returning a RETCODE_IMMUTABLE_POLICY.

The basic way to modify or set the <Entity>Qos is by using a get_qos and set_qos operation to get all QosPolicy settings from this Entity (that is the <Entity>Qos), modify several specific QosPolicy settings and put them back using an user operation to set all QosPolicy settings on this Entity (that is the <Entity>Qos). An example of these operations for the DataWriter are get_qos and set_qos, which take the <Entity>Qos as a parameter.

The "RxO" setting and the "changeable" setting of each QosPolicy are listed in *Table 3* below.

Table 3 QosPolicy Basics

QosPolicy	Concerns Entity	RxO	Changeable After Enabling
user_data	DomainParticipant DataReader DataWriter	No	Yes
topic_data	Topic	No	Yes
group_data	Publisher Subscriber	No	Yes
transport_priority	Topic DataWriter	Not applicable	Yes
lifespan	Topic DataWriter	Not applicable	Yes

Table 3 QosPolicy Basics (continued)

QosPolicy	Concerns Entity	RxO	Changeable After Enabling
durability	Topic DataReader DataWriter	Yes	No
presentation	Publisher Subscriber	Yes	No
deadline	Topic DataReader DataWriter	Yes	Yes
latency_budget	Topic DataReader DataWriter	Yes	Yes
ownership	Topic DataReader DataWriter	Yes	No
ownership_strength	DataWriter	Not applicable	Yes
liveliness	Topic DataReader DataWriter	Yes	No
time_based_filter	DataReader	Not applicable	Yes
partition	Publisher Subscriber	No	Yes
reliability	Topic DataReader DataWriter	Yes	No
destination_order	Topic DataReader DataWriter	Yes	No
history	Topic DataReader DataWriter	No	No
resource_limits	Topic DataReader DataWriter	No	No

Table 3 QosPolicy Basics (continued)

QosPolicy	Concerns Entity	RxO	Changeable After Enabling
entity_factory	DomainParticipantFactory DomainParticipant Publisher Subscriber	No	Yes
writer_data_lifecycle	DataWriter	Not applicable	Yes
reader_data_lifecycle	DataReader	Not applicable	Yes
durability_service	Topic	No	No
scheduling	DomainParticipant	Not applicable	No
subscription_keys	DataReader	Not applicable	No
reader_lifespan	DataReader	Not applicable	Yes
share	DataReader Subscriber	Not applicable	No No
view_keys	DataReaderView	Not applicable	No

The following paragraphs describe the usage of each <name>QosPolicy struct.

3.1.3.1 DeadlineQosPolicy

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
       struct DeadlineQosPolicy
          { Duration_t period; };
```

Description

This QosPolicy defines the period within which a new sample is expected by the DataReader or to be written by the DataWriter.

Attributes

Duration_t period - specifies the period within which a new sample is expected or to be written.

Detailed Description

This QosPolicy will set the period within which a DataReader expects a new sample or, in case of a DataWriter, the period in which it expects applications to write the sample. The default value of the period is DURATION_INFINITE, indicating that there is no deadline. The QosPolicy may be used to monitor the real-time behaviour, a Listener or a StatusCondition may be used to catch the event that is generated when a deadline is missed.

DeadlineQosPolicy is instance oriented (*i.e.* the period is monitored for each individual instance).

The exact consequences of a missed deadline depend on the Entity in which it ocurred, and the OwnershipQosPolicy value of that Entity:

- In case a DataWriter misses an instance deadline (regardless of its OwnershipQosPolicy setting), an offered_deadline_missed_status is raised, which can be detected by either a Listener or a StatusCondition. There are no further consequences.
- In case a DataReader misses an instance deadline, a requested_deadline_missed_status is raised, which can be detected by either a Listener or a StatusCondition. In case the OwnershipQosPolicy is set to SHARED, there are no further consequences. In case the OwnershipQosPolicy is set to EXCLUSIVE, the ownership of that instance on that particular DataReader is transferred to the next available highest strength DataWriter, but this will have no impact on the instance_state whatsoever. So even when a deadline is missed for an instance that has no other (lower-strength) DataWriters to transfer ownership to, the instance_state remains unchanged. See also Section 3.1.3.11, *OwnershipQosPolicy*.

This QosPolicy is applicable to a DataReader, a DataWriter and a Topic. After enabling of the concerning Entity, this QosPolicy may be changed by using the set_qos operation.

Requested/Offered

In case the Requested/Offered QosPolicy are incompatible, the notification OFFERED_INCOMPATIBLE_QOS status on the offering side and REQUESTED_INCOMPATIBLE_QOS status on the requesting side is raised.

Table 4 DeadlineQosPolicy

Period	Compatibility
offered period < requested period	compatible
offered period = requested period	compatible
offered period > requested period	INcompatible

Whether communication is established, is controlled by the Data Distribution Service, depending on the Requested/Offered `QosPolicy` of the `DataWriter` and `DataReader`. In other words, the communication between any `DataWriter` and `DataReader` depends on what is expected by the `DataReader`. As a consequence, a `DataWriter` that has an incompatible `QoS` with respect to what a `DataReader` specifies, is not allowed to send its data to that specific `DataReader`. A `DataReader` that has an incompatible `QoS` with respect to what a `DataWriter` specifies, does not get any data from that particular `DataWriter`.

Changing an existing deadline period using the `set_qos` operation on either the `DataWriter` or `DataReader` may have consequences for the connectivity between readers and writers, depending on their `RxO` values. (See also in Section 3.1.3, *Struct QosPolicy*, the paragraph entitled *Requested/Offered*.) Consider a writer with deadline period `Pw` and a reader with deadline period `Pr`, where `Pw <= Pr`. In this case a connection between that reader and that writer is established. Now suppose `Pw` is changed so that `Pw > Pr`, then the existing connection between reader and writer will be lost, and the reader will behave as if the writer unregistered all its instances, transferring the ownership of these instances when appropriate. See also Section 3.1.3.11, *OwnershipQosPolicy*.

TopicQos

This `QosPolicy` can be set on a `Topic`. The `DataWriter` and/or `DataReader` can copy this qos by using the operations `copy_from_topic_qos` and then `set_qos`. That way the application can relatively easily ensure the `QosPolicy` for the `Topic`, `DataReader` and `DataWriter` are consistent.

3.1.3.2 DestinationOrderQosPolicy

Scope

`DDS`

Synopsis

```
#include <ccpp_dds_dcps.h>
       enum DestinationOrderQosPolicyKind
          { BY_RECEPTION_timestamp_DESTINATIONORDER_QOS,
            BY_SOURCE_timestamp_DESTINATIONORDER_QOS };
       struct DestinationOrderQosPolicy
          { DestinationOrderQosPolicyKind kind; };
```

Description

This `QosPolicy` controls the order in which the `DataReader` stores the data.

Attributes

DestinationOrderQosPolicyKind kind - controls the order in which the DataReader stores the data.

Detailed Description

This QosPolicy controls the order in which the DataReader stores the data. The order of storage is controlled by the timestamp. However a choice can be made to use the timestamp of the DataReader (time of reception) or the timestamp of the DataWriter (source timestamp).

This QosPolicy is applicable to a DataWriter, DataReader and a Topic. After enabling of the concerning entity, this QosPolicy cannot be changed any more.

Attribute

The QosPolicy is controlled by the attribute kind which may be:

- *BY_RECEPTION_TIMESTAMP_DESTINATIONORDER_QOS*
- *BY_SOURCE_TIMESTAMP_DESTINATIONORDER_QOS*

When set to BY_RECEPTION_TIMESTAMP_DESTINATIONORDER_QOS, the order is based on the timestamp, at the moment the sample was received by the DataReader.

When set to BY_SOURCE_TIMESTAMP_DESTINATIONORDER_QOS, the order is based on the timestamp, which was set by the DataWriter. This means that the system needs some time synchronisation.

Requested/Offered

In case the Requested/Offered QosPolicy are incompatible, the notification OFFERED_INCOMPATIBLE_QOS status on the offering side and REQUESTED_INCOMPATIBLE_QOS status on the requesting side is raised.

Table 5 Requested/Offered DestinationOrderQosPolicy

Requested / Offered	BY_RECEPTION_timestamp	BY_SOURCE_timestamp
BY_RECEPTION_timestamp	compatible	INcompatible
BY_SOURCE_timestamp	compatible	compatible

Whether communication is established, is controlled by the Data Distribution Service, depending on the Requested/Offered QosPolicy of the DataWriter and DataReader. In other words, the communication between any DataWriter and DataReader depends on what is expected by the DataReader. As a consequence, a DataWriter that has an incompatible QoS with respect to what a DataReader

specified, is not allowed to send its data to that specific DataReader. A DataReader that has an incompatible QoS with respect to what a DataWriter specified, does not get any data from that particular DataWriter.

TopicQos

This QosPolicy can be set on a Topic. The DataWriter and/or DataReader can copy this qos by using the operations copy_from_topic_qos and then set_qos. That way the application can relatively easily ensure the QosPolicy for the Topic, DataReader and DataWriter are consistent.

3.1.3.3 DurabilityQosPolicy

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
       enum DurabilityQosPolicyKind
          { VOLATILE_DURABILITY_QOS,
            TRANSIENT_LOCAL_DURABILITY_QOS,
            TRANSIENT_DURABILITY_QOS,
            PERSISTENT_DURABILITY_QOS };
       struct DurabilityQosPolicy
          { DurabilityQosPolicyKind kind; };
```

Description

This QosPolicy controls whether the data should be stored for late joining readers.

Attributes

DurabilityQosPolicyKind kind - specifies the type of durability from VOLATILE_DURABILITY_QOS (short life) to PERSISTENT_DURABILITY_QOS (long life).

Detailed Description

The decoupling between DataReader and DataWriter offered by the Data Distribution Service allows an application to write data even if there are no current readers on the network. Moreover, a DataReader that joins the network after some data has been written could potentially be interested in accessing the most current values of the data as well as some history. This QosPolicy controls whether the Data Distribution Service will actually make data available to late-joining DataReaders.

This QosPolicy is applicable to a DataReader, DataWriter and Topic. After enabling of the concerning Entity, this QosPolicy cannot be changed any more.

Attributes

The `QosPolicy` is controlled by the attribute `kind` which may be:

- *`VOLATILE_DURABILITY_QOS`* - the samples are not available to late-joining `DataReaders`. In other words, only `DataReaders`, which were present at the time of the writing and have subscribed to this `Topic`, will receive the sample. When a `DataReader` subscribes afterwards (late-joining), it will only be able to read the next written sample. This setting is typically used for data, which is updated quickly
- *`TRANSIENT_LOCAL_DURABILITY_QOS`* - currently behaves identically to the `TRANSIENT_DURABILITY_QOS`, except for its RxO properties. The desired behaviour of `TRANSIENT_LOCAL_DURABILITY_QOS` can be achieved from the `TRANSIENT_DURABILITY_QOS` with the default (`TRUE`) setting of the `autodispose_unregistered_instances` flag on the `DataWriter` and the `service_cleanup_delay` set to 0 on the durability service. This is because for `TRANSIENT_LOCAL`, the data should only remain available for late-joining readers during the lifetime of its source writer, so it is not required to survive after its source writer has been deleted. Since the deletion of a writer implicitly unregisters all its instances, an `autodispose_unregistered_instances` value of `TRUE` will also dispose the affected data from the durability store, and thus prevent it from remaining available to late joining readers.
- *`TRANSIENT_DURABILITY_QOS`* - some samples are available to late-joining `DataReaders` (stored in memory). This means that the late-joining `DataReaders` are able to read these previously written samples. The `DataReader` does not necessarily have to exist at the time of writing. Not all samples are stored (depending on `QosPolicy History` and `QosPolicy resource_limits`). The storage does not depend on the `DataWriter` and will outlive the `DataWriter`. This may be used to implement reallocation of applications because the data is saved in the Data Distribution Service (not in the `DataWriter`). This setting is typically used for state related information of an application. In this case also the `DurabilityServiceQosPolicy` settings are relevant for the behaviour of the Data Distribution Service
- *`PERSISTENT_DURABILITY_QOS`* - the data is stored in permanent storage (e.g. hard disk). This means that the samples are also available after a system restart. The samples not only outlives the `DataWriters`, but even the Data Distribution Service and the system. This setting is typically used for attributes and settings for an application or the system. In this case also the `DurabilityServiceQosPolicy` settings are relevant for the behaviour of the Data Distribution Service.

Requested/Offered

In case the Requested/Offered QosPolicy are incompatible, the notification OFFERED_INCOMPATIBLE_QOS status on the offering side and REQUESTED_INCOMPATIBLE_QOS status on the requesting side is raised.

Table 6 Requested/Offered DurabilityQosPolicy

Requested / Offered	VOLATILE	TRANSIENT_LOCAL	TRANSIENT	PERSISTENT
VOLATILE	compatible	INcompatible	INcompatible	INcompatible
TRANSIENT_LOCAL	compatible	compatible	INcompatible	INcompatible
TRANSIENT	compatible	compatible	compatible	INcompatible
PERSISTENT	compatible	compatible	compatible	compatible

This means that the Request/Offering mechanism is applicable between:

- the DataWriter and the DataReader. If the QosPolicy settings between DataWriter and DataReader are inconsistent, no communication between them is established. In addition the DataWriter will be informed via a REQUESTED_INCOMPATIBLE_QOS status change and the DataReader will be informed via an OFFERED_INCOMPATIBLE_QOS status change
- the DataWriter and the Data Distribution Service (as a built-in DataReader). If the QosPolicy settings between DataWriter and the Data Distribution Service are inconsistent, no communication between them is established. In that case data published by the DataWriter will not be maintained by the service and as a consequence will not be available for late joining DataReaders. The QosPolicy of the Data Distribution Service in the role of DataReader is specified by the Topic QosPolicy
- the Data Distribution Service (as a built-in DataWriter) and the DataReader. If the QosPolicy settings between the Data Distribution Service and the DataReader are inconsistent, no communication between them is established. In that case the Data Distribution Service will not publish historical data to late joining DataReaders. The QosPolicy of the Data Distribution Service in the role of DataWriter is specified by the Topic QosPolicy.

Cleanup

The DurabilityQosPolicy kind setting TRANSIENT_LOCAL_DURABILITY_QOS, TRANSIENT_DURABILITY_QOS and PERSISTENT_DURABILITY_QOS determine that the DurabilityServiceQosPolicy applies for the Topic. It controls amongst

others at which time the durability service is allowed to remove all information regarding a data-instance. Information on a data-instance is maintained until the following conditions are met:

- the instance has been explicitly disposed of (`instance_state = NOT_ALIVE_DISPOSED_INSTANCE_STATE`),
- ***and*** the system detects that there are no more "live" `DataWriter` objects writing the instance, that is, all `DataWriter` either `unregister_instance` the `instance` (call `unregister_instance` operation) or lose their `liveliness`,
- ***and*** a time interval longer than `service_cleanup_delay` has elapsed since the moment the Data Distribution Service detected that the previous two conditions were met.

The use of the `DurabilityServiceQosPolicy` attribute `service_cleanup_delay` is apparent in the situation where an application disposes of an `instance` and it crashes before having a chance to complete additional tasks related to the disposition. Upon re-start the application may ask for initial data to regain its state and the delay introduced by the `service_cleanup_delay` allows the re-started application to receive the information on the disposed of `instance` and complete the interrupted tasks.

TopicQos

This `QosPolicy` can be set on a `Topic`. The `DataWriter` and/or `DataReader` can copy this qos by using the operations `copy_from_topic_qos` and then `set_qos`. That way the application can relatively easily ensure the `QosPolicy` for the `Topic`, `DataReader` and `DataWriter` are consistent.

3.1.3.4 DurabilityServiceQosPolicy

Scope

`DDS`

Synopsis

```
#include <ccpp_dds_dcps.h>
struct DurabilityServiceQosPolicy
   { Duration_t service_cleanup_delay;
     HistoryQosPolicyKind history_kind;
     Long history_depth;
     Long max_samples;
     Long max_instances;
     Long max_samples_per_instance; };
```

Description

This QosPolicy controls the behaviour of the durability service regarding transient and persistent data.

Attributes

Duration_t service_cleanup_delay - specifies how long the durability service must wait before it is allowed to remove the information on the transient or persistent topic data-instances as a result of incoming dispose messages.

HistoryQosPolicyKind history_kind - specifies the type of history, which may be KEEP_LAST_HISTORY_QOS or KEEP_ALL_HISTORY_QOS, the durability service must apply for the transient or persistent topic data-instances.

Long history_depth - specifies the number of samples of each instance of data (identified by its key) that is managed by the durability service for the transient or persistent topic data-instances. If history_kind is KEEP_LAST_HISTORY_QOS, history_depth must be smaller than or equal to max_samples_per_instance for this QosPolicy to be consistent.

Long max_samples - specifies the maximum number of data samples for all instances the durability service will manage for the transient or persistent topic data-instances.

Long max_instances - specifies the maximum number of instances the durability service - manage for the transient or persistent topic data-instances.

Long max_samples_per_instance - specifies the maximum number of samples of any single instance the durability service will manage for the transient or persistent topic data-instances. If history_kind is KEEP_LAST_HISTORY_QOS, max_samples_per_instance must be greater than or equal to history_depth for this QosPolicy to be consistent.

Detailed Description

This QosPolicy controls the behaviour of the durability service regarding transient and persistent data. It controls for the transient or persistent topic; the time at which information regarding the topic may be discarded, the history policy it must set and the resource limits it must apply.

Cleanup

The setting of the DurabilityServiceQosPolicy only applies when kind of the DurabilityQosPolicy is either TRANSIENT_DURABILITY_QOS or PERSISTENT_DURABILITY_QOS. The service_cleanup_delay setting controls at which time the durability service" is allowed to remove all information regarding a data-instance. Information on a data-instance is maintained until the following conditions are met:

- the instance has been explicitly disposed of (`instance_state = NOT_ALIVE_DISPOSED_INSTANCE_STATE`),
- ***and*** the system detects that there are no more "live" `DataWriter` objects writing the instance, that is, all `DataWriter` either `unregister_instance` the `instance` (call `unregister_instance` operation) or lose their `liveliness`,
- ***and*** a time interval longer than `service_cleanup_delay` has elapsed since the moment the Data Distribution Service detected that the previous two conditions were met.

The use of the attribute `service_cleanup_delay` is apparent in the situation where an application disposes of an `instance` and it crashes before having a chance to complete additional tasks related to the disposition. Upon re-start the application may ask for initial data to regain its state and the delay introduced by the `service_cleanup_delay` allows the re-started application to receive the information on the disposed of `instance` and complete the interrupted tasks.

History

The attributes `history_kind` and `history_depth` apply to the history settings of the durability service's internal `DataWriter` and `DataReader` managing the topic. The `HistoryQosPolicy` behaviour, as described in paragraph 3.1.3.7 (HistoryQosPolicy), applies to these attributes.

Resource Limits

The attributes `max_samples`, `max_instances` and `max_samples_per_instance` apply to the resource limits of the Durability Service's internal `DataWriter` and `DataReader` managing the topic. The `ResourceLimitsQosPolicy` behaviour, as described in paragraph 3.1.3.17 (ResourceLimitsQosPolicy) applies to these attributes.

TopicQos

This `QosPolicy` can be set on a `Topic` only. After enabling of the concerning `Topic`, this `QosPolicy` can not be changed any more.

3.1.3.5 EntityFactoryQosPolicy

Scope

`DDS`

Synopsis

```
#include <ccpp_dds_dcps.h>
       struct EntityFactoryQosPolicy
          { Boolean autoenable_created_entities; };
```

Description

This QosPolicy controls the behaviour of the Entity as a factory for other entities.

Attributes

Boolean autoenable_created_entities - specifies whether the entity acting as a factory automatically enables the instances it creates. If autoenable_created_entities is *TRUE* the factory will automatically enable each created Entity, otherwise it will not.

Detailed Description

This QosPolicy controls the behaviour of the Entity as a factory for other entities. It concerns only DomainParticipantFactory (as factory for DomainParticipant), DomainParticipant (as factory for Publisher, Subscriber, and Topic), Publisher (as factory for DataWriter), and Subscriber (as factory for DataReader).

This policy is mutable. A change in the policy affects only the entities created after the change; not the previously created entities.

The setting of autoenable_created_entities to TRUE indicates that the factory create_<entity> operation will automatically invoke the enable operation each time a new Entity is created. Therefore, the Entity returned by create_<entity> will already be enabled. A setting of FALSE indicates that the Entity will not be automatically enabled: the application will need to enable it explicitly by means of the enable operation. See Section 3.1.1.1, *enable*, for a detailed description about the differences between enabled and disabled entities.

The default setting of autoenable_created_entities is TRUE meaning that by default it is not necessary to explicitly call enable on newly created entities.

3.1.3.6 GroupDataQosPolicy

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
       struct GroupDataQosPolicy
          { OctetSeq value; };
```

Description

This `QosPolicy` allows the application to attach additional information to a Publisher or Subscriber Entity. This information is distributed with the BuiltinTopics.

Attributes

`OctetSeq value` - a sequence of octets that holds the application group data. By default, the sequence has length 0.

Detailed Description

This `QosPolicy` allows the application to attach additional information to a Publisher or Subscriber Entity. This information is distributed with the `BuiltinTopic`. An application that discovers a new Entity of the listed kind, can use this information to add additional functionality. The `GroupDataQosPolicy` is changeable and updates of the BuiltinTopic instance must be expected. Note that the Data Distribution Service is not aware of the real structure of the group data (the Data Distribution System handles it as an opaque type) and that the application is responsible for correct mapping on structural types for the specific platform.

3.1.3.7 HistoryQosPolicy

Scope

`DDS`

Synopsis

```
#include <ccpp_dds_dcps.h>
       enum HistoryQosPolicyKind
          { KEEP_LAST_HISTORY_QOS,
            KEEP_ALL_HISTORY_QOS };
       struct HistoryQosPolicy
          { HistoryQosPolicyKind kind;
            Long depth; };
```

Description

This `QosPolicy` controls which samples will be stored when the value of an instance changes (one or more times) before it is finally communicated.

Attributes

`HistoryQosPolicyKind kind` - specifies the type of history, which may be `KEEP_LAST_HISTORY_QOS` or `KEEP_ALL_HISTORY_QOS`.

`Long depth` - specifies the number of samples of each instance of data (identified by its key) managed by this `Entity`.

Detailed Description

This QosPolicy controls whether the Data Distribution Service should deliver only the most recent sample, attempt to deliver all samples, or do something in between. In other words, how the DataWriter or DataReader should store samples. Normally, only the most recent sample is available but some history can be stored.

DataWriter

On the publishing side this QosPolicy controls the samples that should be maintained by the DataWriter on behalf of existing DataReader objects. The behaviour with respect to a DataReader objects discovered after a sample is written is controlled by the DurabilityQosPolicy.

DataReader

On the subscribing side it controls the samples that should be maintained until the application "takes" them from the Data Distribution Service.

This QosPolicy is applicable to a DataReader, DataWriter and Topic. After enabling of the concerning Entity, this QosPolicy cannot be changed any more.

Attributes

The QosPolicy is controlled by the attribute kind which can be:

- KEEP_LAST_HISTORY_QOS - the Data Distribution Service will only attempt to keep the latest values of the instance and discard the older ones. The attribute "depth" determines how many samples in history will be stored. In other words, only the most recent samples in history are stored. On the publishing side, the Data Distribution Service will only keep the most recent "depth" samples of each instance of data (identified by its key) managed by the DataWriter. On the subscribing side, the DataReader will only keep the most recent "depth" samples received for each instance (identified by its key) until the application "takes" them via the DataReader::take operation. KEEP_LAST_HISTORY_QOS - is the default kind. The default value of depth is 1, indicating that only the most recent value should be delivered. If a depth other than 1 is specified, it should be compatible with the settings of the ResourcelimitsQosPolicy max_samples_per_instance. For these two QosPolicy settings to be compatible, they must verify that depth <= max_samples_per_instance, otherwise a RETCODE_INCONSISTENT_POLICY is generated on relevant operations
- KEEP_ALL_HISTORY_QOS - all samples are stored, provided, the resources are available. On the publishing side, the Data Distribution Service will attempt to keep all samples (representing each value written) of each instance of data (identified by its key) managed by the DataWriter until they can be delivered to all subscribers. On the subscribing side, the Data Distribution Service will

attempt to keep all samples of each instance of data (identified by its key) managed by the DataReader. These samples are kept until the application "takes" them from the Data Distribution Service via the DataReader::take operation. The setting of depth has no effect. Its implied value is LENGTH_UNLIMITED. The resources that the Data Distribution Service can use to keep this history are limited by the settings of the ResourceLimitsQosPolicy. If the limit is reached, the behaviour of the Data Distribution Service will depend on the ReliabilityQosPolicy. If the ReliabilityQosPolicy is BEST_EFFORT_RELIABILITY_QOS, the old values are discarded. If ReliabilityQosPolicy is RELIABLE_RELIABILITY_QOS, the Data Distribution Service will block the DataWriter until it can deliver the necessary old values to all subscribers.

On the subscribing side it controls the samples that should be maintained until the application "takes" them from the Data Distribution Service. On the publishing side this QosPolicy controls the samples that should be maintained by the DataWriter on behalf of DataReader objects. The behaviour with respect to a DataReader objects discovered after a sample is written is controlled by the DurabilityQosPolicy. In more detail, this QosPolicy specifies the behaviour of the Data Distribution Service in case the value of a sample changes (one or more times) before it can be successfully communicated to one or more Subscribers.

Requested/Offered

The setting of the QosPolicy offered is independent of the one requested, in other words they are never considered incompatible. The communication will not be rejected on account of this QosPolicy. The notification OFFERED_INCOMPATIBLE_QOS status on the offering side or REQUESTED_INCOMPATIBLE_QOS status on the requesting side will not be raised.

TopicQos

This QosPolicy can be set on a Topic. The DataWriter and/or DataReader can copy this qos by using the operations copy_from_topic_qos and then set_qos. That way the application can relatively easily ensure the QosPolicy for the Topic, DataReader and DataWriter are consistent.

3.1.3.8 LatencyBudgetQosPolicy

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
       struct LatencyBudgetQosPolicy
```

```
{ Duration_t duration; };
```

Description

Specifies the maximum acceptable additional delay to the typical transport delay from the time the data is written until the data is delivered at the `DataReader` and the application is notified of this fact.

Attributes

`Duration_t duration` - specifies the maximum acceptable additional delay from the time the data is written until the data is delivered.

Detailed Description

This `QosPolicy` specifies the maximum acceptable additional delay to the typical transport delay from the time the data is written until the data is delivered at the `DataReader` and the application is notified of this fact. This `QosPolicy` provides a means for the application to indicate to the Data Distribution Service the "urgency" of the data-communication. By having a non-zero duration the Data Distribution Service can optimise its internal operation. The default value of the `duration` is zero, indicating that the delay should be minimized.

This `QosPolicy` is applicable to a `DataReader`, `DataWriter` and `Topic`. After enabling of the concerning `Entity`, this `QosPolicy` may be changed by using the `set_qos` operation.

Requested/Offered

This `QosPolicy` is considered a hint to the Data Distribution Service, which will automatically adapt its behaviour to meet the requirements of the shortest delay if possible. In case the Requested/Offered `QosPolicy` are incompatible, the notification `OFFERED_INCOMPATIBLE_QOS` status on the offering side and `REQUESTED_INCOMPATIBLE_QOS` status on the requesting side is raised.

Table 7 LatencyBudgetQosPolicy

Duration	Compatibility
`offered duration < requested duration`	compatible
`offered duration = requested duration`	compatible
`offered duration > requested duration`	INcompatible

Note that even when the offered duration is considered compatible to the requested duration, this duration is not enforced in any way: there will be no notification on any violations of the requested duration.

Changing an existing latency budget using the set_qos operation on either the DataWriter or DataReader may have consequences for the connectivity between readers and writers, depending on their RxO values. (See also in Section 3.1.3, *Struct QosPolicy*, the paragraph entitled *Requested/Offered*.) Consider a writer with budget Bw and a reader with budget Br, where Bw <= Br. In this case a connection between that reader and that writer is established. Now suppose Bw is changed so that Bw > Br, then the existing connection between reader and writer will be lost, and the reader will behave as if the writer unregistered all its instances, transferring the ownership of these instances when appropriate. See also Section 3.1.3.11, *OwnershipQosPolicy*.

TopicQos

This QosPolicy can be set on a Topic. The DataWriter and/or DataReader can copy this qos by using the operations copy_from_topic_qos and then set_qos. That way the application can relatively easily ensure the QosPolicy for the Topic, DataReader and DataWriter are consistent.

3.1.3.9 LifespanQosPolicy

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
       struct LifespanQosPolicy
          { Duration_t duration; };
```

Description

This QosPolicy specifies the duration of the validity of the data written by the DataWriter.

Attributes

Duration_t duration - specifies the length in time of the validity of the data.

Detailed Description

This QosPolicy specifies the duration of the validity of the data written by the DataWriter. When this time has expired, the data will be removed or if it has not been delivered yet, it will not be delivered at all. In other words, the duration is the time in which the data is still valid. This means that during this period a DataReader can access the data or if the data has not been delivered yet, it still will be delivered. The default value of the duration is DURATION_INFINITE, indicating that the data does not expire.

This QosPolicy is applicable to a DataWriter and a Topic. After enabling of the concerning Entity, this QosPolicy may be changed by using the set_qos operation.

Requested/Offered

The setting of this QosPolicy is only applicable to the publishing side, in other words the Requested/Offered constraints are not applicable. The communication will not be rejected on account of this QosPolicy. The notification OFFERED_INCOMPATIBLE_QOS status on the offering side will not be raised.

TopicQos

This QosPolicy can be set on a Topic. The DataWriter and/or DataReader can copy this qos by using the operations copy_from_topic_qos and then set_qos. That way the application can relatively easily ensure the QosPolicy for the Topic, DataReader and DataWriter are consistent.

3.1.3.10 LivelinessQosPolicy

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
       enum LivelinessQosPolicyKind
          { AUTOMATIC_LIVELINESS_QOS,
            MANUAL_BY_PARTICIPANT_LIVELINESS_QOS,
            MANUAL_BY_TOPIC_LIVELINESS_QOS };
       struct LivelinessQosPolicy
          { LivelinessQosPolicyKind kind;
            Duration_t lease_duration; };
```

Description

This QosPolicy controls the way the liveliness of an Entity is being determined.

Attributes

LivelinessQosPolicyKind kind - controls the way the liveliness of an Entity is determined.

Duration_t lease_duration - specifies the duration of the interval within which the liveliness must be reported.

Detailed Description

This QosPolicy controls the way the liveliness of an Entity is being determined. The liveliness must be reported periodically before the lease_duration expires.

This QosPolicy is applicable to a DataReader, a DataWriter and a Topic. After enabling of the concerning Entity, this QosPolicy cannot be changed any more.

Attributes

The QosPolicy is controlled by the attribute kind which can be:

- *AUTOMATIC_LIVELINESS_QOS* - the Data Distribution Service will take care of reporting the Liveliness automatically with a rate determined by the lease_duration.
- *MANUAL_BY_PARTICIPANT_LIVELINESS_QOS* - the application must take care of reporting the liveliness before the lease_duration expires. If an Entity reports its liveliness, all Entities within the same DomainParticipant that have their liveliness kind set to MANUAL_BY_PARTICIPANT_LIVELINESS_QOS, can be considered alive by the Data Distribution Service. Liveliness can reported explicitly by calling the operation assert_liveliness on the DomainParticipant or implicitly by writing some data.
- *MANUAL_BY_TOPIC_LIVELINESS_QOS* - the application must take care of reporting the liveliness before the lease_duration expires. This can explicitly be done by calling the operation assert_liveliness on the DataWriter or implicitly by writing some data.

The lease_duration specifies the duration of the interval within which the liveliness should be reported.

Requested/Offered

In case the Requested/Offered QosPolicy are incompatible, the notification OFFERED_INCOMPATIBLE_QOS status on the offering side and REQUESTED_INCOMPATIBLE_QOS status on the requesting side is raised.

Table 8 LivelinessQosPolicy

Offered \ Requested	AUTOMATIC	MANUAL_BY_PARTICIPANT	MANUAL_BY_TOPIC
AUTOMATIC	compatible	INcompatible	INcompatible
MANUAL_BY_PARTICIPANT	compatible	compatible	incompatible
MANUAL_BY_TOPIC	compatible	compatible	compatible

Whether communication is established, is controlled by the Data Distribution Service, depending on the Requested/Offered QosPolicy of the DataWriter and DataReader. In other words, the communication between any DataWriter and DataReader depends on what is expected by the DataReader. As a consequence, a DataWriter that has an incompatible QoS with respect to what a DataReader

specified is not allowed to send its data to that specific DataReader. A DataReader that has an incompatible QoS with respect to what a DataWriter specified does not get any data from that particular DataWriter.

TopicQos

This QosPolicy can be set on a Topic. The DataWriter and/or DataReader can copy this qos by using the operations copy_from_topic_qos and then set_qos. That way the application can relatively easily ensure the QosPolicy for the Topic, DataReader and DataWriter are consistent.

3.1.3.11 OwnershipQosPolicy

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
       enum OwnershipQosPolicyKind
          { SHARED_OWNERSHIP_QOS,
            EXCLUSIVE_OWNERSHIP_QOS };
       struct OwnershipQosPolicy
          { OwnershipQosPolicyKind kind; };
```

Description

This QosPolicy specifies whether a DataWriter exclusively owns an instance.

Attributes

OwnershipQosPolicyKind kind - specifies whether a DataWriter exclusively owns an instance.

Detailed Description

This QosPolicy specifies whether a DataWriter exclusively may own an instance. In other words, whether multiple DataWriter objects can write the same instance at the same time. The DataReader objects will only read the modifications on an instance from the DataWriter owning the instance.

Exclusive ownership is on an instance-by-instance basis. That is, a Subscriber can receive values written by a lower strength DataWriter as long as they affect instances whose values have not been written or registered by a higher-strength DataWriter.

This QosPolicy is applicable to a DataReader, a DataWriter and a Topic. After enabling of the concerning Entity, this QosPolicy cannot be changed any more.

Attribute

The QosPolicy is controlled by the attribute kind which can be:

- *SHARED_OWNERSHIP_QOS* (default) - the same instance can be written by multiple DataWriter objects. All updates will be made available to the DataReader objects. In other words it does not have a specific owner
- *EXCLUSIVE_OWNERSHIP_QOS* - the instance will only be accepted from one DataWriter which is the only one whose modifications will be visible to the DataReader objects.

Requested/Offered

In case the Requested/Offered QosPolicy are incompatible, the notification OFFERED_INCOMPATIBLE_QOS status on the offering side and REQUESTED_INCOMPATIBLE_QOS status on the requesting side is raised.

Table 9 Requested/Offered OwnershipQosPolicy

Requested / Offered	SHARED	EXCLUSIVE
SHARED	compatible	INcompatible
EXCLUSIVE	INcompatible	compatible

Whether communication is established is controlled by the Data Distribution Service, depending on the Requested/Offered QosPolicy of the DataWriter and DataReader. The value of the OWNERSHIP kind offered must exactly match the one requested or else they are considered incompatible. As a consequence, a DataWriter that has an incompatible QoS with respect to what a DataReader specified is not allowed to send its data to that specific DataReader. A DataReader that has an incompatible QoS with respect to what a DataWriter specified does not get any data from that particular DataWriter.

Exclusive ownership

The DataWriter with the highest OwnershipStrengthQosPolicy value and being alive (depending on the LivelinessQosPolicy) and which has not violated its DeadlineQosPolicy contract with respect to the instance, will be considered the owner of the instance. Consequently, the ownership can change as a result of:

- a DataWriter in the system with a higher value of the OwnershipStrengthQosPolicy modifies the instance
- a change in the OwnershipStrengthQosPolicy value (becomes less) of the DataWriter owning the instance
- a change in the liveliness (becomes not alive) of the DataWriter owning the instance

- a deadline with respect to the instance that is missed by the DataWriter that owns the instance.

Timeline

Each DataReader may detect the change of ownership at a different time. In other words, at a particular point in time, the DataReader objects do not have a consistent picture of who owns each instance for that Topic. Outside this grey area in time all DataReader objects will consider the same DataWriter to be the owner.

If multiple DataWriter objects with the same OwnershipStrengthQosPolicy modify the same instance, all DataReader objects will make the same choice of the particular DataWriter that is the owner. The DataReader is also notified of this via a status change that is accessible by means of the Listener or Condition mechanisms.

Ownership of an Instance

DataWriter objects are not aware whether they own a particular instance. There is no error or notification given to a DataWriter that modifies an instance it does not currently own.

TopicQos

This QosPolicy can be set on a Topic. The DataWriter and/or DataReader can copy this **qos** by using the operations copy_from_topic_qos and then set_qos. That way the application can relatively easily ensure the QosPolicy for the Topic, DataReader and DataWriter are consistent.

3.1.3.12 OwnershipStrengthQosPolicy

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
       struct OwnershipStrengthQosPolicy
          { Long value; };
```

Description

This QosPolicy specifies the value of the ownership strength of a DataWriter used to determine the ownership of an instance.

Attributes

Long value - specifies the ownership strength of the DataWriter.

Detailed Description

This QosPolicy specifies the value of the ownership strength of a DataWriter used to determine the ownership of an instance. This ownership is used to arbitrate among multiple DataWriter objects that attempt to modify the same instance. This QosPolicy only applies if the OwnershipQosPolicy is of kind EXCLUSIVE_OWNERSHIP_QOS. For more information, see OwnershipQosPolicy.

This QosPolicy is applicable to a DataWriter only. After enabling of the concerning Entity, this QosPolicy may be changed by using the set_qos operation. When changed, the ownership of the instances may change with it.

3.1.3.13 PartitionQosPolicy

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
   struct PartitionQosPolicy
   { StringSeq name; };
```

Description

This QosPolicy specifies the logical partitions in which the Subscribers and Publishers are active.

Attributes

StringSeq name - holds the sequence of strings, which specifies the partitions.

Detailed Description

This QosPolicy specifies the logical partitions inside the domain in which the Subscribers and Publishers are active. This QosPolicy is particularly used to create a separate subspace, like a real domain versus a simulation domain. A Publisher and/or Subscriber can participate in more than one partition. Each string in the sequence of strings name defines a partition name. A partition name may contain wildcards. Sharing a partition means that at least one of the partition names in the sequence matches. When none of the partition names match, it is not considered an “incompatible” QoS and does not trigger any listeners or conditions. It only means that no communication is established. The default value of the attribute is an empty (zero-sized) sequence. This is treated as a special value that matches the “partition”.

This QosPolicy is applicable to a Publisher and Subscriber. After enabling of the concerning Entity, this QosPolicy may be changed by using the set_qos operation. When changed, it modifies the association of DataReader and DataWriter objects. It may establish new associations or break existing associations. By default, DataWriter and DataReader objects belonging to a Publisher or Subscriber that do not specify a PartitionQosPolicy, will participate in the default partition. In this case the partition name is ““.

Requested/Offered

The offered setting of this QosPolicy is independent of the one requested, in other words they are never considered incompatible. The communication will not be rejected on account of this QosPolicy. The notification OFFERED_INCOMPATIBLE_QOS status on the offering side or REQUESTED_INCOMPATIBLE_QOS status on the requesting side will not be raised.

3.1.3.14 PresentationQosPolicy

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
       enum PresentationQosPolicyAccessScopeKind
          { INSTANCE_PRESENTATION_QOS,
            TOPIC_PRESENTATION_QOS,
            GROUP_PRESENTATION_QOS };
       struct PresentationQosPolicy
          { PresentationQosPolicyAccessScopeKind access_scope;
            Boolean coherent_access;
            Boolean ordered_access; };
```

Description

This QosPolicy controls the extent to which changes to data-instances can be made dependent on each other, the order in which they need to be presented to the user and also the kind of dependencies that can be propagated and maintained by the Data Distribution Service.

Attributes

PresentationQosPolicyAccessScopeKind access_scope - specifies the granularity of the changes that needs to be preserved when communicating a set of samples and the granularity of the ordering in which these changes need to be presented to the user.

boolean coherent_access - controls whether the Data Distribution Service will preserve the groupings of changes, as indicated by the access_scope, made by a publishing application by means of the operations begin_coherent_change and end_coherent_change.

boolean ordered_access - controls whether the Data Distribution Service will preserve the order of the changes, as indicated by the access_scope.

Detailed Description

The support for 'coherent changes' enables a publishing application to change the value of several data-instances that could belong to the same or different topics and have those changes be seen 'atomically' by the readers. This is useful in cases where the values are inter-related. For example, if there are two data-instances representing the 'altitude' and 'velocity vector' of the same aircraft and both are changed, it may be useful to communicate those values in a way the reader can see both together; otherwise it may erroneously interpret that the aircraft is on a collision course.

Basically this QosPolicy allows a Publisher to group a number of samples by enclosing them within calls to begin_coherent_change and end_coherent_change and treat them as if they are to be communicated as a single message. That is, the receiver will only be able to access the data after all the modifications in the set are available at the receiver end.

Samples that belong to a (yet) unfinished coherent update consume resource limits from the receiving DataReader, but are not (yet) accessible through its history, and cannot (yet) push samples out of its history. In order for the DataReader to store samples outside its history administration, its ResourceLimitsQosPolicy should have a value for max_samples_per_instance that is bigger than the depth value of its HistoryQosPolicy.

If not enough resources are available to hold an incoming sample that belongs to an unfinished transaction, one of the following things may happen.

- When some of the resources are in use by the history of the DataReader, the incoming sample will be rejected, and the DataReader will be notified of a SAMPLE_REJECTED event. This will cause the delivery mechanism to retry delivery of the rejected sample at a later moment in time, in the expectation that the application will free resources by actively taking samples out of the reader history.
- When all the available resources are in use by samples belonging to unfinished coherent updates, the application has no way to free up resources and the transaction is either 'deadlocked' by itself (*i.e.* it is too big for the amount of available resources) or by one or more other incomplete transactions. To break out of this deadlock, all samples belonging to the same transaction as the currently incoming sample will be dropped, and the DataReader will be notified of a

SAMPLE_LOST event. No attempt will be made to retransmit the dropped transaction. To avoid this scenario, it is important to make sure the DataReader has set its ResourceLimits to accommodate for the worst case history size *PLUS* the worst case transaction size. In other words, if S_h represents the worst case size of the required history, S_t represents the worst case size of single transaction and N_t represents the worst case number of concurrent transactions, then the ResourceLimits should accommodate for $S_h + (S_t * N_t)$.

A connectivity change may occur in the middle of a set of coherent changes; for example, the set of partitions used by the Publisher or one of its Subscribers may change, a late-joining DataReader may appear on the network, or a communication failure may occur. In the event that such a change prevents an entity from receiving the entire set of coherent changes, that entity must behave as if it had received none of the set.

The support for 'ordered_access' enables a subscribing application to view changes in the order in which they occurred. Ordering is always determined according to the applicable DestinationOrderQosPolicy setting. Depending on the selected access_scope, ordering is either on a per instance basis (this is the default behaviour, even when ordered_access is set to FALSE), on a per DataReader basis or across all DataReaders that span the Subscriber. In case of ordered_access with an access_scope of GROUP, the Subscriber will enforce that all its DataReaders share the same DestinationOrderQosPolicy setting. The DestinationOrderQosPolicy setting of the first DataReader created for that Subscriber will then determine the DestinationOrderQosPolicy setting that is allowed for all subsequent DataReaders. Conflicting settings will result in an INCONSISTENT_POLICY error.

The PresentationQosPolicy is applicable to a Publisher and Subscriber. After enabling of the concerning Entity, this QosPolicy cannot be changed any more.

Attributes

The PresentationQosPolicy is applicable to both Publisher and Subscriber, but behaves differently on the publishing side and the subscribing side. The setting of coherent_access on a Publisher controls whether that Publisher will preserve the coherency of changes (enclosed by calls to begin_coherent_change and end_coherent_change), as indicated by its access_scope and as made available by its embedded DataWriters. However, the Subscriber settings determine whether a coherent set of samples will actually be delivered to the subscribing application in a coherent way.

- If a Publisher or Subscriber sets `coherent_access` to `FALSE`, it indicates that it does not want to maintain coherency between the different samples in a set: a Subscriber that receives only a part of this set may still deliver this partial set of samples to its embedded DataReaders.
- If both Publisher and Subscriber set `coherent_access` to `TRUE`, they indicate that they want to maintain coherency between the different samples in a set: a Subscriber that receives only a part of this set may not deliver this partial set of samples to its embedded DataReaders; it needs to wait for the set to become complete, and it will flush this partial set when it concludes that it will never be able to complete it.

  Coherency is implemented on top of a transaction mechanism between individual DataWriters and DataReaders; completeness of a coherent set is determined by the successful completion of each of its participating transactions. The value of the `access_scope` attribute determines which combination of transactions constitute the contents of a coherent set.

The setting of `ordered_access` has no impact on the way in which a Publisher transmits its samples (although it does influence the RxO properties of this Publisher), but basically it determines whether a Subscriber will preserve the ordering of samples when the subscribing application uses its embedded DataReaders to read or take samples:

- If a Subscriber sets `ordered_access` to `FALSE`, it indicates that it does not want to maintain ordering between the different samples it receives: a subscribing application that reads or takes samples will receive these samples ordered by their key-values, which does probably not resemble the order they were written in.
- If a Subscriber sets `ordered_access` to `TRUE`, it indicates that it does want to maintain ordering within the specified `access_scope` between the different samples it receives: a subscribing application that reads or takes samples will receives these samples sorted by the order in which they were written.

The `access_scope` determines the maximum extent of coherent and/or ordered changes:

- If `access_scope` is set to `INSTANCE_PRESENTATION_QOS` and `coherent_access` is set to `TRUE`, then the Subscriber will behave, with respect to maintaining coherency, in a way similar to an `access_scope` that is set to `TOPIC_PRESENTATION_QOS`. This is caused by the fact that coherency is defined as the successful completion of all participating transactions. If a DataWriter writes a transaction containing samples from different instances, and a connected DataReader misses one of these samples, then the transaction failed and the coherent set is considered incomplete by the receiving DataReader. It doesn't matter that all the other instances have received their samples successfully; an

unsuccessful transaction by definition results in an incomplete coherent set. In that respect the DDS can offer no granularity that is more fine-grained with respect to coherency than that described by the TOPIC_PRESENTATION_QOS.

If access_scope is set to INSTANCE_PRESENTATION_QOS and ordered_access is set to TRUE, then the subscriber will maintain ordering between samples belonging to the same instance. Samples belonging to different instances will still be grouped by their key-values instead of by the order in which they were received.

- If access_scope is set to TOPIC_PRESENTATION_QOS and coherent_access is set to TRUE, then the DDS will define the scope of a coherent set on individual transactions. So a coherent set that spans samples coming from multiple DataWriters (indicated by its enclosure within calls to begin_coherent_change and end_coherent_change on their shared Publisher), is chopped up into separate and disjunct transactions (one for each participating DataWriter), where each transaction is processed separately. On the subscribing side this may result in the successful completion of some of these transactions, and the unsuccessful completion of some others. In such cases all DataReaders that received successful transactions will deliver the embedded content to their applications, without waiting for the completion of other transactions in other DataReaders connected to the same Subscriber.

  If access_scope is set to TOPIC_PRESENTATION_QOS and ordered_access is set to TRUE, then the subscriber will maintain ordering between samples belonging to the same DataReader. This means that samples belonging to the same instance in the same DataReader may no longer be received consecutively if samples belonging to different instances were written in between. It is possible to read/take a limited batch of ordered samples (where max_samples != LENGTH_UNLIMITED). In that case the DataReader will keep a bookmark, so that in subsequent read/take operations your application can start where the previous read/take call left off. There are two ways for the middleware to indicate that you completed a full iteration:

  - The amount of samples returned is smaller than the amount of samples requested.
  - Your read/take call returns RETCODE_NO_DATA, indicating that there are no more samples matching your criteria after the current bookmark. In that case the bookmark is reset and the next read/take will begin a new iteration right from the start of the ordered list.

  The bookmark is also reset in the following cases:

  - A read/take call uses different masks than the previous invocation of read/take.
  - A read/take call uses a different query than the previous invocation of read/take.

- If `access_scope` is set to `GROUP_PRESENTATION_QOS` and `coherent_access` is set to `TRUE`, then the DDS will define the scope of a coherent set on the sum of all participating transactions. So a coherent set that spans samples coming from multiple DataWriters (indicated by its enclosure within calls to `begin_coherent_change` and `end_coherent_change` on their shared Publisher), is chopped up into separate and disjunct transactions (one for each participating DataWriter), where each transactions is processed separately. On the subscribing side this may result in the successful completion of some of these transactions, and the unsuccessful completion of some others. However, each DataReader is only allowed to deliver the embedded content when all participating transactions completed successfully. This means that DataReaders that received successful transactions will need to wait for all other DataReaders attached to the same Subscriber to also complete their transactions successfully. If one or more DataReaders conclude that they will not be able to complete their transactions successfully, then all DataReaders that participate in the original coherent set will flush the content of their transactions. In order for the application to access the state of all DataReaders that span the coherent update, a separate read/take operation will need to be performed on each of the concerned DataReaders. To keep the history state of the DataReaders consistent in between the successive invocations of the read/take operations on the various readers, the DataReaders should be locked for incoming updates by invoking the `begin_access` on the Subscriber prior to accessing the first DataReader. If all concerned DataReaders have been accessed properly, they can be unlocked for incoming updates by invoking the `end_access` on the Subscriber.

  If `access_scope` is set to `GROUP_PRESENTATION_QOS` and `ordered_access` is set to `TRUE`, then ordering is maintained between samples that are written by DataWriters attached to a common Publisher and received by DataReaders attached to a common Subscriber. This way the subscribing application can access the changes as a unit and/or in the proper order. However, this does not necessarily imply that the subscribing application will indeed access the changes as a unit and/or in the correct order. For that to occur, the subscribing application must use the proper logic in accessing its datareaders:

  - Upon notification by the callback operation `on_data_on_readers` of the SubscriberListener or when triggered by the similar `DATA_ON_READERS` status of the Subscriber's `StatusCondition`, the application uses `begin_access` on the Subscriber to indicate it will be accessing data through the Subscriber. This will lock the embedded datareaders for any incoming messages during the coherent data access.

- Then it calls `get_datareaders` on the Subscriber to get the list of DataReader objects where data samples are available. Note that when `ordered_access` is `TRUE`, then the list of DataReaders may contain the same reader several times. In this manner the correct sample order can be maintained among samples in different DataReader objects.
- Following this it calls `read` or `take` on each DataReader in the same order returned to access all the relevant changes in the DataReader. Note that when `ordered_access` is `TRUE`, you should only read or take *one* sample at a time.
- Once it has called `read` or `take` on all the readers, it calls `end_access` on the Subscriber. This will unlock the embedded datareaders again.

Requested/Offered

In case the Requested/Offered `QosPolicy` are incompatible, the notification `OFFERED_INCOMPATIBLE_QOS` status on the offering side and `REQUESTED_INCOMPATIBLE_QOS` status on the requesting side is raised.

Table 10 Requested/Offered PresentationQosPolicy

Requested / Offered	INSTANCE	Topic	Group
instance	compatible	INcompatible	INcompatible
topic	compatible	compatible	INcompatible
group	compatible	compatible	compatible

The value offered is considered compatible with the value requested if and only if the following conditions are met:

1. The inequality “offered `access_scope` >= requested `access_scope`” evaluates to ‘`TRUE`’. For the purposes of this inequality, the values of `PRESENTATION access_scope` are considered ordered such that `INSTANCE < TOPIC < GROUP`.
2. Requested `coherent_access` is `FALSE`, or else both offered and requested `coherent_access` are `TRUE`.
3. Requested `ordered_access` is `FALSE`, or else both offered and requested `ordered_access` are `TRUE`.

In case the quality offered by the Publisher is better than the value requested by the Subscriber, the subscriber’s values determine the resulting behaviour for the subscribing application. In other words, the quality specified at the Subscriber site overrules the corresponding value at the Publisher site.

Consider the following scenario:

1. A Publisher publishes coherent sets with access_scope is GROUP and coherent_access is TRUE.
2. A Subscriber subscribes to these coherent sets with access_scope is TOPIC and coherent_access is TRUE.
3. The Publisher writes a coherent set consisting of 2 samples of Topic A, and 2 samples of Topic B.
4. During transmission, the first sample of Topic B gets lost.

According to the access_scope of the Publisher, the coherent set is incomplete and can therefore not be delivered. However, according to the access_scope of the Subscriber, coherency needs to be maintained on a per Reader/Writer pair basis so the samples for Topic A will be delivered upon arrival, but the samples for Topic B will not.

Basically, when both coherent_access and ordered_access are set to FALSE, then the access_scope serves no other purpose than to determine connectivity between Publishers and Subscribers.

3.1.3.15 ReaderDataLifecycleQosPolicy

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
  enum InvalidSampleVisibilityQosPolicyKind
    { NO_INVALID_SAMPLES,
      MINIMUM_INVALID_SAMPLES,
      ALL_INVALID_SAMPLES };
  struct DDS_InvalidSampleVisibilityQosPolicy
    { InvalidSampleVisibilityQosPolicyKind kind; };
  struct DDS_ReaderDataLifecycleQosPolicy
    { Duration_t autopurge_nowriter_samples_delay;
      Duration_t autopurge_disposed_samples_delay;
      boolean autopurge_dispose_all;
      boolean enable_invalid_samples;
      InvalidSampleVisibilityQosPolicy
           invalid_sample_visibility; };
```

Description

This QosPolicy specifies the maximum duration for which the DataReader will maintain information regarding a data instance for which the instance_state becomes either NOT_ALIVE_NO_WRITERS_INSTANCE_STATE or NOT_ALIVE_DISPOSED_INSTANCE_STATE.

Attributes

Duration_t autopurge_nowriter_samples_delay - specifies the duration for which the DataReader will maintain information regarding a data instance for which the instance_state becomes NOT_ALIVE_NO_WRITERS_INSTANCE_STATE. By default the duration value is DURATION_INFINITE. When the delay time has expired, the data instance is marked so that it can be purged in the next garbage collection sweep.

Duration_t autopurge_disposed_samples_delay - specifies the duration for which the DataReader will maintain information regarding a data instance for which the instance_state becomes NOT_ALIVE_DISPOSED_INSTANCE_STATE. By default the duration value is DURATION_INFINITE. When the delay time has expired, the data instance is marked so that it can be purged in the next garbage collection sweep.

Boolean autopurge_dispose_all - Determines whether all samples in the DataReader will be purged automatically when a dispose_all_data() call is performed on the Topic that is associated with the DataReader. If this attribute set to TRUE, no more samples will exist in the DataReader after the dispose_all_data has been processed. Because all samples are purged, no data available events will be notified to potential Listeners or Conditions that are set for the DataReader. If this attribute is set to FALSE, the dispose_all_data() behaves as if each individual instance was disposed separately.

Boolean enable_invalid_samples - Insert dummy samples if no data sample is available to notify readers of an instance state change. By default the value is TRUE.

NOTE: This feature is deprecated. It is recommended that you use invalid_sample_visibility instead.

InvalidSampleVisibilityQosPolicy invalid_sample_visibility - Insert dummy samples if no data sample is available, to notify readers of an instance state change. By default the value is MINIMUM_INVALID_SAMPLES.

Detailed Description

This QosPolicy specifies the maximum duration for which the DataReader will maintain information regarding a data instance for which the instance_state becomes either NOT_ALIVE_NO_WRITERS_INSTANCE_STATE or NOT_ALIVE_DISPOSED_INSTANCE_STATE. The DataReader manages resources for instances and samples of those instances. The amount of resources managed depends on other QosPolicies like the HistoryQosPolicy and the ResourceLimitsQosPolicy. The DataReader can only release resources for data instances for which all samples have been taken and the instance_state has

become NOT_ALIVE_NO_WRITERS_INSTANCE_STATE or NOT_ALIVE_DISPOSED_INSTANCE_STATE. If an application does not take the samples belonging to a data instance with such an instance_state, the DataReader will never be able to release the maintained resources. The application can use this QosPolicy to instruct the DataReader to release all resources related to the relevant data instance after a specified duration.

There is one exception to this rule. If the autopurge_dispose_all attribute is TRUE, the maintained resources in the DataReader are cleaned up immediately in case dispose_all_data() is called on the Topic that is associated with the DataReader.

Instance state changes are communicated to a DataReader by means of the SampleInfo accompanying a data sample. If no samples are available in the DataReader, a so-called 'invalid sample' can be injected with the sole purpose of notifying applications of the instance state. This behaviour is configured by the InvalidSampleVisibilityQosPolicy.

- If invalid_sample_visibility is set to NO_INVALID_SAMPLES, applications will be notified of instance_state changes only if there is a sample available in the DataReader. The SampleInfo belonging to this sample will contain the updated instance state.
- If invalid_sample_visibility is set to MINIMUM_INVALID_SAMPLES, the middleware will try to update the instance_state on available samples in the DataReader. If no sample is available, an invalid sample will be injected. These samples contain only the key values of the instance. The SampleInfo for invalid samples will have the 'valid_data' flag disabled, and contain the updated instance state.
- If invalid_sample_visibility is set to ALL_INVALID_SAMPLES, every change in the instance_state will be communicated by a separate invalid sample.

NOTE: This value (ALL_INVALID_SAMPLES) is not yet implemented. It is scheduled for a future release.

An alternative but deprecated way to determine the visibility of state changes is to set a boolean value for the enable_invalid_samples field.

- When TRUE, the behavior is similar to the MINIMUM_INVALID_SAMPLES value of the InvalidSampleVisibilityQosPolicy field.
- When FALSE, the behavior is similar to the NO_INVALID_SAMPLES value of the InvalidSampleVisibilityQosPolicy field.

You cannot set both the the enable_invalid_samples field *AND* the invalid_sample_visibility field. If both deviate from their factory default, this is considered a RETCODE_INCONSISTENT_POLICY. If only one of the fields

deviates from its factory default, then that setting will be leading. However, modifying the default value of the `enable_invalid_samples` field will automatically result in a warning message stating that you are using deprecated functionality.

This `QosPolicy` is applicable to a `DataReader` only. After enabling the relevant `DataReader`, this `QosPolicy` can be changed using the `set_qos` operation.

3.1.3.16 ReliabilityQosPolicy

Scope

`DDS`

Synopsis

```
#include <ccpp_dds_dcps.h>
       enum ReliabilityQosPolicyKind
          { BEST_EFFORT_RELIABILITY_QOS,
            RELIABLE_RELIABILITY_QOS };
       struct ReliabilityQosPolicy
          { ReliabilityQosPolicyKind kind;
            Duration_t max_blocking_time;
            Boolean synchronous; };
```

Description

This `QosPolicy` controls the level of reliability of the data distribution offered or requested by the `DataWriters` and `DataReaders`.

Attributes

`ReliabilityQosPolicyKind kind` - specifies the type of reliability which may be `BEST_EFFORT_RELIABILITY_QOS` or `RELIABLE_RELIABILITY_QOS`.

`Duration_t max_blocking_time` - specifies the maximum time the `write` operation may block when the `DataWriter` does not have space to store the value or when synchronous communication is specified and all expected acknowledgements are not yet received.

`Boolean synchronous` - specifies whether a `DataWriter` should wait for acknowledgements by all connected `DataReaders` that also have set a synchronous `ReliabilityQosPolicy`.

It is advisable only to use this policy in combination with `RELIABLE_RELIABILITY`; if used in combination with `BEST_EFFORT` data may not arrive at the `DataReader`, resulting in a timeout at the `DataWriter` indicating that the data has not been received.

Acknowledgments are always sent RELIABLE so that when the DataWriter encounters a timeout it is guaranteed that the DataReader hasn't received the data.

NOTE: This is an OpenSplice-specific parameter, it is *not* part of the DDS Specification.

Detailed Description

This QosPolicy controls the level of reliability of the data distribution requested by a DataReader or offered by a DataWriter. In other words, it controls whether data is allowed to get lost in transmission or not.

This QosPolicy is applicable to a DataReader, DataWriter and Topic. After enabling of the concerning Entity, this QosPolicy cannot be changed any more.

Attributes

The QosPolicy is controlled by the attribute kind which can be:

- *RELIABLE_RELIABILITY_QOS* - the Data Distribution Service will attempt to deliver all samples in the DataWriters history; arrival-checks are performed and data may get re-transmitted in case of lost data. In the steady-state (no modifications communicated via the DataWriter) the Data Distribution Service guarantees that all samples in the DataWriter history will eventually be delivered to the all DataReader objects. Outside the steady-state the HistoryQosPolicy and ResourceLimitsQosPolicy determine how samples become part of the history and whether samples can be discarded from it. In this case also the max_blocking_time must be set
- *BEST_EFFORT_RELIABILITY_QOS* - the Data Distribution Service will only attempt to deliver the data; no arrival-checks are being performed and any lost data is not re-transmitted (non-reliable). Presumably new values for the samples are generated often enough by the application so that it is not necessary to resent or acknowledge any samples.

The effect of the attribute max_blocking_time depends on the setting of the HistoryQosPolicy and ResourcesLimitsQosPolicy and/or the synchronous setting of the ReliabilityQosPolicy. In case the HistoryQosPolicy kind is set to KEEP_ALL_HISTORY_QOS, the write operation on the DataWriter may block if the modification would cause one of the limits, specified in the ResourceLimitsQosPolicy, to be exceeded. Also in case the synchronous attribute value of the ReliabilityQosPolicy is set to TRUE on both sides of a pair of connected DataWriters and DataReaders, then the DataWriter will wait until all its connected synchronous DataReaders have

acknowledged the data. Under these circumstances, the max_blocking_time attribute of the ReliabilityQosPolicy configures the maximum duration the write operation may block.

Requested/Offered

In case the Requested/Offered QosPolicy are incompatible, the notification OFFERED_INCOMPATIBLE_QOS status on the offering side and REQUESTED_INCOMPATIBLE_QOS status on the requesting side is raised.

Table 11 Requested/Offered ReliabilityQosPolicy

Requested / Offered	BEST_EFFORT	RELIABLE
BEST_EFFORT	compatible	INcompatible
RELIABLE	compatible	compatible

TopicQos

This QosPolicy can be set on a Topic. The DataWriter and/or DataReader can copy this qos by using the operations copy_from_topic_qos and then set_qos. That way the application can relatively easily ensure the QosPolicy for the Topic, DataReader and DataWriter are consistent.

3.1.3.17 ResourceLimitsQosPolicy

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
       struct ResourceLimitsQosPolicy
          { Long max_samples;
            Long max_instances;
            Long max_samples_per_instance; };
```

Description

This QosPolicy will specify the maximum amount of resources, which can be used by a DataWriter or DataReader.

Attributes

Long max_samples - the maximum number of data samples for all instances for any single DataWriter (or DataReader). By default, LENGTH_UNLIMITED.

Long max_instances - the maximum number of instances for any single DataWriter (or DataReader). By default, LENGTH_UNLIMITED.

Long max_samples_per_instance - the maximum number of samples of any single instance for any single DataWriter (or DataReader). By default, LENGTH_UNLIMITED.

Detailed Description

This QosPolicy controls the maximum amount of resources that the Data Distribution Service can use in order to meet the requirements imposed by the application and other QosPolicy settings.

This QosPolicy is applicable to a DataReader, a DataWriter and a Topic. After enabling of the concerning Entity, this QosPolicy cannot be changed any more.

Requested/Offered

The value of the QosPolicy offered is independent of the one requested, in other words they are never considered incompatible. The communication will not be rejected on account of this QosPolicy. The notification OFFERED_INCOMPATIBLE_QOS status on the offering side or REQUESTED_INCOMPATIBLE_QOS status on the requesting side will not be raised.

Resource Limits

If the DataWriter objects are publishing samples faster than they are taken by the DataReader objects, the Data Distribution Service will eventually hit against some of the QosPolicy-imposed resource limits. Note that this may occur when just a single DataReader cannot keep up with its corresponding DataWriter.

In case the HistoryQosPolicy is KEEP_LAST_HISTORY_QOS, the setting of ResourceLimitsQosPolicy max_samples_per_instance must be compatible with the HistoryQosPolicy depth. For these two QosPolicy settings to be compatible, they must verify that depth <= max_samples_per_instance.

TopicQos

This QosPolicy can be set on a Topic. The DataWriter and/or DataReader can copy this qos by using the operations copy_from_topic_qos and then set_qos. That way the application can relatively easily ensure the QosPolicy for the Topic, DataReader and DataWriter are consistent.

3.1.3.18 SchedulingQosPolicy

NOTE: This is an OpenSplice-specific QosPolicy, it is *not* part of the DDS Specification.

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
       enum SchedulingClassQosPolicyKind
          { SCHEDULE_DEFAULT,
            SCHEDULE_TIMESHARING,
            SCHEDULE_REALTIME };
       struct SchedulingClassQosPolicy
          { SchedulingClassQosPolicyKind kind; };
       enum SchedulingPriorityQosPolicyKind
          { PRIORITY_RELATIVE,
            PRIORITY_ABSOLUTE };
       struct SchedulingPriorityQosPolicy
          { SchedulingPriorityQosPolicyKind kind; };
       struct SchedulingQosPolicy
          { SchedulingClassQosPolicy scheduling_class;
            SchedulingPriorityQosPolicy scheduling_priority_kind;
            Long scheduling_priority; };
```

Description

This QosPolicy specifies the scheduling parameters that will be used for a thread that is spawned by the DomainParticipant.

Note that some scheduling parameters may not be supported by the underlying Operating System, or that you may need special privileges to select particular settings.

Attributes

SchedulingClassQosPolicyKind scheduling_class.kind - specifies the scheduling class used by the Operating System, which may be SCHEDULE_DEFAULT, SCHEDULE_TIMESHARING or SCHEDULE_REALTIME. Threads can only be spawned within the scheduling classes that are supported by the underlying Operating System.

SchedulingPriorityQosPolicyKind scheduling_priority_kind.kind - specifies the priority type, which may be either PRIORITY_RELATIVE or PRIORITY_ABSOLUTE.

Long scheduling_priority - specifies the priority that will be assigned to threads spawned by the DomainParticipant. Threads can only be spawned with priorities that are supported by the underlying Operating System.

Detailed Description

This QosPolicy specifies the scheduling parameters that will be used for threads spawned by the DomainParticipant. Note that some scheduling parameters may not be supported by the underlying Operating System, or that you may need special privileges to select particular settings. Refer to the documentation of your OS for more details on this subject.

Although the behaviour of the scheduling_class is highly dependent on the underlying OS, in general it can be said that when running in a Timesharing class your thread will have to yield execution to other threads of equal priority regularly. In a Realtime class your thread normally runs until completion, and can only be pre-empted by higher priority threads. Often the highest range of priorities is not accessible through a Timesharing Class.

The scheduling_priority_kind determines whether the specified scheduling_priority should be interpreted as an absolute priority, or whether it should be interpreted relative to the priority of its creator, in this case the priority of the thread that created the DomainParticipant.

3.1.3.19 TimeBasedFilterQosPolicy

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
       struct TimeBasedFilterQosPolicy
          { Duration_t minimum_separation; };
```

Description

This QosPolicy specifies a period after receiving a sample for a particular instance during which a DataReader will filter out new samples for the same instance.

At the end of the period the latest state of the instance will be notified and a new filter period will start. If there are no new samples in a period the filter will *not* notify the same latest already-notified state and it will wait for a new sample on this particular instance to start a new period.

In the case where the reliability QoS kind is RELIABLE the system guarantees that the latest state is notified.

Effectively the DataReader will receive at most one sample with the latest state *per* period for each instance.

Attributes

Duration_t minimum_separation - specifies the minimum period between received samples to be passed through the filter. The default value is `0`, meaning that all samples are accepted.

Detailed Description

This `QosPolicy` allows a `DataReader` to indicate that it is not interested in processing all samples for each instance. Instead it requests at most one change per `minimum_separation` period.

The filter is applied to each data-instance separately. This means that new instances will not be filtered, no matter what the `minimum_separation` period or their publication time is. The filter is only applied to samples belonging to the same instance, limiting the rate at which the `DataReader` is notified of the most current value of each instance. This can be helpful in situations where some nodes are capable of generating data much faster than others can consume it. Instance state changes are not affected by the filter, so a `DataReader` always contains the latest state of an instance.

The `minimum_separation` period must be consistent with the `DeadlineQosPolicy`. If the `minimum_separation` period is greater than the deadline period, the deadline cannot be met; therefore the two QoS policies are inconsistent. An attempt to set these policies with inconsistent values will result in a failure to create the `DataReader` or an `INCONSISTENT_POLICY` return value.

This `QosPolicy` is applicable to a `DataReader` only. After enabling the relevant `DataReader`, this `QosPolicy` can be changed using the `set_qos` operation.

3.1.3.20 TopicDataQosPolicy

Scope

`DDS`

Synopsis

```
#include <ccpp_dds_dcps.h>
       struct TopicDataQosPolicy
          { OctetSeq value; };
```

Description

This QosPolicy allows the application to attach additional information to a Topic Entity. This information is distributed with the BuiltinTopics.

Attributes

OctetSeq value - a sequence of octets that holds the application topic data. By default, the sequence has length 0.

Detailed Description

This QosPolicy allows the application to attach additional information to a Topic Entity. This information is distributed with the BuiltinTopic. An application that discovers a new Topic entity, can use this information to add additional functionality. The TopicDataQosPolicy is changeable and updates of the BuiltinTopic instance must be expected. Note that the Data Distribution Service is not aware of the real structure of the topic data (the Data Distribution System handles it as an opaque type) and that the application is responsible for correct mapping on structural types for the specific platform.

3.1.3.21 TransportPriorityQosPolicy

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
       struct TransportPriorityQosPolicy
          { Long value; };
```

Description

This QosPolicy specifies the priority with which the Data Distribution System can handle the data produced by the DataWriter.

Attributes

Long value - specifies the priority with which the Data Distribution System can handle the data produced by the DataWriter.

Detailed Description

This QosPolicy specifies the priority with which the Data Distribution System can handle the data produced by a DataWriter. This QosPolicy is considered to be a hint to the Data Distribution Service to control the priorities of the underlying transport means. A higher value represents a higher priority and the full range of the type is supported. By default the transport priority is set to 0.

The TransportPriorityQosPolicy is applicable to both Topic and DataWriter entities. After enabling of the concerning Entities, this QosPolicy may be changed by using the set_qos operation.

TopicQos

Note that changing this `QosPolicy` for the `Topic` does not influence the behaviour of the Data Distribution System for existing `DataWriter` entities because this `QosPolicy` is only used by the operation `copy_from_topic_qos` and when specifying `DATAWRITER_QOS_USE_TOPIC_QOS` when creating the `DataWriter`.

3.1.3.22 UserDataQosPolicy

Scope

`DDS`

Synopsis

```
#include <ccpp_dds_dcps.h>
       struct UserDataQosPolicy
          { OctetSeq value; };
```

Description

This `QosPolicy` allows the application to attach additional information to a `DomainParticipant`, `DataReader` or `DataWriter` entity. This information is distributed with the Builtin Topics.

Attributes

`OctetSeq value` - a sequence of octets that holds the application user data. By default, the sequence has length 0.

Detailed Description

This `QosPolicy` allows the application to attach additional information to a `DomainParticipant`, `DataReader` or `DataWriter` entity. This information is distributed with the Builtin Topics. An application that discovers a new `Entity` of the listed kind, can use this information to add additional functionality. The `UserDataQosPolicy` is changeable and updates of the Builtin Topic instance must be expected. Note that the Data Distribution Service is not aware of the real structure of the user data (the Data Distribution System handles it as an opaque type) and that the application is responsible for correct mapping on structural types for the specific platform.

3.1.3.23 WriterDataLifecycleQosPolicy

Scope

`DDS`

Synopsis

```
#include <ccpp_dds_dcps.h>
```

```
struct WriterDataLifecycleQosPolicy
    { Boolean autodispose_unregistered_instances;
      Duration_t autopurge_suspended_samples_delay;
      Duration_t autounregister_instance_delay; };
```

Description

This QosPolicy drives the behaviour of a DataWriter concerning the life-cycle of the instances and samples that have been written by it.

Attributes

Boolean autodispose_unregistered_instances - specifies whether the Data Distribution Service should automatically dispose instances that are unregistered by this DataWriter. By default this value is TRUE.

Duration_t autopurge_suspended_samples_delay – specifies the duration after which the DataWriter will automatically remove a sample from its history during periods in which its Publisher is suspended. This duration is calculated based on the source timestamp of the written sample. By default the duration value is set to DURATION_INFINITE and therefore no automatic purging of samples occurs. See Section 3.4.1.19, *suspend_publications*, on page 265 for more information about suspended publication.

Duration_t autounregister_instance_delay – specifies the duration after which the DataWriter will automatically unregister an instance after the application wrote a sample for it and no further action is performed on the same instance by this DataWriter afterwards. This means that when the application writes a new sample for this instance, the duration is recalculated from that action onwards. By default the duration value is DURATION_INFINITE and therefore no automatic unregistration occurs.

Detailed Description

This QosPolicy controls the behaviour of the DataWriter with regards to the lifecycle of the data-instances it manages; that is, those data-instances that have been registered, either explicitly using one of the register operations, or implicitly by directly writing the data using the special HANDLE_NIL parameter. (See also Section 3.4.2.50, *register_instance*, on page 307).

The autodispose_unregistered_instances flag controls what happens when an instance gets unregistered by the DataWriter:

- If the DataWriter unregisters the instance explicitly using either unregister_instance or unregister_instance_w_timestamp, then the autodispose_unregistered_instances flag is currently ignored and the instance is never disposed automatically.

- If the DataWriter unregisters its instances implicitly because it is deleted, or if a DataReader detects a loss of liveliness of a connected DataWriter, or if autounregister_instance_delay expires, then the autodispose_unregistered_instances flag determines whether the concerned instances are automatically disposed (TRUE) or not (FALSE).

The default value for the autodispose_unregistered_instances flag is TRUE. For TRANSIENT and PERSISTENT topics this means that all instances that are not explicitly unregistered by the application will by default be removed from the Transient and Persistent stores when the DataWriter is deleted or when a loss of its liveliness is detected.

For DataWriters associated with TRANSIENT and PERSISTENT topics setting the autodispose_unregister_instances attribute to TRUE would mean that all instances that are not explicitly unregistered by the application will by default be removed from the Transient and Persistent stores when the DataWriter is deleted, when a loss of liveliness is detected, or when the autounregister_instance_delay expires.

3.1.3.24 SubscriptionKeyQosPolicy

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
   struct SubscriptionKeyQosPolicy
     { Boolean use_key_list,
     StringSeq key_list };
```

Description

This QosPolicy allows the DataReader to define it's own set of keys on the data, potentially different from the keys defined on the topic.

NOTE: This is an OpenSplice-specific QosPolicy, it is *not* part of the DDS Specification.

Attributes

Boolean use_key_list - Controls whether the alternative key list is applied on the DataReader.

StringSeq key_list - A sequence of strings with one or more names of topic fields acting as alternative keys.

Detailed Description

By using the SubscriptionKeyQosPolicy, a DataReader can force its own key-list definition on data samples. The consequences are that the DataReader will internally keep track of instances based on its own key list, instead of the key list dictated by the Topic.

Operations that operate on instances or instance handles, such as `lookup_instance` or `get_key_value`, respect the alternative key-list and work as expected. However, since the mapping of writer instances to reader instances is no longer trivial (one writer instance may now map to more than one matching reader instance and *vice versa*), a writer instance will no longer be able to fully determine the lifecycle of its matching reader instance, nor the value its `view_state` and `instance_state`.

In fact, by diverting from the conceptual 1 – 1 mapping between writer instance and reader instance, the writer can no longer keep an (empty) reader instance `ALIVE` by just refusing to unregister its matching writer instance. That means that when a reader takes all samples from a particular reader instance, that reader instance will immediately be removed from the reader's administration. Any subsequent reception of a message with the same keys will re-introduce the instance into the reader administration, setting its `view_state` back to `NEW`. Compare this to the default behaviour, where the reader instance will be kept alive as long as the writer does not unregister it. That causes the `view_state` in the reader instance to remain `NOT_NEW`, even if the reader has consumed all of its samples prior to receiving an update.

Another consequence of allowing an alternative keylist is that events that are communicated by invalid samples (*i.e.* samples that have only initialized their keyfields) may no longer be interpreted by the reader to avoid situations in which uninitialized non-keyfields are treated as keys in the alternative keylist. This effectively means that all invalid samples (*e.g.* unregister messages and both implicit and explicit dispose messages) will be skipped and can no longer affect the `instance_state`, which will therefore remain `ALIVE`. The only exceptions to this are the messages that are transmitted explicitly using the `writedispose()` call (see Section 3.4.2.59, *writedispose*, on page 321), which always includes a full and valid sample and can therefore modify the `instance_state` to `NOT_ALIVE_DISPOSED`.

By default, the SubscriptionKeyQosPolicy is not used because `use_key_list` is set to `FALSE`.

This QosPolicy is applicable to a DataReader only, and cannot be changed after the DataReader is enabled.

3.1.3.25 ReaderLifespanQosPolicy

Scope

`DDS`

Synopsis

```
#include <ccpp_dds_dcps.h>
  struct ReaderLifespanQosPolicy
   { Boolean use_lifespan,
     Duration_t duration };
```

Description

Automatically remove samples from the DataReader after a specified timeout.

NOTE: This is an OpenSplice-specific QosPolicy, it is *not* part of the DDS Specification.

Attributes

`Boolean use_lifespan` - Controls whether the lifespan is applied to the samples in the DataReader.

`Duration_t duration` - The duration after which data loses validity and is removed.

Detailed Description

This QosPolicy is similar to the `LifespanQosPolicy` (applicable to Topic and DataWriter), but limited to the DataReader on which the QosPolicy is applied. The data is automatically removed from the DataReader if it has not been taken yet after the lifespan duration expires. The duration of the ReaderLifespan is added to the insertion time of the data in the DataReader to determine the expiry time.

When both the `ReaderLifespanQosPolicy` and a DataWriter's `LifespanQosPolicy` are applied to the same data, only the earliest expiry time is taken into account.

By default, the ReaderLifespanQosPolicy is not used and `use_lifespan` is `FALSE`. The duration is set to `DURATION_INFINITE`.

This QosPolicy is applicable to a DataReader only, and is mutable even when the DataReader is already enabled. If modified, the new setting will only be applied to samples that are received after the modification took place.

3.1.3.26 ShareQosPolicy

Scope

`DDS`

Synopsis

```
#include <ccpp_dds_dcps.h>
struct ShareQosPolicy
   { String name,
     Boolean enable };
```

Description

Used to share a DataReader between multiple processes.

NOTE: This is an OpenSplice-specific QosPolicy, it is *not* part of the DDS Specification.

Attributes

`String name` - The label used to identify the shared Entity.

`Boolean enable` - Controls whether the entity is shared.

Detailed Description

This QosPolicy allows sharing of entities by multiple processes or threads. When the policy is enabled, the data distribution service will try to look up an existing entity that matches the name supplied in the ShareQosPolicy. A new entity will only be created if a shared entity registered under the specified name doesn't exist yet.

Shared Readers can be useful for implementing algorithms like the worker pattern, where a single shared reader can contain samples representing different tasks that may be processed in parallel by separate processes. In this algorithm each processes consumes the task it is going to perform (*i.e.* it takes the sample represening that task), thus preventing other processes from consuming and therefore performing the same task.

NOTE: Entities can only be shared between processes if OpenSplice is running in federated mode, because it requires shared memory to communicate between the different processes.

By default, the ShareQosPolicy is not used and `enable` is `FALSE`. `Name` must be set to a valid string for the ShareQosPolicy to be valid when `enable` is set to `TRUE`.

This QosPolicy is applicable to DataReader and Subscriber entities, and cannot be modified after the DataReader or Subscriber is enabled. Note that a DataReader can only be shared if its Subscriber is also shared.

3.1.3.27 ViewKeyQosPolicy

Scope

`DDS`

Synopsis

```
#include <ccpp_dds_dcps.h>
struct ViewKeyQosPolicy
   { Boolean use_key_list;
     StringSeq key_list };
```

Description

Used to define a set of keys on a DataReaderView.

NOTE: This is an OpenSplice-specific QosPolicy, it is *not* part of the DDS Specification.

Detailed Description

This QosPolicy is used to set the key list of a DataReaderView. A DataReaderView allows a different view, defined by this key list, on the data set of the DataReader from which it is created.

Operations that operate on instances or instance handles, such as `lookup_instance` or `get_key_value`, respect the alternative key-list and work as expected. However, since the mapping of writer instances to reader instances is no longer trivial (one writer instance may now map to more than one matching reader instance and *vice versa*), a writer instance will no longer be able to fully determine the lifecycle of its matching reader instance, nor the value its `view_state` and `instance_state`.

In fact, the view sample will always copy the `view_state` and `instance_state` values from the reader sample to which it is slaved. If both samples preserve a 1 – 1 correspondence with respect to their originating instances (this may sometimes be the case even when an alternative keylist is provided, *i.e.* when one reader instance never maps to more than one view instance and *vice versa*) then the resulting `instance_state` and `view_state` still have a valid semantical meaning. If this 1 – 1 correspondence cannot be guaranteed, the resulting `instance_state` and `view_state` are semantically meaningless and should not be used to derive any conclusion regading the lifecycle of a view instance.

By default, the `ViewKeyQosPolicy` is disabled because `use_key_list` is set to `FALSE`.

This QosPolicy is applicable to a DataReaderView only, and cannot be changed after the DataReaderView is created.

3.1.4 Listener Interface

This interface is the abstract base interface for all `Listener` interfaces. `Listeners` provide a generic mechanism for the Data Distribution Service to notify the application of relevant asynchronous status change events, such as a

missed deadline, violation of a `QosPolicy` setting, etc. Each DCPS `Entity` supports its own specialized kind of `Listener`. `Listeners` are related to changes in communication status. For each `Entity` type, one specific `Listener` is derived from this interface. In the following modules, the following `Listeners` are derived from this interface:

- `DomainParticipantListener`
- `ExtDomainParticipantListener`
- `TopicListener`
- `ExtTopicListener`
- `PublisherListener`
- `DataWriterListener`
- `SubscriberListener`

The `Entity` type specific `Listener` interfaces are part of the application which must implement the interface operations. A user-defined class for these operations must be provided by the application which must extend from the **specific** `Listener` class. **All** `Listener` operations **must** be implemented in the user-defined class, it is up to the application whether an operation is empty or contains some functionality.

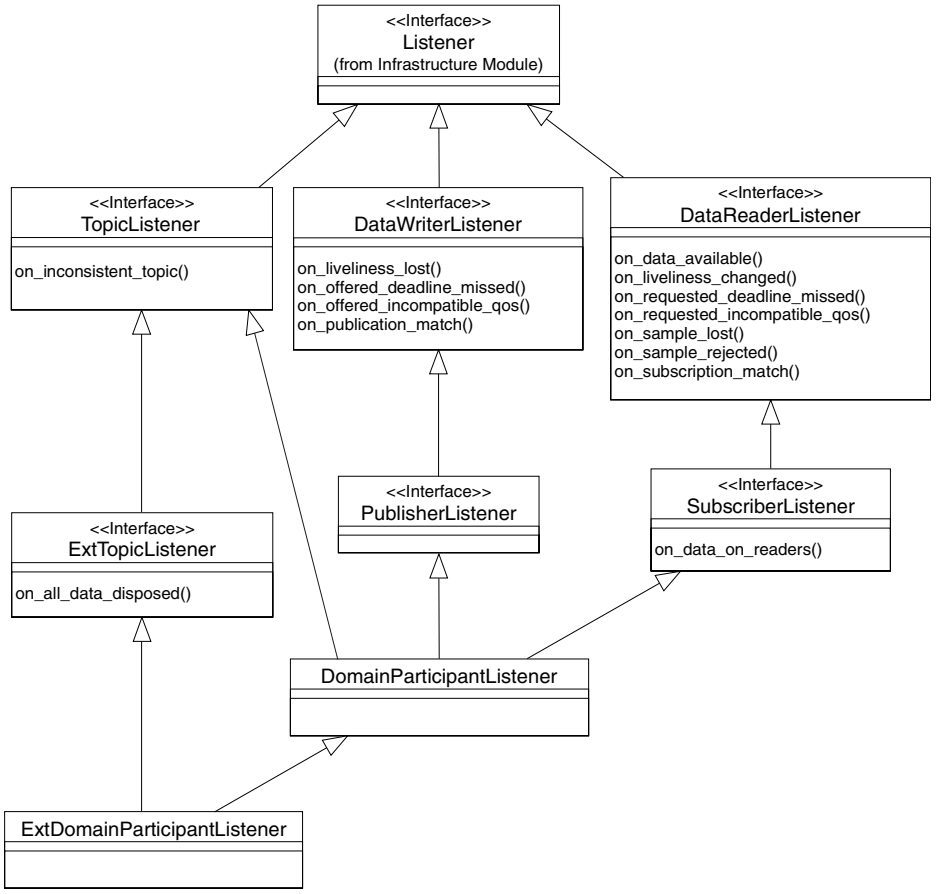

Figure 11 DCPS Listeners

The base class `Listener` does not contain any operations.

3.1.5 Struct Status

Each concrete `Entity` class has a set of `Status` attributes and for each attribute the `Entity` class provides an operation to read the value. Changes to `Status` attributes will affect associated `StatusCondition` and (invoked and associated) `Listener` objects.

The communication statuses whose changes can be communicated to the application depend on the `Entity`. The following table shows the relevant statuses for each `Entity`.

Table 12 Status Description Per Entity

Entity	Status	Meaning
Topic	INCONSISTENT_TOPIC_STATUS	Another Topic exists with the same name but with different characteristics.
	ALL_DATA_ DISPOSED_TOPIC_STATUS	All instances of the Topic have been disposed by the dispose_all_data operation on that topic.
Subscriber	DATA_ON_READERS_STATUS	New information is available.
DataReader	SAMPLE_REJECTED_STATUS	A (received) sample has been rejected.
	LIVELINESS_CHANGED_STATUS	The liveliness of one or more DataWriter objects that were writing instances read through the DataReader has changed. Some DataWriter have become “alive” or “not alive”.
	REQUESTED_ DEADLINE_MISSED_STATUS	The deadline that the DataReader was expecting through its DeadlineQosPolicy was not respected for a specific instance.
	REQUESTED_ INCOMPATIBLE_QOS_STATUS	A QosPolicy setting was incompatible with what is offered.
	DATA_AVAILABLE_STATUS	New information is available.
	SAMPLE_LOST_STATUS	A sample has been lost (never received).
	SUBSCRIPTION_MATCH_STATUS	The DataReader has found a DataWriter that matches the Topic and has compatible QoS.

Table 12 Status Description Per Entity (continued)

Entity	Status	Meaning
DataWriter	LIVELINESS_LOST_STATUS	The liveliness that the DataWriter has committed through its LivelinessQosPolicy was not respected; thus DataReader objects will consider the DataWriter as no longer "alive".
	OFFERED_ DEADLINE_MISSED_STATUS	The deadline that the DataWriter has committed through its DeadlineQosPolicy was not respected for a specific instance.
	OFFERED_ INCOMPATIBLE_QOS_STATUS	A QosPolicy setting was incompatible with what was requested.
	PUBLICATION_MATCH_STATUS	The DataWriter has found DataReader that matches the Topic and has compatible QoS.

A Status attribute can be retrieved with the operation get_<status_name>_status. For example, to get the InconsistentTopicStatus value, the application must call the operation get_inconsistent_topic_status.

Conceptually associated with each Entity communication status is a logical StatusChangedFlag. This flag indicates whether that particular communication status has changed. The StatusChangedFlag is only conceptual, therefore, it is not important whether this flag actually exists.

For the plain communication Status, the StatusChangedFlag is initially set to FALSE. It becomes TRUE whenever the plain communication Status changes and it is reset to FALSE each time the application accesses the plain communication Status via the proper get_<status_name>_status operation on the Entity.

A flag set means that a change has occurred since the last time the application has read its value.

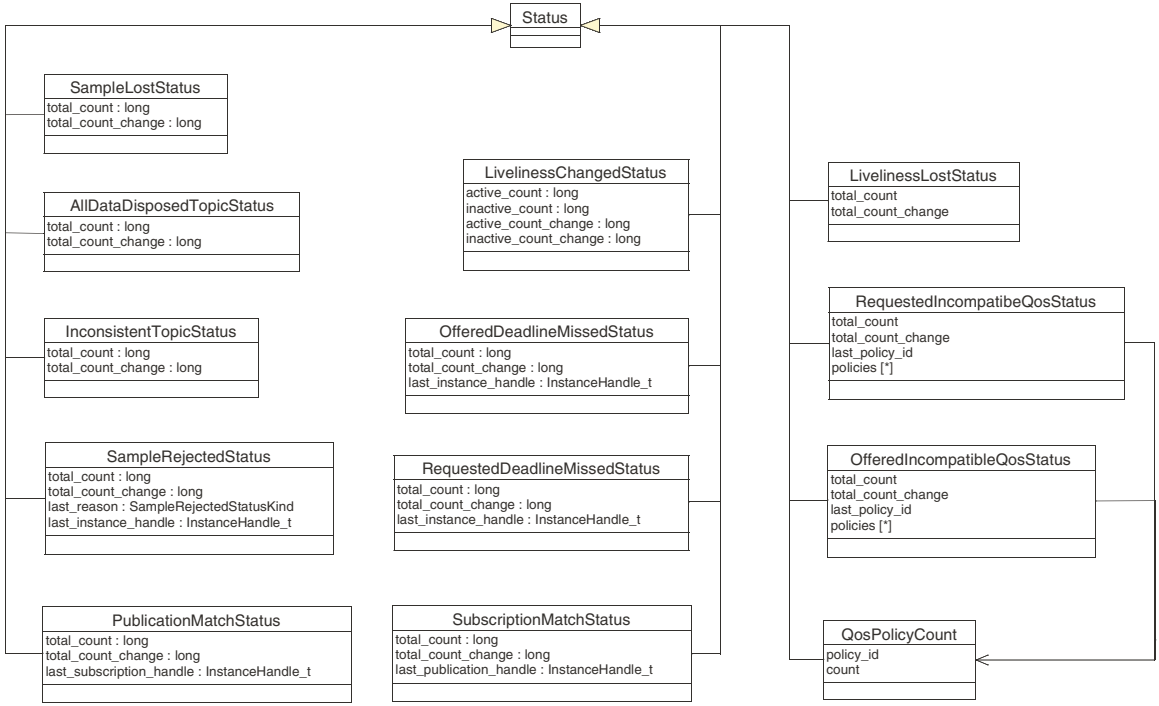

Figure 12 DCPS Status Values

Each `Status` attribute is implemented as a struct and therefore does not provide any operations. The interface description of these structs is as follows:

```
// struct <name>Status
//
   struct InconsistentTopicStatus
      { Long total_count;
        Long total_count_change; };
   struct AllDataDisposedTopicStatus
      { Long total_count;
        Long total_count_change; }
   struct SampleLostStatus
      { Long total_count;
        Long total_count_change; };
   enum SampleRejectedStatusKind
      { NOT_REJECTED,
        REJECTED_BY_INSTANCES_LIMIT,
        REJECTED_BY_SAMPLES_LIMIT,
        REJECTED_BY_SAMPLES_PER_INSTANCE_LIMIT };
   struct SampleRejectedStatus
      { Long total_count;
        Long total_count_change;
        SampleRejectedStatusKind last_reason;
```

```
        InstanceHandle_t last_instance_handle; };
    struct LivelinessLostStatus
       { Long total_count;
         Long total_count_change; };
    struct LivelinessChangedStatus
       { Long alive_count;
         Long not_alive_count;
         Long alive_count_change;
         Long not_alive_count_change;
         InstanceHandle_t last_publication_handle; };
    struct OfferedDeadlineMissedStatus
       { Long total_count;
         Long total_count_change;
         InstanceHandle_t last_instance_handle; };
    struct RequestedDeadlineMissedStatus
       { Long total_count;
         Long total_count_change;
         InstanceHandle_t last_instance_handle; };
    struct OfferedIncompatibleQosStatus
       { Long total_count;
         Long total_count_change;
         QosPolicyId_t last_policy_id;
         QosPolicyCountSeq policies; };
    struct RequestedIncompatibleQosStatus
       { Long total_count;
         Long total_count_change;
         QosPolicyId_t last_policy_id;
         QosPolicyCountSeq policies; };
    struct PublicationMatchedStatus
       { Long total_count;
         Long total_count_change;
         Long current_count;
         Long current_count_change;
         InstanceHandle_t last_subscription_handle; };
    struct SubscriptionMatchedStatus
       { Long total_count;
         Long total_count_change;
         Long current_count;
         Long current_count_change;
         InstanceHandle_t last_publication_handle; };
//
// implemented API operations
//     <no operations>
```

The next paragraphs describe the usage of each `<name>Status` struct.

3.1.5.1 InconsistentTopicStatus

Scope

`DDS`

Synopsis

```
#include <ccpp_dds_dcps.h>
struct InconsistentTopicStatus
          { Long total_count;
            Long total_count_change; };
```

Description

This struct contains the statistics about attempts to create other `Topics` with the same name but with different characteristics.

Attributes

`Long total_count` - the total detected cumulative count of `Topic` creations, whose name matches the `Topic` to which this `Status` is attached and whose characteristics are inconsistent.

`Long total_count_change` - the change in `total_count` since the last time the `Listener` was called or the `Status` was read.

Detailed Description

This struct contains the statistics about attempts to create other `Topics` with the same name but with different characteristics.

The attribute `total_count` holds the total detected cumulative count of `Topic` creations, whose name matches the `Topic` to which this `Status` is attached and whose characteristics are inconsistent .

The attribute `total_count_change` holds the incremental number of inconsistent `Topics`, since the last time the `Listener` was called or the `Status` was read.

3.1.5.2 LivelinessChangedStatus

Scope

`DDS`

Synopsis

```
#include <ccpp_dds_dcps.h>
struct LivelinessChangedStatus
          { Long alive_count;
            Long not_alive_count;
            Long alive_count_change;
            Long not_alive_count_change;
```

```
InstanceHandle_t last_publication_handle; };
```

Description

This struct contains the statistics about whether the liveliness of one or more connected `DataWriter` objects has changed.

Attributes

`Long alive_count` - the total count of currently alive `DataWriter` objects that write the topic read by the `DataReader` to which this `Status` is attached.

`Long not_alive_count` - the total count of currently not alive `DataWriter` objects that wrote the topic read by the `DataReader` to which this `Status` is attached.

`Long alive_count_change` - the change in `alive_count` since the last time the `Listener` was called or the `Status` was read.

`Long not_alive_count_change` - the change in `not_alive_count` since the last time the `Listener` was called or the `Status` was read.

`InstanceHandle_t last_publication_handle` - handle to the last `DataWriter` whose change in liveliness caused this status to change.

Detailed Description

This struct contains the statistics about whether the liveliness of one or more connected `DataWriter` objects that were writing instances read through the `DataReader` has changed. In other words, some `DataWriter` have become “alive” or “not alive”.

The attribute `alive_count` holds the total number of currently alive `DataWriter` objects that write the topic read by the `DataReader` to which this `Status` is attached. This count increases when a newly-matched `DataWriter` asserts its liveliness for the first time or when a `DataWriter` previously considered to be not alive reasserts its liveliness. The count decreases when a `DataWriter` considered alive fails to assert its liveliness and becomes not alive, whether because it was deleted normally or for some other reason.

The attribute `not_alive_count` holds the total count of currently not alive `DataWriters` that wrote the topic read by the `DataReader` to which this `Status` is attached, and that are no longer asserting their liveliness. This count increases when a `DataWriter` considered alive fails to assert its liveliness and becomes not alive for some reason other than the normal deletion of that `DataWriter`. It decreases when a previously not alive `DataWriter` either reasserts its liveliness or is deleted normally.

The attribute `alive_count_change` holds the change in `alive_count` since the last time the `Listener` was called or the `Status` was read.

The attribute not_alive_count_change holds the change in not_alive_count since the last time the Listener was called or the Status was read.

The attribute last_publication_handle contains the instance handle to the PublicationBuiltinTopicData instance that represents the last datawriter whose change in liveliness caused this status to change. Be aware that this handle belongs to *another* datareader, the PublicationBuiltinTopicDataDataReader in the builtin-subscriber, and has no meaning in the context of the datareader from which the LivelinessChangedStatus was obtained. If the builtin-subscriber has not explicitly been obtained using get_builtin_subscriber on the DomainParticipant, then there is no PublicationBuiltinTopicDataDataReader as well, in which case the last_publication_handle will be set to HANDLE_NIL.

3.1.5.3 LivelinessLostStatus

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
struct LivelinessLostStatus
          { Long total_count;
            Long total_count_change; };
```

Description

This struct contains the statistics about whether the liveliness of the DataWriter to which this Status is attached has been committed through its LivelinessQosPolicy.

Attributes

Long total_count - the total cumulative count of times the DataWriter to which this Status is attached failed to actively signal its liveliness within the offered liveliness period.

Long total_count_change - the change in total_count since the last time the Listener was called or the Status was read.

Detailed Description

This struct contains the statistics about whether the liveliness of the DataWriter to which this Status is attached has been committed through its LivelinessQosPolicy. In other words, whether the DataWriter failed to

actively signal its liveliness within the offered liveliness period. In such a case, the connected DataReader objects will consider the DataWriter as no longer "alive".

The attribute total_count holds the total cumulative number of times that the previously-alive DataWriter became not alive due to a failure to actively signal its liveliness within its offered liveliness period. This count does not change when an already not alive DataWriter simply remains not alive for another liveliness period.

The attribute total_count_change holds the change in total_count since the last time the Listener was called or the Status was read.

3.1.5.4 OfferedDeadlineMissedStatus

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
struct OfferedDeadlineMissedStatus
          { Long total_count
            Long total_count_change
            InstanceHandle_t last_instance_handle }
```

Description

This struct contains the statistics about whether the deadline that the DataWriter to which this Status is attached has committed through its DeadlineQosPolicy was not respected for a specific instance.

Attributes

Long total_count - the total cumulative count of times the DataWriter to which this Status is attached failed to write within its offered deadline.

Long total_count_change - the change in total_count since the last time the Listener was called or the Status was read.

InstanceHandle_t last_instance_handle - the handle to the last instance in the DataWriter to which this Status is attached, for which an offered deadline was missed.

Detailed Description

This struct contains the statistics about whether the deadline that the DataWriter to which this Status is attached has committed through its DeadlineQosPolicy was not respected for a specific instance.

The attribute total_count holds the total cumulative number of offered deadline periods elapsed during which the DataWriter to which this Status is attached failed to provide data. Missed deadlines accumulate; that is, each deadline period the total_count will be incremented by one.

The attribute total_count_change holds the change in total_count since the last time the Listener was called or the Status was read.

The attribute last_instance_handle holds the handle to the last instance in the DataWriter to which this Status is attached, for which an offered deadline was missed.

3.1.5.5 OfferedIncompatibleQosStatus

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
struct OfferedIncompatibleQosStatus
          { Long total_count
            Long total_count_change
            QosPolicyId_t last_policy_id
            QosPolicyCountSeq policies }
```

Description

This struct contains the statistics about whether an offered QosPolicy setting was incompatible with the requested QosPolicy setting.

Attributes

Long total_count - the total cumulative count of DataReader objects discovered by the DataWriter with the same Topic and Partition and with a requested DataReaderQos that was incompatible with the one offered by the DataWriter.

Long total_count_change - the change in total_count since the last time the Listener was called or the Status was read.

QosPolicyId_t last_policy_id - the id of one of the QosPolicy settings that was found to be incompatible with what was offered, the last time an incompatibility was detected.

QosPolicyCountSeq policies - a list containing for each QosPolicy the total number of times that the concerned DataWriter discovered a DataReader for the same Topic and a requested DataReaderQos that is incompatible with the one offered by the DataWriter.

Detailed Description

This struct contains the statistics about whether an offered QosPolicy setting was incompatible with the requested QosPolicy setting.

The Request/Offering mechanism is applicable between:

- the DataWriter and the DataReader. If the QosPolicy settings between DataWriter and DataReader are incompatible, no communication between them is established. In addition the DataWriter will be informed via a REQUESTED_INCOMPATIBLE_QOS status change and the DataReader will be informed via an OFFERED_INCOMPATIBLE_QOS status change.
- the DataWriter and the Durability Service (as a built-in DataReader). If the QosPolicy settings between DataWriter and the Durability Service are inconsistent, no communication between them is established. In that case data published by the DataWriter will not be maintained by the service and as a consequence will not be available for late joining DataReaders. The QosPolicy of the Durability Service in the role of DataReader is specified by the DurabilityServiceQosPolicy in the Topic.
- the Durability Service (as a built-in DataWriter) and the DataReader. If the QosPolicy settings between the Durability Service and the DataReader are inconsistent, no communication between them is established. In that case the Durability Service will not publish historical data to late joining DataReaders. The QosPolicy of the Durability Service in the role of DataWriter is specified by the DurabilityServiceQosPolicy in the Topic.

The attribute total_count holds the total cumulative count of DataReader objects discovered by the DataWriter with the same Topic and a requested DataReaderQos that was incompatible with the one offered by the DataWriter.

The attribute total_count_change holds the change in total_count since the last time the Listener was called or the Status was read.

The attribute last_policy_id holds the id of one of the QosPolicy settings that was found to be incompatible with what was offered, the last time an incompatibility was detected.

The attribute policies holds a list containing for each QosPolicy the total number of times that the concerned DataWriter discovered an incompatible DataReader for the same Topic.Each element in the list represents a counter for a different QosPolicy, identified by a corresponding unique index number. A named list of all index numbers is expressed as a set of constants in the API. See Table 13, *Overview of all named QosPolicy indexes* for an overview of all these constants.

Table 13 Overview of all named QosPolicy indexes

Index name	Index Value
INVALID_QOS_POLICY_ID	0
USERDATA_QOS_POLICY_ID	1
DURABILITY_QOS_POLICY_ID	2
PRESENTATION_QOS_POLICY_ID	3
DEADLINE_QOS_POLICY_ID	4
LATENCYBUDGET_QOS_POLICY_ID	5
OWNERSHIP_QOS_POLICY_ID	6
OWNERSHIPSTRENGTH_QOS_POLICY_ID	7
LIVELINESS_QOS_POLICY_ID	8
TIMEBASEDFILTER_QOS_POLICY_ID	9
PARTITION_QOS_POLICY_ID	10
RELIABILITY_QOS_POLICY_ID	11
DESTINATIONORDER_QOS_POLICY_ID	12
HISTORY_QOS_POLICY_ID	13
RESOURCELIMITS_QOS_POLICY_ID	14
ENTITYFACTORY_QOS_POLICY_ID	15
WRITERDATALIFECYCLE_QOS_POLICY_ID	16
READERDATALIFECYCLE_QOS_POLICY_ID	17
TOPICDATA_QOS_POLICY_ID	18
GROUPDATA_QOS_POLICY_ID	19
TRANSPORTPRIORITY_QOS_POLICY_ID	20
LIFESPAN_QOS_POLICY_ID	21
DURABILITYSERVICE_QOS_POLICY_ID	22

3.1.5.6 PublicationMatchedStatus

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
struct PublicationMatchedStatus
          { Long total_count
            Long total_count_change
            Long current_count;
```

```
Long current_count_change;
InstanceHandle_t last_subscription_handle }
```

Description

This struct contains the statistics about the discovered number of matching DataReaders currently connected to the owner of this status, and of the cumulative number of DataReaders that has connected to the owner of this status over time.

Attributes

Long total_count - Total cumulative count of DataReaders compatible with the concerned DataWriter.

Long total_count_change - The change in total_count since the last time the Status was read.

Long current_count - Total count of DataReaders that are currently available and compatible with the DataWriter.

Long current_count_change - The change in `current_count` since the last time the Status was read.

InstanceHandle_t last_subscription_handle - Handle to the last DataReader that matched the DataWriter causing the status to change.

Detailed Description

This struct contains the statistics about the discovered number of DataReaders that are compatible with the DataWriter to which the Status is attached. DataReader and DataWriter are compatible if they use the same Topic and if the QoS requested by the DataReader is compatible with that offered by the DataWriter. A DataReader will automatically connect to a matching DataWriter, but will disconnect when that DataReader is deleted, when either changes its QoS into an incompatible value, or when either puts its matching counterpart on its ignore-list using the `ignore_subscription` or `ignore_publication` operations on the DomainParticipant.

The `total_count` includes DataReaders that have already been disconnected, while in the `current_count` only the currently connected DataReaders are considered.

3.1.5.7 RequestedDeadlineMissedStatus

Scope

`DDS`

Synopsis

```
#include <ccpp_dds_dcps.h>
```

```
struct RequestedDeadlineMissedStatus
          { Long total_count
            Long total_count_change
            InstanceHandle_t last_instance_handle }
```

Description

This struct contains the statistics about whether the deadline that the DataReader to which this Status is attached was expecting through its DeadlineQosPolicy, was not respected for a specific instance.

Attributes

Long total_count - the total cumulative count of the missed deadlines detected for any instance read by the DataReader to which this Status is attached.

Long total_count_change - the change in total_count since the last time the Listener was called or the Status was read.

InstanceHandle_t last_instance_handle - the handle to the last instance in the DataReader to which this Status is attached for which a missed deadline was detected.

Detailed Description

This struct contains the statistics about whether the deadline that the DataReader to which this Status is attached was expecting through its DeadlineQosPolicy was not respected for a specific instance. Missed deadlines accumulate, that is, each deadline period the total_count will be incremented by one for each instance for which data was not received.

The attribute total_count holds the total cumulative count of the missed deadlines detected for any instance read by the DataReader.

The attribute total_count_change holds the change in total_count since the last time the Listener was called or the Status was read.

The attribute last_instance_handle holds the handle to the last instance in the DataReader for which a missed deadline was detected.

3.1.5.8 RequestedIncompatibleQosStatus

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
struct RequestedIncompatibleQosStatus
          { Long total_count
            Long total_count_change
```

```
QosPolicyId_t last_policy_id
QosPolicyCountSeq policies }
```

Description

This struct contains the statistics about whether a requested QosPolicy setting was incompatible with the offered QosPolicy setting.

Attributes

Long total_count - the total cumulative count of DataWriter objects, discovered by the DataReader to which this Status is attached, with the same Topic and an offered DataWriterQos that was incompatible with the one requested by the DataReader.

Long total_count_change - the change in total_count since the last time the Listener was called or the Status was read.

QosPolicyId_t last_policy_id - the *<name>*_QOS_POLICY_ID of one of the QosPolicies that was found to be incompatible with what was requested, the last time an incompatibility was detected.

QosPolicyCountSeq policies - a list containing (for each QosPolicy) the total number of times that the concerned DataReader discovered a DataWriter with the same Topic and an offered DataWriterQos that is incompatible with the one requested by the DataReader.

Detailed Description

This struct contains the statistics about whether a requested QosPolicy setting was incompatible with the offered QosPolicy setting.

The Request/Offering mechanism is applicable between:

- the DataWriter and the DataReader. If the QosPolicy settings between DataWriter and DataReader are incompatible, no communication between them is established. In addition the DataWriter will be informed via a REQUESTED_INCOMPATIBLE_QOS status change and the DataReader will be informed via an OFFERED_INCOMPATIBLE_QOS status change.
- the DataWriter and the Durability Service (as a built-in DataReader). If the QosPolicy settings between DataWriter and the Durability Service are inconsistent, no communication between them is established. In that case data published by the DataWriter will not be maintained by the service and as a consequence will not be available for late joining DataReaders. The QosPolicy of the Durability Service in the role of DataReader is specified by the DurabilityServiceQosPolicy in the Topic.

- the Durability Service (as a built-in DataWriter) and the DataReader. If the QosPolicy settings between the Durability Service and the DataReader are inconsistent, no communication between them is established. In that case the Durability Service will not publish historical data to late joining DataReaders. The QosPolicy of the Durability Service in the role of DataWriter is specified by the DurabilityServiceQosPolicy in the Topic.

The attribute total_count holds the total cumulative count of DataWriter objects discovered by the DataReader with the same Topic and an offered DataWriterQos that was incompatible with the one requested by the DataReader.

The attribute total_count_change holds the change in total_count since the last time the Listener was called or the Status was read.

The attribute last_policy_id holds the *<name>*_QOS_POLICY_ID of one of the QosPolicies that was found to be incompatible with what was requested, the last time an incompatibility was detected.

The attribute policies holds a list containing for each QosPolicy the total number of times that the concerned DataReader discovered an incompatible DataWriter for the same Topic. Each element in the list represents a counter for a different QosPolicy, identified by a corresponding unique index number. A named list of all index numbers is expressed as a set of constants in the API. See Table 13, *Overview of all named QosPolicy indexes*, on page 101 for an overview of all these constants.

3.1.5.9 SampleLostStatus

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
struct SampleLostStatus
          { Long total_count
            Long total_count_change }
```

Description

This struct contains the statistics about whether a sample has been lost (never received).

Attributes

Long total_count - the total cumulative count of all samples lost across all instances of data published under the Topic.

Long total_count_change - the change in total_count since the last time the Listener was called or the Status was read.

Detailed Description

This struct contains the statistics about whether a sample has been lost (never received). The status is independent of the differences in instances, in other words, it includes all samples lost across all instances of data published under the Topic.

total_count holds the total cumulative count of all samples lost across all instances of data published under the Topic.

total_count_change holds the change in total_count since the last time the Listener was called or the Status was read.

3.1.5.10 SampleRejectedStatus

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
enum SampleRejectedStatusKind
          { NOT_REJECTED
            REJECTED_BY_INSTANCES_LIMIT,
            REJECTED_BY_SAMPLES_LIMIT,
            REJECTED_BY_SAMPLES_PER_INSTANCE_LIMIT }
struct SampleRejectedStatus
          { Long total_count
            Long total_count_change
            SampleRejectedStatusKind last_reason
            InstanceHandle_t last_instance_handle }
```

Description

This struct contains the statistics about samples that have been rejected.

Attributes

Long total_count - the total cumulative count of samples rejected by the DataReader to which this Status is attached.

Long total_count_change - the change in total_count since the last time the Listener was called or the Status was read.

SampleRejectedStatusKind last_reason - the reason for rejecting the last sample.

InstanceHandle_t last_instance_handle - the handle to the instance which would have been updated by the last sample that was rejected.

Detailed Description

This struct contains the statistics about whether a received sample has been rejected.

The attribute `total_count` holds the total cumulative count of samples rejected by the `DataReader` to which this `Status` is attached.

The attribute `total_count_change` holds the change in `total_count` since the last time the `Listener` was called or the `Status` was read.

The attribute `last_reason` holds the reason for rejecting the last sample. The attribute can have the following values:

- *`NOT_REJECTED`* - no sample has been rejected yet.
- *`REJECTED_BY_INSTANCES_LIMIT`* - the sample was rejected because it would exceed the maximum number of instances set by the `ResourceLimitsQosPolicy`.
- *`REJECTED_BY_SAMPLES_LIMIT`* - the sample was rejected because it would exceed the maximum number of samples set by the `ResourceLimits QosPolicy`.
- *`REJECTED_BY_SAMPLES_PER_INSTANCE_LIMIT`* - the sample was rejected because it would exceed the maximum number of samples per instance set by the `ResourceLimitsQosPolicy`.

The attribute `last_instance_handle` holds the handle to the instance which would have updated by the last sample that was rejected.

3.1.5.11 SubscriptionMatchedStatus

Scope

`DDS`

Synopsis

```
#include <ccpp_dds_dcps.h>
struct SubscriptionMatchedStatus
          { Long total_count
            Long total_count_change
            Long current_count;
            Long current_count_change;
            InstanceHandle_t last_publication_handle }
```

Description

This struct contains the statistics about the discovered number of matching DataWriters currently connected to the owner of this status, and of the cumulative number of DataWriters that has connected to the owner of this status over time.

Attributes

Long total_count - Total cumulative count of DataWriters compatible with the concerned DataReader.

Long total_count_change - The change in total_count since the last time the Status was read.

Long current_count - Total count of DataWriters that are currently available and compatible with the DataWriter.

Long current_count_change - The change in current_count since the last time the Status was read.

InstanceHandle_t last_publication_handle - Handle to the last DataWriter that matched the DataReader causing the status to change.

Detailed Description

This struct contains the statistics about the discovered number of DataWriters that are compatible with the DataReader to which the Status is attached. DataWriter and DataReader are compatible if they use the same Topic and if the QoS requested by the DataReader is compatible with that offered by the DataWriter. A DataWriter will automatically connect to a matching DataReader, but will disconnect when that DataWriter is deleted, when either changes its QoS into an incompatible value, or when either puts its matching counterpart on its ignore-list using the ignore_subscription or ignore_publication operations on the DomainParticipant.

The total_count includes DataWriters that have already been disconnected, while in the current_count only the currently connected DataWriters are considered.

3.1.5.12 AllDataDisposedTopicStatus

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
struct AllDataDisposedTopicStatus
 { Long total_count
   Long total_count_change }
```

Description

This struct contains the statistics about the occurence of the ALL_DATA_DISPOSED_TOPIC_STATUS event on the Topic to which this Status is attached.

Attributes

Long total_count - the total detected cumulative count of ALL_DATA_DISPOSED_TOPIC_STATUS events.

Long total_count_change - the change in total_count since the last time the Status was read.

Detailed Description

This struct contains the statistics about the occurence of the ALL_DATA_DISPOSED_TOPIC_STATUS event on the Topic to which this Status is attached. The Status is directly related to the invocation of the DDS::Topic::dispose_all_data() operation. Statistics are only kept when all instances are disposed using this operation, not when instances are disposed seperately by individual dispose calls.

3.1.6 Class WaitSet

A WaitSet object allows an application to wait until one or more of the attached Condition objects evaluates to TRUE or until the timeout expires.

The WaitSet has no factory and must be created by the application. It is directly created as an object by using WaitSet constructors.

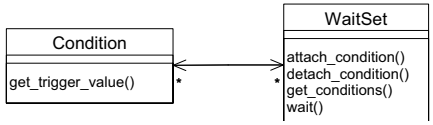

Figure 13 DCPS WaitSets

The interface description of this class is as follows:

```
class WaitSet
{
//
// implemented API operations
//
    ReturnCode_t
       wait
          (ConditionSeq& active_conditions,
          const Duration_t& timeout);
    ReturnCode_t
       attach_condition
          (Condition_ptr cond);
    ReturnCode_t
       detach_condition
          (Condition_ptr cond);
    ReturnCode_t
       get_conditions
```

```
                (ConditionSeq& attached_conditions);
};
```

The following paragraphs describe the usage of all WaitSet operations.

3.1.6.1 attach_condition

Scope

`DDS::WaitSet`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   attach_condition
      (Condition_ptr cond);
```

Description

This operation attaches a `Condition` to the `WaitSet`.

Parameters

`in Condition_ptr cond` - a pointer to a `Condition`.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_BAD_PARAMETER` or `RETCODE_OUT_OF_RESOURCES`.

Detailed Description

This operation attaches a `Condition` to the `WaitSet`. The parameter `cond` must be either a `ReadCondition`, `QueryCondition`, `StatusCondition` or `GuardCondition`. To get this parameter see:

- `ReadCondition` created by `create_readcondition`
- `QueryCondition` created by `create_querycondition`
- `StatusCondition` retrieved by `get_statuscondition` on an `Entity`
- `GuardCondition` created by the C++ operation `new`.

When a `GuardCondition` is initially created, the `trigger_value` is `FALSE`.

When a `Condition`, whose `trigger_value` evaluates to `TRUE`, is attached to a `WaitSet` that is currently being waited on (using the `wait` operation), the `WaitSet` will unblock immediately.

Return Code

When the operation returns:

- *RETCODE_OK* - the Condition is attached to the WaitSet
- *RETCODE_ERROR* - an internal error has occurred
- *RETCODE_BAD_PARAMETER* - the parameter cond is not a valid Condition_ptr
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.1.6.2 detach_condition

Scope

DDS::WaitSet

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   detach_condition
      (Condition_ptr cond);
```

Description

This operation detaches a Condition from the WaitSet.

Parameters

in Condition_ptr cond - a pointer to a Condition in the WaitSet.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_OUT_OF_RESOURCES or RETCODE_PRECONDITION_NOT_MET.

Detailed Description

This operation detaches a Condition from the WaitSet. If the Condition was not attached to this WaitSet, the operation returns RETCODE_PRECONDITION_NOT_MET.

Return Code

When the operation returns:

- *RETCODE_OK* - the Condition is detached from the WaitSet.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - the parameter cond is not a valid Condition_ptr.

- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_PRECONDITION_NOT_MET* - the Condition was not attached to this WaitSet.

3.1.6.3 get_conditions

Scope

DDS::WaitSet

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_conditions
      (ConditionSeq_out attached_conditions);
```

Description

This operation retrieves the list of attached conditions.

Parameters

inout ConditionSeq& attached_conditions - a reference to a sequence which is used to pass the list of attached conditions.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation retrieves the list of attached conditions in the WaitSet. The parameter attached_conditions is a reference to a sequence which afterwards will refer to the sequence of attached conditions. The attached_conditions sequence and its buffer may be pre-allocated by the application and therefore must either be re-used in a subsequent invocation of the get_conditions operation or be released by invoking its destructor either implicitly or explicitly. If the pre-allocated sequence is not big enough to hold the number of triggered Conditions, the sequence will automatically be (re-)allocated to fit the required size. The resulting sequence will either be an empty sequence, meaning there were no conditions attached, or will contain a list of ReadCondition, QueryCondition, StatusCondition and GuardCondition. These conditions previously have been attached by attach_condition and were created by there respective create operation:

- ReadCondition created by create_readcondition

- `QueryCondition` created by `create_querycondition`
- `StatusCondition` retrieved by `get_statuscondition` on an `Entity`
- `GuardCondition` created by the C++ operation `new`.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the list of attached conditions is returned
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_OUT_OF_RESOURCES`* - the Data Distribution Service ran out of resources to complete this operation.

3.1.6.4 wait

Scope

`DDS::WaitSet`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   wait
      (ConditionSeq& active_conditions,
        const Duration_t& timeout);
```

Description

This operation allows an application thread to wait for the occurrence of at least one of the conditions that is attached to the `WaitSet`.

Parameters

`inout ConditionSeq active_conditions` - a sequence which is used to pass the list of all the attached conditions that have a `trigger_value` of `TRUE`.

`in const Duration_t& timeout` - the maximum duration to block for the `wait`, after which the application thread is unblocked. The special constant `DURATION_INFINITE` can be used when the maximum waiting time does not need to be bounded.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_OUT_OF_RESOURCES`, `RETCODE_TIMEOUT` or `RETCODE_PRECONDITION_NOT_MET`.

Detailed Description

This operation allows an application thread to wait for the occurrence of at least one of the `conditions` to evaluate to `TRUE` that is attached to the `WaitSet`. If all of the conditions attached to the `WaitSet` have a `trigger_value` of `FALSE`, the `wait` operation will block the calling thread. The result of the operation is the continuation of the application thread after which the result is left in `active_conditions`. This is a reference to a sequence, which will contain the list of all the attached conditions that have a `trigger_value` of `TRUE`. The `active_conditions` sequence and its buffer may be pre-allocated by the application and therefore must either be re-used in a subsequent invocation of the `wait` operation or be released by invoking its destructor either implicitly or explicitly. If the pre-allocated sequence is not big enough to hold the number of triggered `Conditions`, the sequence will automatically be (re-)allocated to fit the required size. The parameter `timeout` specifies the maximum duration for the `wait` to block the calling application thread (when none of the attached conditions has a `trigger_value` of `TRUE`). In that case the return value is `RETCODE_TIMEOUT` and the `active_conditions` sequence is left empty. Since it is not allowed for more than one application thread to be waiting on the same `WaitSet`, the operation returns immediately with the value `RETCODE_PRECONDITION_NOT_MET` when the `wait` operation is invoked on a `WaitSet` which already has an application thread blocking on it.

Return Code

When the operation returns:

- *`RETCODE_OK`* - at least one of the attached `conditions` has a `trigger_value` of `TRUE`.
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_OUT_OF_RESOURCES`* - the Data Distribution Service ran out of resources to complete this operation.
- *`RETCODE_TIMEOUT`* - the `timeout` has elapsed without any of the attached `conditions` becoming `TRUE`.
- *`RETCODE_PRECONDITION_NOT_MET`* - the `WaitSet` already has an application thread blocking on it.

3.1.7 Class Condition

This class is the base class for all the conditions that may be attached to a `WaitSet`. This base class is specialized in three classes by the Data Distribution Service: `GuardCondition`, `StatusCondition` and `ReadCondition` (also there is a `QueryCondition` which is a specialized `ReadCondition`).

Each `Condition` has a `trigger_value` that can be `TRUE` or `FALSE` and is set by the Data Distribution Service (except a `GuardCondition`) depending on the evaluation of the `Condition`.

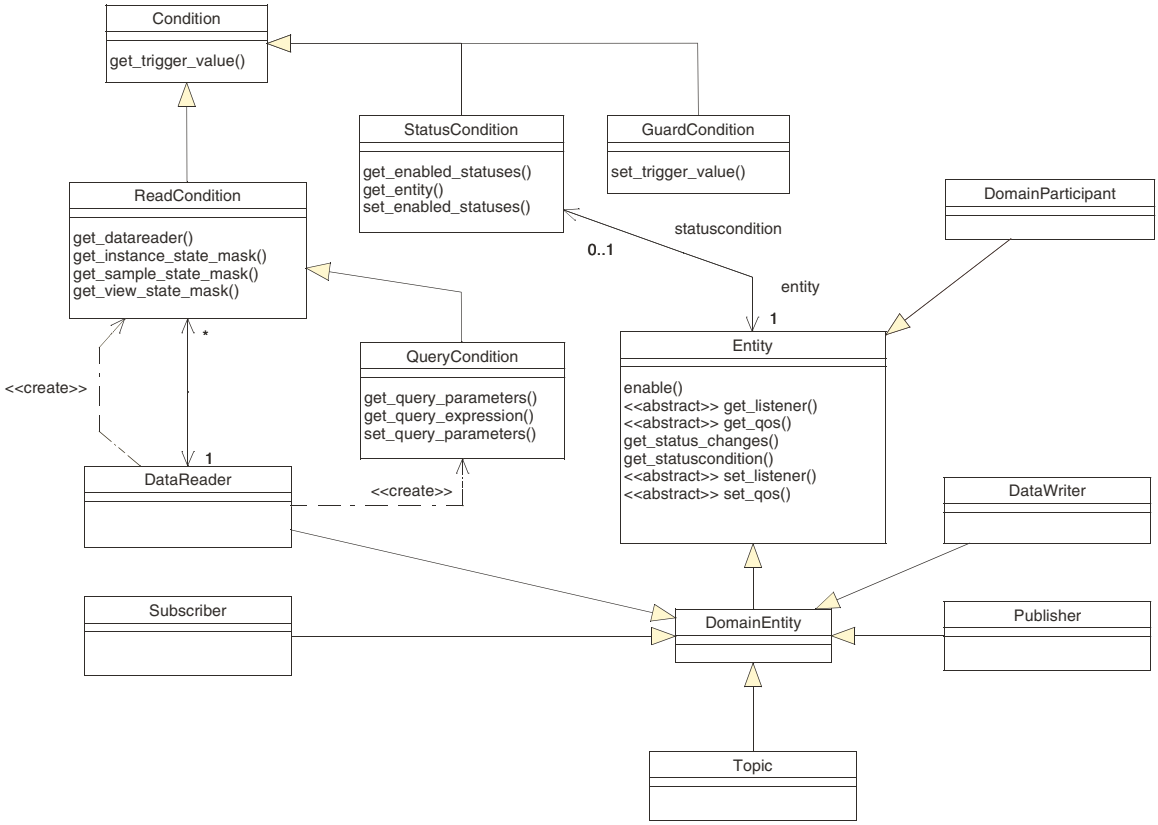

Figure 14 DCPS Conditions

The interface description of this class is as follows:

```
class Condition
{
//
// implemented API operations
//
   Boolean
      get_trigger_value
         (void);
};
```

The next paragraph describes the usage of the `Condition` operation.

3.1.7.1 get_trigger_value

Scope

`DDS::Condition`

Synopsis

```
#include <ccpp_dds_dcps.h>
Boolean
   get_trigger_value
      (void);
```

Description

This operation returns the `trigger_value` of the `Condition`.

Parameters

<none>

Return Value

`Boolean` - is the `trigger_value`.

Detailed Description

A `Condition` has a `trigger_value` that can be `TRUE` or `FALSE` and is set by the Data Distribution Service (except a `GuardCondition`). This operation returns the `trigger_value` of the `Condition`.

3.1.8 Class GuardCondition

A `GuardCondition` object is a specific `Condition` whose `trigger_value` is completely under the control of the application. The `GuardCondition` has no factory and must be created by the application. The `GuardCondition` is directly created as an object by using the `GuardCondition` constructor. When a `GuardCondition` is initially created, the `trigger_value` is `FALSE`. The purpose of the `GuardCondition` is to provide the means for an application to manually wake up a `WaitSet`. This is accomplished by attaching the `GuardCondition` to the `Waitset` and setting the `trigger_value` by means of the `set_trigger_value` operation.

The interface description of this class is as follows:

```
class GuardCondition
{
//
// inherited from Condition
//
// Boolean
//    get_trigger_value
```

```
//        (void);
//
// implemented API operations
//
    ReturnCode_t
       set_trigger_value
          (Boolean value);
};
```

The next paragraphs describe the usage of all `GuardCondition` operations. The inherited operation is listed but not fully described since it is not implemented in this class. The full description of this operation is given in the class from which it is inherited. This is described in their respective paragraph.

3.1.8.1 get_trigger_value (inherited)

This operation is inherited and therefore not described here. See the class `Condition` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
Boolean
   get_trigger_value
      (void);
```

3.1.8.2 set_trigger_value

Scope

`DDS::GuardCondition`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   set_trigger_value
      (Boolean value);
```

Description

This operation sets the `trigger_value` of the `GuardCondition`.

Parameters

`in Boolean value` - the boolean value to which the `GuardCondition` is set.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK` or `RETCODE_ERROR`.

Detailed Description

A GuardCondition object is a specific Condition which trigger_value is completely under the control of the application. This operation must be used by the application to manually wake-up a WaitSet. This operation sets the trigger_value of the GuardCondition to the parameter value. The GuardCondition is directly created using the GuardCondition constructor. When a GuardCondition is initially created, the trigger_value is FALSE.

Return Code

When the operation returns:

- *RETCODE_OK* - the specified trigger_value has successfully been applied.
- *RETCODE_ERROR* - an internal error has occurred.

3.1.9 Class StatusCondition

Entity objects that have status attributes also have a StatusCondition, access is provided to the application by the get_statuscondition operation.

The communication statuses whose changes can be communicated to the application depend on the Entity. The following table shows the relevant statuses for each Entity.

Table 14 Status Per Entity

Entity	Status Name
Topic	INCONSISTENT_TOPIC_STATUS ALL_DATA_DISPOSED_TOPIC_STATUS
Subscriber	DATA_ON_READERS_STATUS
DataReader	SAMPLE_REJECTED_STATUS
	LIVELINESS_CHANGED_STATUS
	REQUESTED_DEADLINE_MISSED_STATUS
	REQUESTED_INCOMPATIBLE_QOS_STATUS
	DATA_AVAILABLE_STATUS
	SAMPLE_LOST_STATUS
	SUBSCRIPTION_MATCHED_STATUS
DataWriter	LIVELINESS_LOST_STATUS
	OFFERED_DEADLINE_MISSED_STATUS
	OFFERED_INCOMPATIBLE_QOS_STATUS
	PUBLICATION_MATCHED_STATUS

The trigger_value of the StatusCondition depends on the communication statuses of that Entity (e.g., missed deadline) and also depends on the value of the StatusCondition attribute mask (enabled_statuses mask). A StatusCondition can be attached to a WaitSet in order to allow an application to suspend until the trigger_value has become TRUE.

The trigger_value of a StatusCondition will be TRUE if one of the enabled StatusChangedFlags is set. That is, trigger_value==FALSE only if all the values of the StatusChangedFlags are FALSE.

The sensitivity of the StatusCondition to a particular communication status is controlled by the list of enabled_statuses set on the condition by means of the set_enabled_statuses operation.

When the enabled_statuses are not changed by the set_enabled_statuses operation, all statuses are enabled by default.

The interface description of this class is as follows:

```
class StatusCondition
{
//
// inherited from Condition
//
// Boolean
//    get_trigger_value
//       (void);
//
// implemented API operations
//
   StatusMask
      get_enabled_statuses
         (void);

   ReturnCode_t
      set_enabled_statuses
         (StatusMask mask);

   Entity_ptr
      get_entity
         (void);
};
```

The next paragraphs describe the usage of all StatusCondition operations. The inherited operations are listed but not fully described because they are not implemented in this class. The full description of these operations is given in the classes from which they are inherited.

3.1.9.1 get_enabled_statuses

Scope

`DDS::StatusCondition`

Synopsis

```
#include <ccpp_dds_dcps.h>
StatusMask
   get_enabled_statuses
      (void);
```

Description

This operation returns the list of enabled communication statuses of the `StatusCondition`.

Parameters

<none>

Return Value

`StatusMask` - a bit mask in which each bit shows which status is taken into account for the `StatusCondition`.

Detailed Description

The `trigger_value` of the `StatusCondition` depends on the communication status of that `Entity` (e.g., missed deadline, loss of information, etc.), 'filtered' by the set of `enabled_statuses` on the `StatusCondition`.

This operation returns the list of communication statuses that are taken into account to determine the `trigger_value` of the `StatusCondition`. This operation returns the statuses that were explicitly set on the last call to `set_enabled_statuses` or, if `set_enabled_statuses` was never called, the default list.

The result value is a bit mask in which each bit shows which status is taken into account for the `StatusCondition`. The relevant bits represents one of the following statuses:

- `INCONSISTENT_TOPIC_STATUS`
- `ALL_DATA_DISPOSED_TOPIC_STATUS`
- `OFFERED_DEADLINE_MISSED_STATUS`
- `REQUESTED_DEADLINE_MISSED_STATUS`
- `OFFERED_INCOMPATIBLE_QOS_STATUS`
- `REQUESTED_INCOMPATIBLE_QOS_STATUS`
- `SAMPLE_LOST_STATUS`

- SAMPLE_REJECTED_STATUS
- DATA_ON_READERS_STATUS
- DATA_AVAILABLE_STATUS
- LIVELINESS_LOST_STATUS
- LIVELINESS_CHANGED_STATUS
- PUBLICATION_MATCHED_STATUS
- SUBSCRIPTION_MATCHED_STATUS

Each status bit is declared as a constant and can be used in an AND operation to check the status bit against the result of type StatusMask. Not all statuses are relevant to all Entity objects. See the respective Listener objects for each Entity for more information.

3.1.9.2 get_entity

Scope

DDS::StatusCondition

Synopsis

```
#include <ccpp_dds_dcps.h>
Entity_ptr
   get_entity
      (void);
```

Description

This operation returns the Entity associated with the StatusCondition or the NULL pointer.

Parameters

<none>

Return Value

Entity_ptr - a pointer to the Entity associated with the StatusCondition or the NULL pointer.

Detailed Description

This operation returns the Entity associated with the StatusCondition. Note that there is exactly one Entity associated with each StatusCondition. When the Entity was already deleted (there is no associated Entity any more), the NULL pointer is returned.

3.1.9.3 get_trigger_value (inherited)

This operation is inherited and therefore not described here. See the class `Condition` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
Boolean
   get_trigger_value
      (void);
```

3.1.9.4 set_enabled_statuses

Scope

`DDS::StatusCondition`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   set_enabled_statuses
      (StatusMask mask);
```

Description

This operation sets the list of communication statuses that are taken into account to determine the `trigger_value` of the `StatusCondition`.

Parameters

`in StatusMask mask` - a bit mask in which each bit sets the status which is taken into account for the `StatusCondition`.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR` or `RETCODE_ALREADY_DELETED`.

Detailed Description

The `trigger_value` of the `StatusCondition` depends on the communication status of that `Entity` (e.g., missed deadline, loss of information, etc.), 'filtered' by the set of `enabled_statuses` on the `StatusCondition`.

This operation sets the list of communication statuses that are taken into account to determine the `trigger_value` of the `StatusCondition`. This operation may change the `trigger_value` of the `StatusCondition`.

`WaitSet` objects behaviour depend on the changes of the `trigger_value` of their attached `Conditions`. Therefore, any `WaitSet` to which the `StatusCondition` is attached is potentially affected by this operation.

If this function is not invoked, the default list of `enabled_statuses` includes all the statuses.

The parameter `mask` is a bit mask in which each bit shows which status is taken into account for the `StatusCondition`. The relevant bits represents one of the following states:

- `INCONSISTENT_TOPIC_STATUS`
- `ALL_DATA_DISPOSED_TOPIC_STATUS`
- `OFFERED_DEADLINE_MISSED_STATUS`
- `REQUESTED_DEADLINE_MISSED_STATUS`
- `OFFERED_INCOMPATIBLE_QOS_STATUS`
- `REQUESTED_INCOMPATIBLE_QOS_STATUS`
- `SAMPLE_LOST_STATUS`
- `SAMPLE_REJECTED_STATUS`
- `DATA_ON_READERS_STATUS`
- `DATA_AVAILABLE_STATUS`
- `LIVELINESS_LOST_STATUS`
- `LIVELINESS_CHANGED_STATUS`
- `PUBLICATION_MATCHED_STATUS`
- `SUBSCRIPTION_MATCHED_STATUS`

Each status bit is declared as a constant and can be used in an OR operation to set the status bit in the parameter `mask` of type `StatusMask`. Not all statuses are relevant to all `Entity` objects. See the respective `Listener` objects for each `Entity` for more information.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the list of communication statuses is set
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_ALREADY_DELETED`* - the `StatusCondition` has already been deleted.

3.1.10 Class ErrorInfo

The *`ErrorInfo`* mechanism is an OpenSplice-specific extension to the OMG-DDS standard, that can help DDS users to get a more finegrained overview of the context of an error. The DDS specification only mandates that functions return a

`ReturnCode_t` value as a broad categorization of potential types of problems (there are 12 possible `ReturnCode_t` values, of which 11 indicate some kind of error), but factory operations do not even have this mechanism at their disposal since they return the object they were requested to create.

The *`ErrorInfo`* was added to OpenSplice for the following reasons:

- It can provide context for errors that occur in factory operations (*e.g.* when `create_topic` returns `NULL`).
- It can provide an `ErrorCode_t` value, that represents a much more fine-grained error categorization than the `ReturnCode_t` (21 categories *vs.* the 11 categories provided by `ReturnCode_t`).
- It can provide an error description that can give a much more dedicated explanation of the exact circumstances of the error.
- It can provide the name of the function call/component that caused the error.
- It can provide source code location where the error occured (file name + line number).
- It can provide a stacktrace of the thread that ran into the error.

The *`ErrorInfo`* class obtains its information from the API-level log messages recorded by the internal mechanisms of the data distribution service. These are messages that are, by default, also written to the `ospl-info.log` file. The application can access this information through an *`ErrorInfo`* object, and take appropriate action based on the contents of this information. The *`ErrorInfo`* has no factory and an instance of the class can be created by the application by calling its default (empty) constructor.

The interface of this class is as follows:

```
Class ErrorInfo
{
  ReturnCode_t
    update
    (void);

  ReturnCode_t
    get_code
    (ErrorCode_t& code);

  ReturnCode_t
    get_message
    (char*& message);

  ReturnCode_t
    get_location
    (char*& location);
```

```
  ReturnCode_t
    get_source_line
    (char*& source_line);

  ReturnCode_t
    get_stack_trace
    (char*& stack_trace);
};
```

The following sections describe the usage of all *ErrorInfo* operations.

3.1.10.1 update

Scope

`DDS::ErrorInfo`

Synopsis

```
#include <ccpp_dds_dcps.h>
  ReturnCode_t
    update
    (void);
```

Description

This operation updates the `ErrorInfo` object with the latest available information.

Parameters

`<none>`

Return Value

ReturnCode_t - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_NO_DATA`.

Detailed Description

This operation requests the latest error information from the data distribution service and stores it in the `ErrorInfo` object. The error information remains available in the `ErrorInfo` object until a new error occurs *and* the update operation is explicitly invoked on the `ErrorInfo` object. If the information is successfully updated, `RETCODE_OK` is returned. If no information is available because no error has occurred yet, `RETCODE_NO_DATA` is returned.

3.1.10.2 get_code

Scope

`DDS::ErrorInfo`

Synopsis

```
#include <ccpp_dds_dcps.h>
  ReturnCode_t
    get_code
     (ErrorCode_t& code);
```

NOTE: This operation is not consistently implemented everywhere: various kinds of errors are still categorized as 'UNDEFINED'.

Description

This operation retrieves the error code of the last error message.

Parameters

inout ErrorCode_t& code - The ErrorCode_t struct in which the error code will be stored.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_NO_DATA.

Detailed Description

This operation stores the error code of the latest error in the provided ErrorCode_t struct. The ErrorCode_t type is an OpenSplice-specific equivalent to the ReturnCode_t type that is mandated by the OMG-DDS standard, but the ErrorCode_t type has a more fine-grained error categorization which uses 21 categories instead of the 11 provided by the ReturnCode_t type.

Table 15 below contains a list of all supported ErrorInfo values and their meaning.

Table 15 All ErrorInfo values

Label	Value	Meaning.
ERRORCODE_UNDEFINED	0	Error has not (yet) been categorized.
ERRORCODE_ERROR	1	Unexpected error.
ERRORCODE_OUT_OF_RESOURCES	2	Not enough resources to complete the operation.
ERRORCODE_CREATION_KERNEL_ENTITY_FAILED	3	The kernel was not able to create the entity. Probably there is not enough shared memory available.
ERRORCODE_INVALID_VALUE	4	A value is passed that is outside its valid bounds.

Table 15 All `ErrorInfo` values (continued)

Label	Value	Meaning.
ERRORCODE_INVALID_DURATION	5	A Duration is passed that is outside its valid bounds or that has not been normalized properly.
ERRORCODE_INVALID_TIME	6	A Time is passed that is outside its valid bounds or that has not been normalized properly.
ERRORCODE_ENTITY_INUSE	7	Attempted to delete an entity that is still in use.
ERRORCODE_CONTAINS_ENTITIES	8	Attempted to delete a factory that still contains entities.
ERRORCODE_ENTITY_UNKNOWN	9	A pointer to an unknown entity has been passed.
ERRORCODE_HANDLE_NOT_REGISTERED	10	A handle has been passed that is no longer in use.
ERRORCODE_HANDLE_NOT_MATCH	11	A handle has been passed to an entity to which it does not belong.
ERRORCODE_HANDLE_INVALID	12	An unknown handle has been passed.
ERRORCODE_INVALID_SEQUENCE	13	A sequence has been passed that has inconsistent variables (*e.g.* length > maximum, buffer equals NULL while maximum > 0, *etc.*)
ERRORCODE_UNSUPPORTED_VALUE	14	A value has been passed that is not (yet) supported.
ERRORCODE_INCONSISTENT_VALUE	15	A value has been passed that is inconsistent
ERRORCODE_IMMUTABLE_QOS_POLICY	16	Attempted to modify a QosPolicy that is immutable.
ERRORCODE_INCONSISTENT_QOS	17	Attempted to set QosPolicy values that are mutually inconsistent.
ERRORCODE_UNSUPPORTED_QOS_POLICY	18	Attempted to pass a QosPolicy setting that is not (yet) supported.
ERRORCODE_CONTAINS_CONDITIONS	19	Attempted to delete a WaitSet that still has Conditions attached to it.
ERRORCODE_CONTAINS_LOANS	20	Attempted to delete a DataReader/DataView that has unreturned loans.
ERRORCODE_INCONSISTENT_TOPIC	21	Attempted to create a topic that is inconsistent with existing topic definitions.

3.1.10.3 get_message

Scope

`DDS::ErrorInfo`

Synopsis

```
#include <ccpp_dds_dcps.h>
  ReturnCode_t
    get_message
    (char*& message);
```

Description

This operation retrieves the description of the latest error.

Parameters

`inout char*& message` - Reference to a string holding the latest description.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_NO_DATA`.

Detailed Description

This operation stores the description of the latest error in a newly-allocated string. If the pointer supplied by the application through the message parameter already contains a string, it is freed. If no error has occurred, `RETCODE_NO_DATA` is returned and `NULL` is assigned to the message parameter.

3.1.10.4 get_location

Scope

`DDS::ErrorInfo`

Synopsis

```
#include <ccpp_dds_dcps.h>
  ReturnCode_t
    get_location
    (char*& location);
```

Description

This operation retrieves the location or context of the latest error.

Parameters

inout char& message* - Pointer to a string holding the location of the latest error.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_NO_DATA.

Detailed Description

This operation stores the context or location of the latest error in a newly-allocated string. The string may contain the name of an operation or component of the data distribution service in which the error occurred, or other descriptive information on the location of the error. If the pointer supplied by the application through the location parameter already contains a string, it is freed. If no error has occurred, RETCODE_NO_DATA is returned and NULL is assigned to the location parameter.

3.1.10.5 get_source_line

Scope

DDS::ErrorInfo

Synopsis

```
#include <ccpp_dds_dcps.h>
  ReturnCode_t
    get_source_line
    (char*& source_line);
```

Description

This operation retrieves the location within the sourcecode of the latest error.

Parameters

inout char& source_line* - Pointer to a string holding the sourcecode information of the latest error.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_NO_DATA.

Detailed Description

This operation stores the name and line number of the source file in which the latest error occurred, seperated by a colon, in a newly-allocated string. If the pointer supplied by the application through the source_line parameter already contains a string, it is freed. If no error has occurred, `RETCODE_NO_DATA` is returned and `NULL` is assigned to the source_line parameter.

3.1.10.6 get_stack_trace

Scope

`DDS::ErrorInfo`

Synopsis

```
#include <ccpp_dds_dcps.h>
  ReturnCode_t
    get_stack_trace
    (char*& stack_trace);
```

NOTE: This operation is not yet implemented. It is scheduled for a future release.

3.2 Domain Module

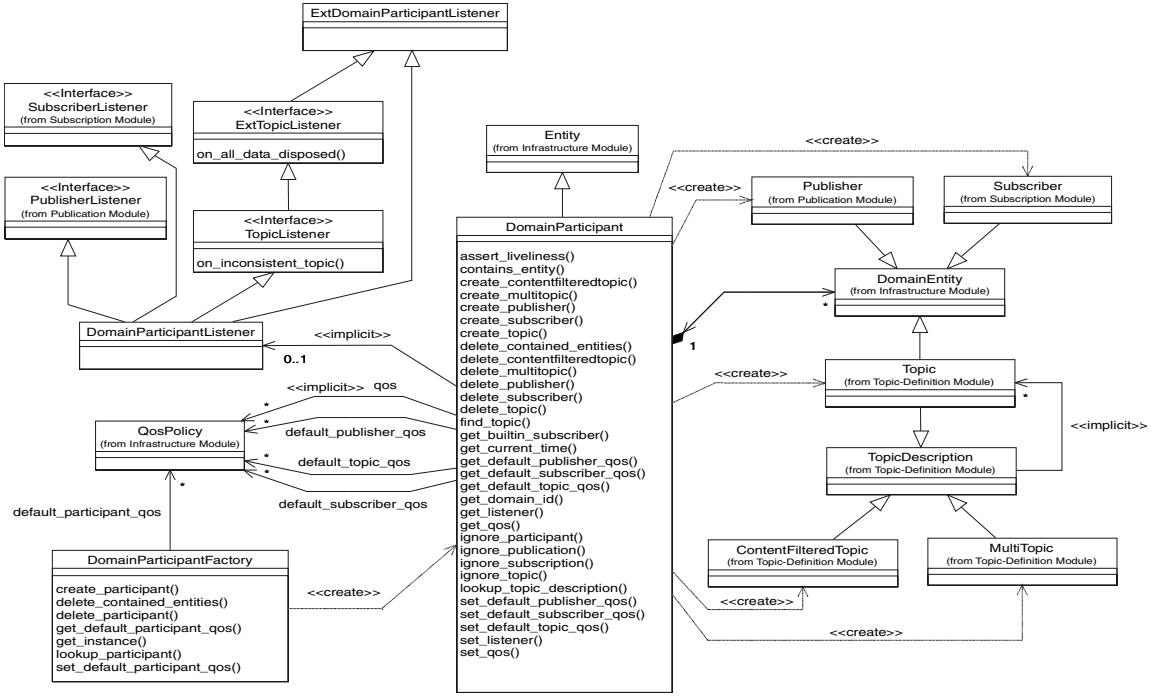

Figure 15 DCPS Domain Module's Class Model

This module contains the following classes:

- `DomainParticipant`
- `DomainParticipantFactory`
- `DomainParticipantListener` (interface).
- `Domain` (*not depicted*)

3.2.1 Class DomainParticipant

All the DCPS `Entity` objects are attached to a `DomainParticipant`.
A `DomainParticipant` represents the local membership of the application in a `Domain`.
A `Domain` is a distributed concept that links all the applications that must be able to communicate with each other. It represents a communication plane: only the `Publishers` and the `Subscribers` attached to the same `Domain` can interact.

This class implements several functions:

- it acts as a container for all other `Entity` objects
- it acts as a factory for the `Publisher`, `Subscriber`, `Topic`, `ContentFilteredTopic` and `MultiTopic` objects
- it provides access to the built-in `Topic` objects
- it provides information about `Topic` objects
- It isolates applications within the same `Domain` (sharing the same `domainId`) from other applications in a different `Domain` on the same set of computers. In this way, several independent distributed applications can coexist in the same physical network without interfering, or even being aware of each other.
- It provides administration services in the `Domain`, offering operations, which allow the application to ignore locally any information about a given `Participant`, `Publication`, `Subscription` or `Topic`.

The interface description of this class is as follows:

```
class DomainParticipant
{
//
// inherited from class Entity
//
// StatusCondition_ptr
//     get_statuscondition
//         (void);
// StatusMask
//     get_status_changes
//         (void);
// ReturnCode_t
```

```
//    enable
//       (void);
//
// implemented API operations
//
   Publisher_ptr
      create_publisher
         (const PublisherQos& qos,
         PublisherListener_ptr a_listener,
         StatusMask mask);
   ReturnCode_t
      delete_publisher
         (Publisher_ptr p);
   Subscriber_ptr
      create_subscriber
         (const SubscriberQos& qos,
         SubscriberListener_ptr a_listener,
         StatusMask mask);
   ReturnCode_t
      delete_subscriber
         (Subscriber_ptr s);
   Subscriber_ptr
      get_builtin_subscriber
         (void);
   Topic_ptr
      create_topic
         (const char* topic_name,
         const char* type_name,
         const TopicQos& qos,
         TopicListener_ptr a_listener,
         StatusMask mask);
   ReturnCode_t
      delete_topic
         (Topic_ptr a_topic);
   Topic_ptr
      find_topic
         (const char* topic_name,
         const Duration_t& timeout);
   TopicDescription_ptr
      lookup_topicdescription
         (const char* name);
   ContentFilteredTopic_ptr
      create_contentfilteredtopic
         (const char* name,
         Topic_ptr related_topic,
         const char* filter_expression,
         const StringSeq& expression_parameters);
   ReturnCode_t
      delete_contentfilteredtopic
         (ContentFilteredTopic_ptr
```

```
      a_contentfilteredtopic);
MultiTopic_ptr
   create_multitopic
      (const char* name,
      const char* type_name,
      const char* subscription_expression,
      const StringSeq& expression_parameters);
ReturnCode_t
   delete_multitopic
      (MultiTopic_ptr a_multitopic);
ReturnCode_t
   delete_contained_entities
      (void);
ReturnCode_t
   set_qos
      (const DomainParticipantQos& qos);
ReturnCode_t
   get_qos
      (DomainParticipantQos& qos);
ReturnCode_t
   set_listener
      (DomainParticipantListener_ptr a_listener,
      StatusMask mask);
DomainParticipantListener_ptr
   get_listener
      (void);
ReturnCode_t
   ignore_participant
      (InstanceHandle_t handle);
ReturnCode_t
   ignore_topic
      (InstanceHandle_t handle);
ReturnCode_t
   ignore_publication
      (InstanceHandle_t handle);
ReturnCode_t
   ignore_subscription
      (InstanceHandle_t handle);
DomainId_t
   get_domain_id
      (void);
ReturnCode_t
   get_discovered_participants
      (InstanceHandleSeq& participant_handles);
ReturnCode_t
   get_discovered_participant_data
      (ParticipantBuiltinTopicData& participant_data,
        InstanceHandle_t handle);
ReturnCode_t
   get_discovered_topics
```

```
            (InstanceHandleSeq& topic_handles);
        ReturnCode_t
           get_discovered_topic_data
              (TopicBuiltinTopicData& topic_data,
                InstanceHandle_t handle);
        ReturnCode_t
           assert_liveliness
              (void);
        ReturnCode_t
           set_default_publisher_qos
              (const PublisherQos& qos);
        ReturnCode_t
           get_default_publisher_qos
              (PublisherQos& qos);
        ReturnCode_t
           set_default_subscriber_qos
              (const SubscriberQos& qos);
        ReturnCode_t
           get_default_subscriber_qos
              (SubscriberQos& qos);
        ReturnCode_t
           set_default_topic_qos
              (const TopicQos& qos);
        ReturnCode_t
           get_default_topic_qos
              (TopicQos& qos);
        Boolean
           contains_entity
              (InstanceHandle_t a_handle);
        ReturnCode_t
           get_current_time
              (Time_t& current_time);
    };
```

The next paragraphs describe the usage of all `DomainParticipant` operations. The inherited operations are listed but not fully described because they are not implemented in this class. The full description of these operations is given in the classes from which they are inherited.

3.2.1.1 assert_liveliness

Scope

`DDS::DomainParticipant`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
    assert_liveliness
       (void);
```

Description

This operation asserts the liveliness for the DomainParticipant.

Parameters

<none>

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES or RETCODE_NOT_ENABLED.

Detailed Description

This operation will manually assert the liveliness for the DomainParticipant. This way, the Data Distribution Service is informed that the DomainParticipant is still alive. This operation only needs to be used when the DomainParticipant contains DataWriters with the LivelinessQosPolicy set to MANUAL_BY_PARTICIPANT_LIVELINESS_QOS, and it will only affect the liveliness of those DataWriters.

Writing data via the write operation of a DataWriter will assert the liveliness on the DataWriter itself and its DomainParticipant. Therefore, assert_liveliness is only needed when **not** writing regularly.

The liveliness should be asserted by the application, depending on the LivelinessQosPolicy.

Return Code

When the operation returns:

- *RETCODE_OK* - the liveliness of this DomainParticipant has successfully been asserted.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the DomainParticipant has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_NOT_ENABLED* - the DomainParticipant is not enabled.

3.2.1.2 contains_entity

Scope

DDS::DomainParticipant

Synopsis

```
#include <ccpp_dds_dcps.h>
Boolean
   contains_entity
      (InstanceHandle_t a_handle);
```

Description

This operation checks whether or not the given `Entity` represented by `a_handle` is created by the `DomainParticipant` or any of its contained entities.

Parameters

`in InstanceHandle_t a_handle` - an `Entity` in the Data Distribution System.

Return Value

`Boolean` - `TRUE` if `a_handle` represents an `Entity` that is created by the `DomainParticipant` or any of its contained `Entities`. Otherwise the return value is `FALSE`.

Detailed Description

This operation checks whether or not the given `Entity` represented by `a_handle` is created by the `DomainParticipant` itself (`TopicDescription`, `Publisher` or `Subscriber`) or created by any of its contained entities (`DataReader`, `ReadCondition`, `QueryCondition`, `DataWriter`, etc.).

Return value is `TRUE` if `a_handle` represents an `Entity` that is created by the `DomainParticipant` or any of its contained `Entities`. Otherwise the return value is `FALSE`.

3.2.1.3 create_contentfilteredtopic

Scope

```
DDS::DomainParticipant
```

Synopsis

```
#include <ccpp_dds_dcps.h>
ContentFilteredTopic_ptr
   create_contentfilteredtopic
      (const char* name,
       Topic_ptr related_topic,
       const char* filter_expression,
       const StringSeq& expression_parameters);
```

Description

This operation creates a ContentFilteredTopic for a DomainParticipant in order to allow DataReaders to subscribe to a subset of the topic content.

Parameters

in const char name* - the name of the ContentFilteredTopic.

in Topic_ptr related_topic - the pointer to the base topic on which the filtering will be applied. Therefore, a filtered topic is based on an existing Topic.

in const char filter_expression* - the SQL expression (subset of SQL), which defines the filtering.

in const StringSeq& expression_parameters - the handle to a sequence of strings with the parameter value used in the SQL expression (i.e., the number of %n tokens in the expression). The number of values in expression_parameters must be equal or greater than the highest referenced %n token in the filter_expression (e.g. if %1 and %8 are used as parameter in the filter_expression, the expression_parameters should at least contain n+1 = 9 values).

Return Value

ContentFilteredTopic_ptr - the pointer to the newly created ContentFilteredTopic. In case of an error, a NULL pointer is returned.

Detailed Description

This operation creates a ContentFilteredTopic for a DomainParticipant in order to allow DataReaders to subscribe to a subset of the topic content. The base topic, which is being filtered is defined by the parameter related_topic. The resulting ContentFilteredTopic only relates to the samples published under the related_topic, which have been filtered according to their content. The resulting ContentFilteredTopic only exists at the DataReader side and will never be published. The samples of the related_topic are filtered according to the SQL expression (which is a subset of SQL) as defined in the parameter filter_expression (see Appendix H, *DCPS Queries and Filters*).

The filter_expression may also contain parameters, which appear as %n tokens in the expression which must be set by the sequence of strings defined by the parameter expression_parameters. The number of values in expression_parameters must be equal or greater than the highest referenced %n token in the filter_expression (e.g. if %1 and %8 are used as parameter in the filter_expression, the expression_parameters should at least contain n+1 = 9 values).

The filter_expression is a string that specifies the criteria to select the data samples of interest. In other words, it identifies the selection of data from the associated Topics. It is an SQL expression where the WHERE clause gives the content filter.

3.2.1.4 create_multitopic

Scope

DDS::DomainParticipant

Synopsis

```
#include <ccpp_dds_dcps.h>
MultiTopic_ptr
   create_multitopic
      (const char* name,
         const char* type_name,
        const char* subscription_expression,
        const StringSeq& expression_parameters);
```

NOTE: This operation is not yet implemented. It is scheduled for a future release.

Description

This operation creates a MultiTopic for a DomainParticipant in order to allow DataReaders to subscribe to a filtered/re-arranged combination and/or subset of the content of several topics.

Parameters

in const char name* - the name of the multi topic.

in const char type_name* - the name of the type of the MultiTopic. This type_name must have been registered using register_type prior to calling this operation.

in const char subscription_expression* - the SQL expression (subset of SQL), which defines the selection, filtering, combining and re-arranging of the sample data.

in const StringSeq& expression_parameters - the handle to a sequence of strings with the parameter value used in the SQL expression (i.e., the number of %n tokens in the expression). The number of values in expression_parameters must be equal or greater than the highest referenced %n token in the subscription_expression (e.g. if %1 and %8 are used as parameter in the subscription_expression, the expression_parameters should at least contain n+1 = 9 values).

Return Value

MultiTopic_ptr - is the pointer to the newly created MultiTopic. In case of an error, a NULL pointer is returned.

Detailed Description

This operation creates a MultiTopic for a DomainParticipant in order to allow DataReaders to subscribe to a filtered/re-arranged combination and/or subset of the content of several topics. Before the MultiTopic can be created, the type_name of the MultiTopic must have been registered prior to calling this operation. Registering is done, using the register_type operation from TypeSupport. The list of topics and the logic, which defines the selection, filtering, combining and re-arranging of the sample data, is defined by the SQL expression (subset of SQL) defined in subscription_expression. The subscription_expression may also contain parameters, which appear as %n tokens in the expression. These parameters are defined in expression_parameters. The number of values in expression_parameters must be equal or greater than the highest referenced %n token in the subscription_expression (e.g. if %1 and %8 are used as parameter in the subscription_expression, the expression_parameters should at least contain n+1 = 9 values).

The subscription_expression is a string that specifies the criteria to select the data samples of interest. In other words, it identifies the selection and rearrangement of data from the associated Topics. It is an SQL expression where the SELECT clause provides the fields to be kept, the FROM part provides the names of the Topics that are searched for those fields, and the WHERE clause gives the content filter. The Topics combined may have different types but they are restricted in that the type of the fields used for the NATURAL JOIN operation must be the same.

The DataReader, which is associated with a MultiTopic only accesses information which exist locally in the DataReader, based on the Topics used in the subscription_expression. The actual MultiTopic will never be produced, only the individual Topics.

3.2.1.5 create_publisher

Scope

DDS::DomainParticipant

Synopsis

```
#include <ccpp_dds_dcps.h>
Publisher_ptr
   create_publisher
      (const PublisherQos& qos,
```

```
    PublisherListener_ptr a_listener,
    StatusMask mask);
```

Description

This operation creates a `Publisher` with the desired `QosPolicy` settings and if applicable, attaches the optionally specified `PublisherListener` to it.

Parameters

`in const PublisherQos& qos` - a collection of `QosPolicy` settings for the new `Publisher`. In case these settings are not self consistent, no `Publisher` is created.

`in PublisherListener_ptr a_listener` - a pointer to the `PublisherListener` instance which will be attached to the new `Publisher`. It is permitted to use `NULL` as the value of the listener: this behaves as a `PublisherListener` whose operations perform no action.

`in StatusMask mask` - a bit-mask in which each bit enables the invocation of the `PublisherListener` for a certain status.

Return Value

`Publisher_ptr` - Return value is a pointer to the newly created `Publisher`. In case of an error, the `NULL` pointer is returned.

Detailed Description

This operation creates a `Publisher` with the desired `QosPolicy` settings and if applicable, attaches the optionally specified `PublisherListener` to it. When the `PublisherListener` is not applicable, the `NULL` pointer must be supplied instead. To delete the `Publisher` the operation `delete_publisher` or `delete_contained_entities` must be used.

In case the specified `QosPolicy` settings are not consistent, no `Publisher` is created and the `NULL` pointer is returned. `The NULL pointer` can also be returned when insufficient access rights exist for the partition(s) listed in the provided `QoS` structure.

Default QoS

The constant `PUBLISHER_QOS_DEFAULT` can be used as parameter `qos` to create a `Publisher` with the default `PublisherQos` as set in the `DomainParticipant`. The effect of using `PUBLISHER_QOS_DEFAULT` is the same as calling the operation `get_default_publisher_qos` and using the resulting `PublisherQos` to create the `Publisher`.

Communication Status

For each communication status, the `StatusChangedFlag` flag is initially set to `FALSE`. It becomes `TRUE` whenever that communication status changes. For each communication status activated in the `mask`, the associated `PublisherListener` operation is invoked and the communication status is reset to `FALSE`, as the listener implicitly accesses the status which is passed as a parameter to that operation. The fact that the status is reset prior to calling the listener means that if the application calls the `get_<status_name>_status` from inside the listener it will see the status already reset.

The following statuses are applicable to the `PublisherListener`:

- `OFFERED_DEADLINE_MISSED_STATUS` *(propagated)*
- `OFFERED_INCOMPATIBLE_QOS_STATUS` *(propagated)*
- `LIVELINESS_LOST_STATUS` *(propagated)*
- `PUBLICATION_MATCHED_STATUS` *(propagated)*.

Be aware that the `PUBLICATION_MATCHED_STATUS` is not applicable when the infrastructure does not have the information available to determine connectivity. This is the case when OpenSplice is configured not to maintain discovery information in the Networking Service. (See the description for the `NetworkingService/Discovery/enabled` property in the Deployment Manual for more information about this subject.) In this case the operation will return `NULL`.

Status bits are declared as a constant and can be used by the application in an OR operation to create a tailored mask. The special constant `STATUS_MASK_NONE` can be used to indicate that the created entity should not respond to any of its available statuses. The DDS will therefore attempt to propagate these statuses to its factory. The special constant `STATUS_MASK_ANY_V1_2` can be used to select all applicable statuses specified in the “Data Distribution Service for Real-time Systems Version 1.2” specification which are applicable to the `PublisherListener`.

Status Propagation

The Data Distribution Service will trigger the most specific and relevant `Listener`. In other words, in case a communication status is also activated on the `DataWriterListener` of a contained `DataWriter`, the `DataWriterListener` on that contained `DataWriter` is invoked instead of the `PublisherListener`. This means that a status change on a contained `DataWriter` only invokes the `PublisherListener` if the contained `DataWriter` itself does not handle the trigger event generated by the status change.

In case a communication status is not activated in the `mask` of the `PublisherListener`, the `DomainParticipantListener` of the containing `DomainParticipant` is invoked (if attached and activated for the status that

occurred). This allows the application to set a default behaviour in the DomainParticipantListener of the containing DomainParticipant and a Publisher specific behaviour when needed. In case the DomainParticipantListener is also not attached or the communication status is not activated in its mask, the application is not notified of the change.

3.2.1.6 create_subscriber

Scope

DDS::DomainParticipant

Synopsis

```
#include <ccpp_dds_dcps.h>
Subscriber_ptr
   create_subscriber
      (const SubscriberQos& qos,
       SubscriberListener_ptr a_listener,
       StatusMask mask);
```

Description

This operation creates a Subscriber with the desired QosPolicy settings and if applicable, attaches the optionally specified SubscriberListener to it.

Parameters

in const SubscriberQos& qos - a collection of QosPolicy settings for the new Subscriber. In case these settings are not self consistent, no Subscriber is created.

in SubscriberListener_ptr a_listener - a pointer to the SubscriberListener instance which will be attached to the new Subscriber. It is permitted to use NULL as the value of the listener: this behaves as a SubscriberListener whose operations perform no action.

in StatusMask mask - a bit-mask in which each bit enables the invocation of the SubscriberListener for a certain status.

Return Value

Subscriber_ptr - Return value is a pointer to the newly created Subscriber. In case of an error, the NULL pointer is returned.

Detailed Description

This operation creates a Subscriber with the desired QosPolicy settings and if applicable, attaches the optionally specified SubscriberListener to it. When the SubscriberListener is not applicable, the NULL pointer must be supplied instead. To delete the Subscriber the operation delete_subscriber or delete_contained_entities must be used.

In case the specified QosPolicy settings are not consistent, no Subscriber is created and the NULL pointer is returned. The NULL pointer can also be returned when insufficient access rights exist for the partition(s) listed in the provided QoS structure.

Default QoS

The constant SUBSCRIBER_QOS_DEFAULT can be used as parameter qos to create a Subscriber with the default SubscriberQos as set in the Domainparticipant. The effect of using SUBSCRIBER_QOS_DEFAULT is the same as calling the operation get_default_subscriber_qos and using the resulting SubscriberQos to create the Subscriber.

Communication Status

For each communication status, the StatusChangedFlag flag is initially set to FALSE. It becomes TRUE whenever that communication status changes. For each communication status activated in the mask, the associated SubscriberListener operation is invoked and the communication status is reset to FALSE, as the listener implicitly accesses the status which is passed as a parameter to that operation. The fact that the status is reset prior to calling the listener means that if the application calls the get_<status_name>_status from inside the listener it will see the status already reset.

The following statuses are applicable to the SubscriberListener:

- REQUESTED_DEADLINE_MISSED_STATUS *(propagated)*
- REQUESTED_INCOMPATIBLE_QOS_STATUS *(propagated)*
- SAMPLE_LOST_STATUS *(propagated)*
- SAMPLE_REJECTED_STATUS *(propagated)*
- DATA_AVAILABLE_STATUS *(propagated)*
- LIVELINESS_CHANGED_STATUS *(propagated)*
- SUBSCRIPTION_MATCHED_STATUS *(propagated)*.
- DATA_ON_READERS_STATUS.

Be aware that the SUBSCRIPTION_MATCHED_STATUS is not applicable when the infrastructure does not have the information available to determine connectivity. This is the case when OpenSplice is configured not to maintain discovery

information in the Networking Service. (See the description for the NetworkingService/Discovery/enabled property in the Deployment Manual for more information about this subject.) In this case the operation will return NULL.

Status bits are declared as a constant and can be used by the application in an OR operation to create a tailored mask. The special constant STATUS_MASK_NONE can be used to indicate that the created entity should not respond to any of its available statuses. The DDS will therefore attempt to propagate these statuses to its factory. The special constant STATUS_MASK_ANY_V1_2 can be used to select all applicable statuses specified in the "Data Distribution Service for Real-time Systems Version 1.2" specification which are applicable to the PublisherListener.

Status Propagation

The Data Distribution Service will trigger the most specific and relevant Listener. In other words, in case a communication status is also activated on the DataReaderListener of a contained DataReader, the DataReaderListener on that contained DataReader is invoked instead of the SubscriberListener. This means that a status change on a contained DataReader only invokes the SubscriberListener if the contained DataReader itself does not handle the trigger event generated by the status change.

In case a communication status is not activated in the mask of the SubscriberListener, the DomainParticipantListener of the containing DomainParticipant is invoked (if attached and activated for the status that occurred). This allows the application to set a default behaviour in the DomainParticipantListener of the containing DomainParticipant and a Subscriber specific behaviour when needed. In case the DomainParticipantListener is also not attached or the communication status is not activated in its mask, the application is not notified of the change.

The statuses DATA_ON_READERS_STATUS and DATA_AVAILABLE_STATUS are "Read Communication Statuses" and are an exception to all other plain communication statuses: they have no corresponding status structure that can be obtained with a get_<status_name>_status operation and they are mutually exclusive. When new information becomes available to a DataReader, the Data Distribution Service will first look in an attached and activated SubscriberListener or DomainParticipantListener (in that order) for the DATA_ON_READERS_STATUS. In case the DATA_ON_READERS_STATUS can not be handled, the Data Distribution Service will look in an attached and activated DataReaderListener, SubscriberListener or DomainParticipantListener for the DATA_AVAILABLE_STATUS (in that order).

3.2.1.7 create_topic

Scope

`DDS::DomainParticipant`

Synopsis

```
#include <ccpp_dds_dcps.h>
Topic_ptr
   create_topic
      (const char* topic_name,
       const char* type_name,
       const TopicQos& qos,
       TopicListener_ptr a_listener,
       StatusMask mask);
```

Description

This operation creates a reference to a new or existing `Topic` under the given name, for a specific type, with the desired `QosPolicy` settings and if applicable, attaches the optionally specified `TopicListener` to it.

Parameters

in const char topic_name* - the name of the `Topic` to be created. A new `Topic` will only be created, when no `Topic`, with the same name, is found within the `DomainParticipant`.

in const char type_name* - a local alias of the data type, which must have been registered before creating the `Topic`.

in const TopicQos& qos - a collection of `QosPolicy` settings for the new `Topic`. In case these settings are not self consistent, no `Topic` is created.

in TopicListener_ptr a_listener - a pointer to the `TopicListener` instance which will be attached to the new `Topic`. It is permitted to use `NULL` as the value of the listener: this behaves as a `TopicListener` whose operations perform no action.

in StatusMask mask - a bit-mask in which each bit enables the invocation of the `TopicListener` for a certain status.

Return Value

Topic_ptr - Return value is a pointer to the new or existing `Topic`. In case of an error, the `NULL` pointer is returned.

Detailed Description

This operation creates a reference to a new or existing Topic under the given name, for a specific type, with the desired QosPolicy settings and if applicable, attaches the optionally specified TopicListener to it. When the TopicListener is not applicable, the NULL pointer must be supplied instead. In case the specified QosPolicy settings are not consistent, no Topic is created and the NULL pointer is returned. To delete the Topic the operation delete_topic or delete_contained_entities must be used.

Default QoS

The constant TOPIC_QOS_DEFAULT can be used as parameter qos to create a Topic with the default TopicQos as set in the DomainParticipant. The effect of using TOPIC_QOS_DEFAULT is the same as calling the operation get_default_topic_qos and using the resulting TopicQos to create the Topic.

The Topic is bound to the type type_name. Prior to creating the Topic, the type_name must have been registered with the Data Distribution Service. Registering the type_name is done using the data type specific register_type operation.

Existing Topic Name

Before creating a new Topic, this operation performs a lookup_topicdescription for the specified topic_name. When a Topic is found with the same name in the current domain, the QoS and type_name of the found Topic are matched against the parameters qos and type_name. When they are the same, no Topic is created but a new proxy of the existing Topic is returned. When they are not exactly the same, no Topic is created and the NULL pointer is returned.

When a Topic is obtained multiple times, it must also be deleted that same number of times using delete_topic or calling delete_contained_entities once to delete all the proxies.

Local Proxy

Since a Topic is a global concept in the system, access is provided through a local proxy. In other words, the reference returned is actually not a reference to a Topic but to a locally created proxy. The Data Distribution Service propagates Topics and makes remotely created Topics locally available through this proxy. For each create, a new proxy is created. Therefore the Topic must be deleted the same number of times, as the Topic was created with the same topic_name per Domain. In other words, each reference (local proxy) must be deleted separately.

Communication Status

For each communication status, the `StatusChangedFlag` flag is initially set to `FALSE`. It becomes `TRUE` whenever that communication status changes. For each communication status activated in the `mask`, the associated `TopicListener` operation is invoked and the communication status is reset to `FALSE`, as the listener implicitly accesses the status which is passed as a parameter to that operation. The fact that the status is reset prior to calling the listener means that if the application calls the `get_<status_name>_status` from inside the listener it will see the status already reset.

The following statuses are applicable to the `TopicListener`:

- `INCONSISTENT_TOPIC_STATUS`.

The following statuses are applicable to the `ExtTopicListener`:

- `ALL_DATA_DISPOSED_TOPIC_STATUS`

NOTE: The `DDS::STATUS_MASK_ANY_V1_2` mask does not include the `ALL_DATA_DISPOSED_TOPIC_STATUS` bit, because this is an OpenSplice extension.

Status bits are declared as a constant and can be used by the application in an OR operation to create a tailored mask. The special constant `STATUS_MASK_NONE` can be used to indicate that the created entity should not respond to any of its available statuses. The DDS will therefore attempt to propagate these statuses to its factory. The special constant `STATUS_MASK_ANY_V1_2` can be used to select all statuses specified in the "Data Distribution Service for Real-time Systems Version 1.2" specification which are applicable to the `PublisherListener`.

Status Propagation

In case a communication status is not activated in the `mask` of the `TopicListener`, the `DomainParticipantListener` of the containing `DomainParticipant` is invoked (if attached and activated for the status that occurred). This allows the application to set a default behaviour in the `DomainParticipantListener` of the containing `DomainParticipant` and a `Topic` specific behaviour when needed. In case the `DomainParticipantListener` is also not attached or the communication status is not activated in its `mask`, the application is not notified of the change.

3.2.1.8 delete_contained_entities

Scope

`DDS::DomainParticipant`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   delete_contained_entities
      (void);
```

Description

This operation deletes all the `Entity` objects that were created on the `DomainParticipant`.

Parameters

<none>

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_ALREADY_DELETED`, `RETCODE_OUT_OF_RESOURCES` or `RETCODE_PRECONDITION_NOT_MET`.

Detailed Description

This operation deletes all the `Entity` objects that were created on the `DomainParticipant`. In other words, it deletes all `Publisher`, `Subscriber`, `Topic`, `ContentFilteredTopic` and `MultiTopic` objects. Prior to deleting each contained `Entity`, this operation regressively calls the corresponding `delete_contained_entities` operation on each `Entity` (if applicable). In other words, all `Entity` objects in the `Publisher` and `Subscriber` are deleted, including the `DataWriter` and `DataReader`. Also the `QueryCondition` and `ReadCondition` objects contained by the `DataReader` are deleted.

Topic

Since a `Topic` is a global concept in the system, access is provided through a local proxy. The Data Distribution Service propagates `Topics` and makes remotely created `Topics` locally available through this proxy. Such a proxy is created by the `create_topic` or `find_topic` operation. When a reference to the same `Topic` was created multiple times (either by `create_topic` or `find_topic`), all references (local proxies) are deleted. With the last proxy, the `Topic` itself is also removed from the system.

NOTE: The operation will return `PRECONDITION_NOT_MET` if the any of the contained entities is in a state where it cannot be deleted. This will occur, for example, if a contained `DataReader` cannot be deleted because the application has called a `read` or `take` operation and has not called the corresponding

return_loan operation to return the loaned samples. In such cases, the operation does not roll back any entity deletions performed prior to the detection of the problem.

Return Code

When the operation returns:

- *RETCODE_OK* - the contained Entity objects are deleted and the application may delete the DomainParticipant.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the DomainParticipant has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_PRECONDITION_NOT_MET* - one or more of the contained entities are in a state where they cannot be deleted.

3.2.1.9 delete_contentfilteredtopic

Scope

DDS::DomainParticipant

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   delete_contentfilteredtopic
      (ContentFilteredTopic_ptr a_contentfilteredtopic);
```

Description

This operation deletes a ContentFilteredTopic.

Parameters

in ContentFilteredTopic_ptr a_contentfilteredtopic - a reference to the ContentFilteredTopic, which is to be deleted.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES or RETCODE_PRECONDITION_NOT_MET.

Detailed Description

This operation deletes a ContentFilteredTopic.

The deletion of a ContentFilteredTopic is not allowed if there are any existing DataReader objects that are using the ContentFilteredTopic. If the delete_contentfilteredtopic operation is called on a ContentFilteredTopic with existing DataReader objects attached to it, it will return PRECONDITION_NOT_MET.

The delete_contentfilteredtopic operation must be called on the same DomainParticipant object used to create the ContentFilteredTopic. If delete_contentfilteredtopic is called on a different DomainParticipant the operation will have no effect and it will return PRECONDITION_NOT_MET.

Return Code

When the operation returns:

- *RETCODE_OK* - the ContentFilteredTopic is deleted
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - the parameter a_contentfilteredtopic is not a valid ContentFilteredTopic_ptr
- *RETCODE_ALREADY_DELETED* - the DomainParticipant has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_PRECONDITION_NOT_MET* - the operation is called on a different DomainParticipant, as used when the ContentFilteredTopic was created, or the ContentFilteredTopic is being used by one or more DataReader objects.

3.2.1.10 delete_multitopic

Scope

DDS::DomainParticipant

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   delete_multitopic
      (MultiTopic_ptr a_multitopic);
```

NOTE: This operation is not yet implemented. It is scheduled for a future release.

Description

This operation deletes a MultiTopic.

Parameters

in MultiTopic_ptr a_multitopic - a pointer to the MultiTopic, which is to be deleted.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES or RETCODE_PRECONDITION_NOT_MET.

Detailed Description

This operation deletes a MultiTopic.

The deletion of a MultiTopic is not allowed if there are any existing DataReader objects that are using the MultiTopic. If the delete_multitopic operation is called on a MultiTopic with existing DataReader objects attached to it, it will return RETCODE_PRECONDITION_NOT_MET.

The delete_multitopic operation must be called on the same DomainParticipant object used to create the MultiTopic. If delete_multitopic is called on a different DomainParticipant the operation will have no effect and it will return RETCODE_PRECONDITION_NOT_MET.

Return Code

When the operation returns:

- *RETCODE_OK* - the MultiTopic is deleted
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - the parameter a_multitopic is not a valid MultiTopic_ptr
- *RETCODE_ALREADY_DELETED* - the DomainParticipant has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_PRECONDITION_NOT_MET* - the operation is called on a different DomainParticipant, as used when the MultiTopic was created, or the MultiTopic is being used by one or more DataReader objects.

3.2.1.11 delete_publisher

Scope

`DDS::DomainParticipant`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   delete_publisher
      (Publisher_ptr p);
```

Description

This operation deletes a `Publisher`.

Parameters

`in Publisher_ptr p` - a pointer to the `Publisher`, which is to be deleted.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_BAD_PARAMETER`, `RETCODE_ALREADY_DELETED`, `RETCODE_OUT_OF_RESOURCES` or `RETCODE_PRECONDITION_NOT_MET`.

Detailed Description

This operation deletes a `Publisher`. A `Publisher` cannot be deleted when it has any attached `DataWriter` objects. When the operation is called on a `Publisher` with `DataWriter` objects, the operation returns `RETCODE_PRECONDITION_NOT_MET`. When the operation is called on a different `DomainParticipant`, as used when the `Publisher` was created, the operation has no effect and returns `RETCODE_PRECONDITION_NOT_MET`.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the `Publisher` is deleted
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_BAD_PARAMETER`* - the parameter `p` is not a valid `Publisher_ptr`
- *`RETCODE_ALREADY_DELETED`* - the `DomainParticipant` has already been deleted
- *`RETCODE_OUT_OF_RESOURCES`* - the Data Distribution Service ran out of resources to complete this operation.

- *RETCODE_PRECONDITION_NOT_MET* - the operation is called on a different DomainParticipant, as used when the Publisher was created, or the Publisher contains one or more DataWriter objects.

3.2.1.12 delete_subscriber

Scope

DDS::DomainParticipant

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   delete_subscriber
      (Subscriber_ptr s);
```

Description

This operation deletes a Subscriber.

Parameters

in Subscriber_ptr s - a pointer to the Subscriber, which is to be deleted.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES or RETCODE_PRECONDITION_NOT_MET.

Detailed Description

This operation deletes a Subscriber. A Subscriber cannot be deleted when it has any attached DataReader objects. When the operation is called on a Subscriber with DataReader objects, the operation returns RETCODE_PRECONDITION_NOT_MET. When the operation is called on a different DomainParticipant, as used when the Subscriber was created, the operation has no effect and returns RETCODE_PRECONDITION_NOT_MET.

Return Code

When the operation returns:

- *RETCODE_OK* - the Subscriber is deleted
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - the parameter s is not a valid Subscriber_ptr

- *RETCODE_ALREADY_DELETED* - the DomainParticipant has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_PRECONDITION_NOT_MET* - the operation is called on a different DomainParticipant, as used when the Subscriber was created, or the Subscriber contains one or more DataReader objects.

3.2.1.13 delete_topic

Scope

DDS::DomainParticipant

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   delete_topic
      (Topic_ptr a_topic);
```

Description

This operation deletes a Topic.

Parameters

in Topic_ptr a_topic - a pointer to the Topic, which is to be deleted.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES or RETCODE_PRECONDITION_NOT_MET.

Detailed Description

This operation deletes a Topic. A Topic cannot be deleted when there are any DataReader, DataWriter, ContentFilteredTopic or MultiTopic objects, which are using the Topic. When the operation is called on a Topic referenced by any of these objects, the operation returns RETCODE_PRECONDITION_NOT_MET. When the operation is called on a different DomainParticipant, as used when the Topic was created, the operation has no effect and returns RETCODE_PRECONDITION_NOT_MET.

Local proxy

Since a `Topic` is a global concept in the system, access is provided through a local proxy. In other words, the reference is actually not a reference to a `Topic` but to the local proxy. The Data Distribution Service propagates `Topics` and makes remotely created `Topics` locally available through this proxy. Such a proxy is created by the `create_topic` or `find_topic` operation. This operation will delete the local proxy. When a reference to the same `Topic` was created multiple times (either by `create_topic` or `find_topic`), each reference (local proxy) must be deleted separately. When this proxy is the last proxy for this `Topic`, the `Topic` itself is also removed from the system. As mentioned, a proxy may only be deleted when there are no other entities attached to it. However, it is possible to delete a proxy while there are entities attached to a different proxy.

Return Code

When the operation returns:

- *RETCODE_OK* - the `Topic` is deleted
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - the parameter `a_topic` is not a valid `Topic_ptr`
- *RETCODE_ALREADY_DELETED* - the `DomainParticipant` has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_PRECONDITION_NOT_MET* - the operation is called on a different `DomainParticipant`, as used when the `Topic` was created, or the `Topic` is still referenced by other objects.

3.2.1.14 enable (inherited)

This operation is inherited and therefore not described here. See the class `Entity` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   enable
      (void);
```

3.2.1.15 find_topic

Scope

```
DDS::DomainParticipant
```

Synopsis

```
#include <ccpp_dds_dcps.h>
Topic_ptr
   find_topic
      (const char* topic_name,
        const Duration_t& timeout);
```

Description

This operation gives access to an existing (or ready to exist) enabled `Topic`, based on its `topic_name`.

Parameters

`in const char* topic_name` - the name of the `Topic` that the application wants access to.

`in const Duration_t& timeout` - the maximum duration to block for the `DomainParticipant_find_topic`, after which the application thread is unblocked. The special constant `DURATION_INFINITE` can be used when the maximum waiting time does not need to be bounded.

Return Value

`Topic_ptr` - Return value is a pointer to the `Topic` found.

Detailed Description

This operation gives access to an existing `Topic`, based on its `topic_name`. The operation takes as arguments the `topic_name` of the `Topic` and a `timeout`.

If a `Topic` of the same `topic_name` already exists, it gives access to this `Topic`. Otherwise it waits (blocks the caller) until another mechanism creates it. This other mechanism can be another thread, a configuration tool, or some other Data Distribution Service utility. If after the specified `timeout` the `Topic` can still not be found, the caller gets unblocked and the `NULL` pointer is returned.

A `Topic` obtained by means of `find_topic`, must also be deleted by means of `delete_topic` so that the local resources can be released. If a `Topic` is obtained multiple times it must also be deleted that same number of times using `delete_topic` or calling `delete_contained_entities` once to delete all the proxies.

A `Topic` that is obtained by means of `find_topic` in a specific `DomainParticipant` can only be used to create `DataReaders` and `DataWriters` in that `DomainParticipant` if its corresponding `TypeSupport` has been registered to that same `DomainParticipant`.

Local Proxy

Since a Topic is a global concept in the system, access is provided through a local proxy. In other words, the reference returned is actually not a reference to a Topic but to a locally created proxy. The Data Distribution Service propagates Topics and makes remotely created Topics locally available through this proxy. For each time this operation is called, a new proxy is created. Therefore the Topic must be deleted the same number of times, as the Topic was created with the same topic_name per Domain. In other words, each reference (local proxy) must be deleted separately.

3.2.1.16 get_builtin_subscriber

Scope

DDS::DomainParticipant

Synopsis

```
#include <ccpp_dds_dcps.h>
Subscriber_ptr
   get_builtin_subscriber
      (void);
```

Description

This operation returns the built-in Subscriber associated with the DomainParticipant.

Parameters

<none>

Return Value

Subscriber_ptr - Result value is a pointer to the built-in Subscriber associated with the DomainParticipant.

Detailed Description

This operation returns the built-in Subscriber associated with the DomainParticipant. Each DomainParticipant contains several built-in Topic objects. The built-in Subscriber contains the corresponding DataReader objects to access them. All these DataReader objects belong to a single built-in Subscriber. Note that there is exactly one built-in Subscriber associated with each DomainParticipant.

3.2.1.17 get_current_time

Scope

`DDS::DomainParticipant`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_current_time
      (Time_t& current_time);
```

Description

This operation returns the value of the current time that the Data Distribution Service uses to time-stamp written data as well as received data in `current_time`.

Parameters

`inout Time_t& current_time` - the value of the current time as used by the Data Distribution System. The input value of `current_time` is ignored.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_BAD_PARAMETER`, `RETCODE_ALREADY_DELETED`, `RETCODE_OUT_OF_RESOURCES` or `RETCODE_NOT_ENABLED`.

Detailed Description

This operation returns the value of the current time that the Data Distribution Service uses to time-stamp written data as well as received data in `current_time`. The input value of `current_time` is ignored by the operation.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the value of the current time is returned in `current_time`.
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_BAD_PARAMETER`* - the parameter `current_time` is not a valid reference.
- *`RETCODE_ALREADY_DELETED`* - the `DomainParticipant` has already been deleted
- *`RETCODE_OUT_OF_RESOURCES`* - the Data Distribution Service ran out of resources to complete this operation.
- *`RETCODE_NOT_ENABLED`* - the `DomainParticipant` is not enabled.

3.2.1.18 get_default_publisher_qos

Scope

`DDS::DomainParticipant`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_default_publisher_qos
      (PublisherQos& qos);
```

Description

This operation gets the struct with the default `Publisher QosPolicy` settings of the `DomainParticipant`.

Parameters

`inout PublisherQos& qos` - a reference to the `PublisherQos` struct (provided by the application) in which the default `QosPolicy` settings for the `Publisher` are written.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_ALREADY_DELETED` or `RETCODE_OUT_OF_RESOURCES`.

Detailed Description

This operation gets the struct with the default `Publisher QosPolicy` settings of the `DomainParticipant` (that is the `PublisherQos`) which is used for newly created `Publisher` objects, in case the constant `PUBLISHER_QOS_DEFAULT` is used. The default `PublisherQos` is only used when the constant is supplied as parameter `qos` to specify the `PublisherQos` in the `create_publisher` operation. The application must provide the `PublisherQos` struct in which the `QosPolicy` settings can be stored and pass the `qos` reference to the operation. The operation writes the default `QosPolicy` settings to the struct referenced to by `qos`. Any settings in the struct are overwritten.

The values retrieved by this operation match the set of values specified on the last successful call to `set_default_publisher_qos`, or, if the call was never made, the default values as specified for each `QosPolicy` setting as defined in Table 2 on page 38

Return Code

When the operation returns:

- *RETCODE_OK* - the default Publisher QosPolicy settings of this DomainParticipant have successfully been copied into the specified PublisherQos parameter.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the DomainParticipant has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.2.1.19 get_default_subscriber_qos

Scope

DDS::DomainParticipant

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_default_subscriber_qos
      (SubscriberQos& qos);
```

Description

This operation gets the struct with the default Subscriber QosPolicy settings of the DomainParticipant.

Parameters

inout SubscriberQos& qos - a reference to the QosPolicy struct (provided by the application) in which the default QosPolicy settings for the Subscriber is written.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ALREADY_DELETED or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation gets the struct with the default Subscriber QosPolicy settings of the DomainParticipant (that is the SubscriberQos) which is used for newly created Subscriber objects, in case the constant SUBSCRIBER_QOS_DEFAULT is used. The default SubscriberQos is only used when the constant is supplied as parameter qos to specify the SubscriberQos in the create_subscriber operation. The application must provide the QoS struct in which the policy can be

stored and pass the qos reference to the operation. The operation writes the default QosPolicy to the struct referenced to by qos. Any settings in the struct are overwritten.

The values retrieved by this operation match the set of values specified on the last successful call to set_default_subscriber_qos, or, if the call was never made, the default values as specified for each QosPolicy defined in Table 2 on page 38

Return Code

When the operation returns:

- *RETCODE_OK* - the default Subscriber QosPolicy settings of this DomainParticipant have successfully been copied into the specified SubscriberQos parameter.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the DomainParticipant has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.2.1.20 get_default_topic_qos

Scope

DDS::DomainParticipant

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_default_topic_qos
      (TopicQos& qos);
```

Description

This operation gets the struct with the default Topic QosPolicy settings of the DomainParticipant.

Parameters

inout TopicQos& qos - a reference to the QosPolicy struct (provided by the application) in which the default QosPolicy settings for the Topic is written.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ALREADY_DELETED or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation gets the struct with the default Topic QosPolicy settings of the DomainParticipant (that is the TopicQos) which is used for newly created Topic objects, in case the constant TOPIC_QOS_DEFAULT is used. The default TopicQos is only used when the constant is supplied as parameter qos to specify the TopicQos in the create_topic operation. The application must provide the QoS struct in which the policy can be stored and pass the qos reference to the operation. The operation writes the default QosPolicy to the struct referenced to by qos. Any settings in the struct are overwritten.

The values retrieved by this operation match the set of values specified on the last successful call to set_default_topic_qos, or, if the call was never made, the default values as specified for each QosPolicy defined in Table 2 on page 38

Return Code

When the operation returns:

- *RETCODE_OK* - the default Topic QosPolicy settings of this DomainParticipant have successfully been copied into the specified TopicQos parameter.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the DomainParticipant has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.2.1.21 get_discovered_participants

Scope

DDS::DomainParticipant

Synopsis

```
#include <ccpp_dcps.h>
ReturnCode_t
   get_discovered_participants
      (InstanceHandleSeq& participant_handles);
```

Description

This operation retrieves the list of DomainParticipants that have been discovered in the domain.

Parameters

inout InstanceHandleSeqHolder participant_handles - a sequence which is used to pass the list of all associated participants.

Return Value

int - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ILLEGAL_OPERATION, RETCODE_UNSUPPORTED, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES, or RETCODE_NOT_ENABLED.

Detailed Description

This operation retrieves the list of DomainParticipants that have been discovered in the domain and that the application has not indicated should be "ignored" by means of the DomainParticipant ignore_participant operation.

The participant_handles sequence and its buffer may be pre-allocated by the application and therefore must either be re-used in a subsequent invocation of the get_discovered_participants operation or be released by calling free on the returned participant_handles. If the pre-allocated sequence is not big enough to hold the number of associated participants, the sequence will automatically be (re-)allocated to fit the required size. The handles returned in the participant_handles sequence are the ones that are used by the DDS implementation to locally identify the corresponding matched Participant entities. You can access more detailed information about a particular participant by passing its participant_handle to the get_discovered_participant_data operation.

Return Code

When the operation returns:

- *RETCODE_OK* - the list of associated participants has been successfully obtained.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ILLEGAL_OPERATION* - the operation is invoked on an inappropriate object.
- *RETCODE_UNSUPPORTED* - OpenSplice is configured not to maintain the information about "associated" participants.
- *RETCODE_ALREADY_DELETED* - the DomainParticipant has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

- *RETCODE_NOT_ENABLED* - the DomainParticipant is not enabled.

3.2.1.22 get_discovered_participant_data

Scope

DDS::DomainParticipant

Synopsis

```
#include <ccpp_dcps.h>
ReturnCode_t
   get_discovered_participant_data
      (ParticipantBuiltinTopicData& participant_data,
        InstanceHandle_t participant_handle);
```

Description

This operation retrieves information on a DomainParticipant that has been discovered on the network. The participant must be in the same domain as the participant on which this operation is invoked and must not have been "ignored" by means of the DomainParticipant ignore_participant operation.

Parameters

in DomainParticipant _this - the DomainParticipant object on which the operation is operated.

*inout ParticipantBuiltinTopicData *participant_data* - a pointer to the sample in which the information about the specified partition is to be stored.

in const InstanceHandle_t participant_handle - a handle to the participant whose information needs to be retrieved.

Return Value

int - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ILLEGAL_OPERATION, RETCODE_UNSUPPORTED, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES, or RETCODE_NOT_ENABLED.

Detailed Description

This operation retrieves information on a DomainParticipant that has been discovered on the network. The participant must be in the same domain as the participant on which this operation is invoked and must not have been "ignored" by means of the DomainParticipant ignore_participant operation.

The `partition_handle` must correspond to a partition currently associated with the `DomainParticipant`, otherwise the operation will fail and return `RETCODE_ERROR`. The operation `get_discovered_participant_data` can be used to find more detailed information about a particular participant that is found with the `get_discovered_participants` operation.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the information on the specified partition has been successfully retrieved.
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_ILLEGAL_OPERATION`* - the operation is invoked on an inappropriate object.
- *`RETCODE_UNSUPPORTED`* - OpenSplice is configured not to maintain the information about "associated" partition.
- *`RETCODE_ALREADY_DELETED`* - the `DomainParticipant` has already been deleted.
- *`RETCODE_OUT_OF_RESOURCES`* - the Data Distribution Service ran out of resources to complete this operation.
- *`RETCODE_NOT_ENABLED`* - the `DomainParticipant` is not enabled.

3.2.1.23 get_discovered_topics

Scope

`DDS::DomainParticipant`

Synopsis

```
#include <ccpp_dcps.h>
ReturnCode_t
   get_discovered_topics
      (InstanceHandleSeq& topic_handles);
```

Description

This operation retrieves the list of `Topics` that have been discovered in the domain.

Parameters

`inout InstanceHandleSeq *topic_handles` - a sequence which is used to pass the list of all associated topics.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ILLEGAL_OPERATION, RETCODE_UNSUPPORTED, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES, or RETCODE_NOT_ENABLED.

Detailed Description

This operation retrieves the list of Topics that have been discovered in the domain and that the application has not indicated should be "ignored" by means of the DomainParticipant ignore_topic operation.

The topic_handles sequence and its buffer may be pre-allocated by the application and therefore must either be re-used in a subsequent invocation of the get_discovered_topics operation or be released by calling free on the returned topic_handles. If the pre-allocated sequence is not big enough to hold the number of associated participants, the sequence will automatically be (re-)allocated to fit the required size. The handles returned in the topic_handles sequence are the ones that are used by the DDS implementation to locally identify the corresponding matched Topic entities. You can access more detailed information about a particular topic by passing its topic_handle to the get_discovered_topic_data operation.

Return Code

When the operation returns:

- *RETCODE_OK* - the list of associated topics has been successfully obtained.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ILLEGAL_OPERATION* - the operation is invoked on an inappropriate object.
- *RETCODE_UNSUPPORTED* - OpenSplice is configured not to maintain the information about "associated" topics.
- *RETCODE_ALREADY_DELETED* - the DomainParticipant has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_NOT_ENABLED* - the DomainParticipant is not enabled.

3.2.1.24 get_discovered_topic_data

Scope

DDS::DomainParticipant

Synopsis

```
#include <ccpp_dcps.h>
ReturnCode_t
   get_discovered_topic_data
      (TopicBuiltinTopicData& topic_data,
        InstanceHandle_t handle);
```

Description

This operation retrieves information on a `Topic` that has been discovered on the network. The topic must have been created by a participant in the same domain as the participant on which this operation is invoked and must not have been "ignored" by means of the `DomainParticipant ignore_topic` operation.

Parameters

`inout TopicBuiltinTopicData *topic_data` - a pointer to the sample in which the information about the specified topic is to be stored.

`in const InstanceHandle_t topic_handle` - a handle to the topic whose information needs to be retrieved.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_ILLEGAL_OPERATION`, `RETCODE_UNSUPPORTED`, `RETCODE_ALREADY_DELETED`, `RETCODE_OUT_OF_RESOURCES`, or `RETCODE_NOT_ENABLED`.

Detailed Description

This operation retrieves information on a `Topic` that has been discovered on the network. The topic must have been created by a participant in the same domain as the participant on which this operation is invoked and must not have been "ignored" by means of the `DomainParticipant ignore_topic` operation.

The `topic_handle` must correspond to a topic currently associated with the `DomainParticipant`, otherwise the operation will fail and return `RETCODE_ERROR`. The operation `get_discovered_topic_data` can be used to find more detailed information about a particular topic that is found with the `get_discovered_topics` operation.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the information on the specified topic has successfully been retrieved.
- *`RETCODE_ERROR`* - an internal error has occurred.

- *RETCODE_ILLEGAL_OPERATION* - the operation is invoked on an inappropriate object.
- *RETCODE_UNSUPPORTED* - OpenSplice is configured not to maintain the information about "associated" topics.
- *RETCODE_ALREADY_DELETED* - the DomainParticipant has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_NOT_ENABLED* - the DomainParticipant is not enabled.

3.2.1.25 get_domain_id

Scope

DDS::DomainParticipant

Synopsis

```
#include <ccpp_dds_dcps.h>
DomainId_t
   get_domain_id
      (void);
```

Description

This operation returns the DomainId of the Domain to which this DomainParticipant is attached.

Parameters

<none>

Return Value

DomainId_t - result is the DomainId.

Detailed Description

This operation returns the DomainId of the Domain to which this DomainParticipant is attached. See also section 3.2.2.1, *create_participant*, on page 182).

3.2.1.26 get_listener

Scope

DDS::DomainParticipant

Synopsis

```
#include <ccpp_dds_dcps.h>
DomainParticipantListener_ptr
   get_listener
      (void);
```

Description

This operation allows access to a `DomainParticipantListener`.

Parameters

<none>

Return Value

`DomainParticipantListener_ptr` - result is a pointer to the `DomainParticipantListener` attached to the `DomainParticipant`.

Detailed Description

This operation allows access to a `DomainParticipantListener` attached to the `DomainParticipant`. When no `DomainParticipantListener` was attached to the `DomainParticipant`, the `NULL` pointer is returned.

3.2.1.27 get_qos

Scope

`DDS::DomainParticipant`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_qos
      (DomainParticipantQos& qos);
```

Description

This operation allows access to the existing set of QoS policies for a `DomainParticipant`.

Parameters

`inout DomainParticipantQos& qos` - a reference to the destination `DomainParticipantQos` struct in which the `QosPolicy` settings will be copied.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ALREADY_DELETED or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation allows access to the existing set of QoS policies of a DomainParticipant on which this operation is used. This DomainparticipantQos is stored at the location pointed to by the qos parameter.

Return Code

When the operation returns:

- *RETCODE_OK* - the existing set of QoS policy values applied to this DomainParticipant has successfully been copied into the specified DomainParticipantQos parameter.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the DomainParticipant has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.2.1.28 get_status_changes (inherited)

This operation is inherited and therefore not described here. See the class Entity for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
StatusMask
   get_status_changes
      (void);
```

3.2.1.29 get_statuscondition (inherited)

This operation is inherited and therefore not described here. See the class Entity for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
StatusCondition
   get_statuscondition_ptr
      (void);
```

3.2.1.30 ignore_participant

Scope

`DDS::DomainParticipant`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   ignore_participant
      (InstanceHandle_t handle);
```

NOTE: This operation is not yet implemented. It is scheduled for a future release.

3.2.1.31 ignore_publication

Scope

`DDS::DomainParticipant`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   ignore_publication
      (InstanceHandle_t handle);
```

NOTE: This operation is not yet implemented. It is scheduled for a future release.

3.2.1.32 ignore_subscription

Scope

`DDS::DomainParticipant`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   ignore_subscription
      (InstanceHandle_t handle);
```

NOTE: This operation is not yet implemented. It is scheduled for a future release.

3.2.1.33 ignore_topic

Scope

`DDS::DomainParticipant`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
```

```
ignore_topic
   (InstanceHandle_t handle);
```

NOTE: This operation is not yet implemented. It is scheduled for a future release.

3.2.1.34 lookup_topicdescription

Scope

`DDS::DomainParticipant`

Synopsis

```
#include <ccpp_dds_dcps.h>
TopicDescription_ptr
   lookup_topicdescription
      (const char* name);
```

Description

This operation gives access to a locally-created `TopicDescription`, with a matching `name`.

Parameters

`in const char* name` - the name of the `TopicDescription` to look for.

Return Value

`TopicDescription_ptr` - Return value is a pointer to the `TopicDescription` found. When no such `TopicDescription` is found, the `NULL` pointer is returned.

Detailed Description

The operation `lookup_topicdescription` gives access to a locally-created `TopicDescription`, based on its name. The operation takes as argument the name of the `TopicDescription`.

If one or more local `TopicDescription` proxies (see also section *3.2.1.15*) of the same name already exist, a pointer to one of the already existing local proxies is returned: `lookup_topicdescription` will never create a new local proxy. That means that the proxy that is returned does not need to be deleted separately from its original. When no local proxy exists, it returns the `NULL` pointer. The operation never blocks.

The operation `lookup_topicdescription` may be used to locate any locally-created `Topic`, `ContentFilteredTopic` and `MultiTopic` object.

3.2.1.35 set_default_publisher_qos

Scope

`DDS::DomainParticipant`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   set_default_publisher_qos
      (const PublisherQos& qos);
```

Description

This operation sets the default `PublisherQos` of the `DomainParticipant`.

Parameters

`in const PublisherQos& qos` - a collection of `QosPolicy` settings, which contains the new default `QosPolicy` settings for the newly created `Publishers`.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_BAD_PARAMETER`, `RETCODE_UNSUPPORTED`, `RETCODE_ALREADY_DELETED` or `RETCODE_OUT_OF_RESOURCES`.

Detailed Description

This operation sets the default `PublisherQos` of the `DomainParticipant` (that is the struct with the `QosPolicy` settings) which is used for newly created `Publisher` objects, in case the constant `PUBLISHER_QOS_DEFAULT` is used. The default `PublisherQos` is only used when the constant is supplied as parameter `qos` to specify the `PublisherQos` in the `create_publisher` operation. The `PublisherQos` is always self consistent, because its policies do not depend on each other. This means that this operation never returns the `RETCODE_INCONSISTENT_POLICY`. The values set by this operation are returned by `get_default_publisher_qos`.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the new default `PublisherQos` is set
- *`RETCODE_ERROR`* - an internal error has occurred.

- *RETCODE_BAD_PARAMETER* - the parameter qos is not a valid PublisherQos. It contains a QosPolicy setting with an enum value that is outside its legal boundaries.
- *RETCODE_UNSUPPORTED* - one or more of the selected QosPolicy values are currently not supported by OpenSplice.
- *RETCODE_ALREADY_DELETED* - the DomainParticipant has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.2.1.36 set_default_subscriber_qos

Scope

DDS::DomainParticipant

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   set_default_subscriber_qos
      (const SubscriberQos& qos);
```

Description

This operation sets the default SubscriberQos of the DomainParticipant.

Parameters

in const SubscriberQos& qos - a collection of QosPolicy settings, which contains the new default QosPolicy settings for the newly created Subscribers.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_UNSUPPORTED, RETCODE_ALREADY_DELETED or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation sets the default SubscriberQos of the DomainParticipant (that is the struct with the QosPolicy settings) which is used for newly created Subscriber objects, in case the constant SUBSCRIBER_QOS_DEFAULT is used. The default SubscriberQos is only used when the constant is supplied as parameter qos to specify the SubscriberQos in the create_subscriber operation. The SubscriberQos is always self consistent, because its policies do

not depend on each other. This means that this operation never returns the RETCODE_INCONSISTENT_POLICY. The values set by this operation are returned by get_default_subscriber_qos.

Return Code

When the operation returns:

- *RETCODE_OK* - the new default SubscriberQos is set
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - the parameter qos is not a valid PublisherQos. It contains a QosPolicy setting with an enum value that is outside its legal boundaries.
- *RETCODE_UNSUPPORTED* - one or more of the selected QosPolicy values are currently not supported by OpenSplice.
- *RETCODE_ALREADY_DELETED* - the DomainParticipant has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.2.1.37 set_default_topic_qos

Scope

DDS::DomainParticipant

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   set_default_topic_qos
      (const TopicQos& qos);
```

Description

This operation sets the default TopicQos of the DomainParticipant.

Parameters

in const TopicQos& qos - a collection of QosPolicy settings, which contains the new default QosPolicy settings for the newly created Topics.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_UNSUPPORTED, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES or RETCODE_INCONSISTENT_POLICY.

Detailed Description

This operation sets the default `TopicQos` of the `DomainParticipant` (that is the struct with the `QosPolicy` settings) which is used for newly created `Topic` objects, in case the constant `TOPIC_QOS_DEFAULT` is used. The default `TopicQos` is only used when the constant is supplied as parameter `qos` to specify the `TopicQos` in the `create_topic` operation. This operation checks if the `TopicQos` is self consistent. If it is not, the operation has no effect and returns `RETCODE_INCONSISTENT_POLICY`. The values set by this operation are returned by `get_default_topic_qos`.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the new default `TopicQos` is set
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_BAD_PARAMETER`* - the parameter `qos` is not a valid `TopicQos`. It contains a `QosPolicy` setting with an invalid `Duration_t` value or an enum value that is outside its legal boundaries
- *`RETCODE_UNSUPPORTED`* - one or more of the selected QosPolicy values are currently not supported by OpenSplice.
- *`RETCODE_ALREADY_DELETED`* - the `DomainParticipant` has already been deleted
- *`RETCODE_OUT_OF_RESOURCES`* - the Data Distribution Service ran out of resources to complete this operation.
- *`RETCODE_INCONSISTENT_POLICY`* - the parameter `qos` contains conflicting `QosPolicy` settings, e.g. a history depth that is higher than the specified resource limits.

3.2.1.38 set_listener

Scope

```
DDS::DomainParticipant
```

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   set_listener
      (DomainParticipantListener_ptr a_listener,
        StatusMask mask);
```

Description

This operation attaches a DomainParticipantListener to the DomainParticipant.

Parameters

in DomainParticipantListener_ptr a_listener - a pointer to the DomainParticipantListener instance, which will be attached to the DomainParticipant.

in StatusMask mask - a bit mask in which each bit enables the invocation of the DomainParticipantListener for a certain status.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_UNSUPPORTED, RETCODE_ALREADY_DELETED or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation attaches a DomainParticipantListener to the DomainParticipant. Only one DomainParticipantListener can be attached to each DomainParticipant. If a DomainParticipantListener was already attached, the operation will replace it with the new one. When a_listener is the NULL pointer, it represents a listener that is treated as a NOOP[1] for all statuses activated in the bit mask.

Communication Status

For each communication status, the StatusChangedFlag flag is initially set to FALSE. It becomes TRUE whenever that communication status changes. For each communication status activated in the mask, the associated DomainParticipantListener operation is invoked and the communication status is reset to FALSE, as the listener implicitly accesses the status which is passed as a parameter to that operation. The status is reset prior to calling the listener, so if the application calls the get_<status_name>_status from inside the listener it will see the status already reset. An exception to this rule is the NULL listener, which does not reset the communication statuses for which it is invoked.

The following statuses are applicable to the DomainParticipantListener:

- INCONSISTENT_TOPIC_STATUS *(propagated)*
- OFFERED_DEADLINE_MISSED_STATUS *(propagated)*
- REQUESTED_DEADLINE_MISSED_STATUS *(propagated)*

1. Short for **No-Op**eration, an instruction that does nothing.

- OFFERED_INCOMPATIBLE_QOS_STATUS *(propagated)*
- REQUESTED_INCOMPATIBLE_QOS_STATUS *(propagated)*
- SAMPLE_LOST_STATUS *(propagated)*
- SAMPLE_REJECTED_STATUS *(propagated)*
- DATA_ON_READERS_STATUS *(propagated)*
- DATA_AVAILABLE_STATUS *(propagated)*
- LIVELINESS_LOST_STATUS *(propagated)*
- LIVELINESS_CHANGED_STATUS *(propagated)*
- PUBLICATION_MATCHED_STATUS *(propagated)*
- SUBSCRIPTION_MATCHED_STATUS *(propagated)*

Be aware that the PUBLICATION_MATCHED_STATUS and SUBSCRIPTION_MATCHED_STATUS are not applicable when the infrastructure does not have the information available to determine connectivity. This is the case when OpenSplice is configured not to maintain discovery information in the Networking Service. (See the description for the NetworkingService/Discovery/enabled property in the Deployment Manual for more information about this subject.) In this case the operation will return RETCODE_UNSUPPORTED.

Status bits are declared as a constant and can be used by the application in an OR operation to create a tailored mask. The special constant STATUS_MASK_NONE can be used to indicate that the created entity should not respond to any of its available statuses. The DDS will therefore attempt to propagate these statuses to its factory. The special constant STATUS_MASK_ANY_V1_2 can be used to select all applicable statuses specified in the "Data Distribution Service for Real-time Systems Version 1.2" specification which are applicable to the PublisherListener.

Status Propagation

The Data Distribution Service will trigger the most specific and relevant Listener. In other words, in case a communication status is also activated on the Listener of a contained entity, the Listener on that contained entity is invoked instead of the DomainParticipantListener. This means that a status change on a contained entity only invokes the DomainParticipantListener if the contained entity itself does not handle the trigger event generated by the status change.

The statuses DATA_ON_READERS_STATUS and DATA_AVAILABLE_STATUS are "Read Communication Statuses" and are an exception to all other plain communication statuses: they have no corresponding status structure that can be obtained with a get_<status_name>_status operation and they are mutually exclusive. When new information becomes available to a DataReader, the Data Distribution Service will first look in an attached and activated SubscriberListener or DomainParticipantListener (in that order) for the

DATA_ON_READERS_STATUS. In case the DATA_ON_READERS_STATUS can not be handled, the Data Distribution Service will look in an attached and activated DataReaderListener, SubscriberListener or DomainParticipant Listener for the DATA_AVAILABLE_STATUS (in that order).

Return Code

When the operation returns:

- *RETCODE_OK* - the DomainParticipantListener is attached
- *RETCODE_ERROR* - an internal error has occurred
- *RETCODE_UNSUPPORTED* - a status was selected that cannot be supported because the infrastructure does not maintain the required connectivity information.
- *RETCODE_ALREADY_DELETED* - the DomainParticipant has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.2.1.39 set_qos

Scope

DDS::DomainParticipant

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   set_qos
      (const DomainParticipantQos& qos);
```

Description

This operation replaces the existing set of QosPolicy settings for a DomainParticipant.

Parameters

in const DomainParticipantQos& qos - new set of QosPolicy settings for the DomainParticipant.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ALREADY_DELETED or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation replaces the existing set of `QosPolicy` settings for a `DomainParticipant`. The parameter `qos` contains the `QosPolicy` settings which is checked for self-consistency.

The set of `QosPolicy` settings specified by the `qos` parameter are applied on top of the existing QoS, replacing the values of any policies previously set (provided, the operation returned `RETCODE_OK`).

Return Code

When the operation returns:

- *`RETCODE_OK`* - the new `DomainParticipantQos` is set
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_ALREADY_DELETED`* - the `DomainParticipant` has already been deleted
- *`RETCODE_OUT_OF_RESOURCES`* - the Data Distribution Service ran out of resources to complete this operation.

3.2.1.40 delete_historical_data

Scope

`DDS::DomainParticipant`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   delete_historical_data
     (const string partition_expression,
      const string topic_expression);
```

Description

This operation deletes all historical TRANSIENT and PERSISTENT data that is storedby the durability service that is configured to support this DomainParticipant.

Parameters

`in const string partition_expression` - An expression to define a filter on partitions.

`in const string topic_expression` - An expression to define a filter on topic names.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR.

Detailed Description

This operation deletes all historical TRANSIENT and PERSISTENT data that is stored by the durability service that is configured to support this DomainParticipant. It only deletes the samples stored in the transient and persistent store, samples stored in individual application DataReaders is spared and remains available to these readers. However, late-joiners will no longer be able to obtain the deleted samples.

The partition_expression and topic_expression strings can be used to specify selection criteria for the topic and/or partition in which the data will be deleted. Wildcards are supported. Note that these parameters are mandatory and cannot be empty. The "*" expression can be used to match all partitions and/or topics.

Only data that exists prior to this method invocationis deleted. Data that is still being inserted during this method invocationwill not be removed.

Return Code

When the operation returns:

- *RETCODE_OK* - all data matching the topic and partition expressions has been deleted.
- *RETCODE_ERROR* - an internal error has occurred.

3.2.2 Class DomainParticipantFactory

The purpose of this class is to allow the creation and destruction of DomainParticipant objects. DomainParticipantFactory itself has no factory. It is a pre-existing singleton object that can be accessed by means of the get_instance operation on the DomainParticipantFactory class.

The pre-defined value TheParticipantFactory can also be used as an alias for the singleton factory returned by the operation get_instance.

The interface description of this class is as follows:

```
class DomainParticipantFactory
{
//
// implemented API operations
//
   static DomainParticipantFactory_ptr
      get_instance
         (void);
   DomainParticipant_ptr
```

```
        create_participant
            (DomainId_t domainId,
            const DomainParticipantQos& qos,
            DomainParticipantListener_ptr a_listener,
            StatusMask mask);
        ReturnCode_t
            delete_participant
                (DomainParticipant_ptr a_participant);
        DomainParticipant_ptr
            lookup_participant
                (DomainId_t domainId);
        ReturnCode_t
            set_default_participant_qos
                (const DomainParticipantQos& qos);
        ReturnCode_t
            get_default_participant_qos
                (DomainParticipantQos& qos);
        ReturnCode_t
            set_qos
                (const DomainParticipantFactoryQos& qos);
        ReturnCode_t
            get_qos
                (DomainParticipantFactoryQos& qos);
        ReturnCode_t
            delete_domain
                (Domain_ptr a_domain);
        Domain
            lookup_domain
                (const DomainId_t domainId);
        ReturnCode_t
            delete_contained_entities
                (void);
        ReturnCode_t
            detach_all_domains
                (Boolean block_operations,
                Boolean delete_entities);
    };
```

The next paragraphs describe the usage of all `DomainParticipantFactory` operations.

3.2.2.1 create_participant

Scope

`DDS::DomainParticipantFactory`

Synopsis

```
#include <ccpp_dds_dcps.h>
       DomainParticipant_ptr
```

```
create_participant
   (DomainId_t domainId,
     const DomainParticipantQos& qos,
     DomainParticipantListener_ptr a_listener,
     StatusMask mask);
```

Description

This operation creates a new DomainParticipant which will join the domain identified by domainId, with the desired DomainParticipantQos and attaches the optionally specified DomainParticipantListener to it.

Parameters

in const DomainId_t domainId - the ID of the Domain to which the DomainParticipant is joined. This should be the ID as specified in the configuration file. This will also be applicable for the lookup_participant, lookup_domain and get_domain_id operations.

in const DomainParticipantQos& qos - a DomainParticipantQos for the new DomainParticipant. When this set of QosPolicy settings is inconsistent, no DomainParticipant is created.

in DomainParticipantListener_ptr a_listener - a pointer to the DomainParticipantListener instance which will be attached to the new DomainParticipant. It is permitted to use NULL as the value of the listener: this behaves as a DomainParticipantListener whose operations perform no action.

in StatusMask mask - a bit-mask in which each bit enables the invocation of the DomainParticipantListener for a certain status.

Return Value

DomainParticipant_ptr - a pointer to the newly created DomainParticipant. In case of an error, the NULL pointer is returned.

Detailed Description

This operation creates a new DomainParticipant, with the desired DomainParticipantQos and attaches the optionally specified DomainParticipantListener to it. The DomainParticipant signifies that the calling application intends to join the Domain identified by the domainId argument.

If the specified QosPolicy settings are not consistent, the operation will fail; no DomainParticipant is created and the operation returns the NULL pointer. To delete the DomainParticipant the operation delete_participant must be used.

Identifying the Domain

The DomainParticipant will attach to the Domain that is specified by the domainId parameter. This parameter consists of an integer specified in the Id tag in the configuration file. Note that to make multiple connections to a Domain (create multiple Participants for the same Domain) within a single process, all of the Participants must use the same identification (*i.e.* all use the same domain Id).

The constant DOMAIN_ID_DEFAULT can be used for this parameter. If this is done the value of Id tag from the configuration file specified by the environment variable called OSPL_URI will be used.

It is recommended to use this domain Id in conjunction with the OSPL_URI environment variable instead of hard-coding a domain Id into your application, since this gives you much more flexibility in the deployment phase of your product. See also Section 1.3.2.1, *The OSPL_URI environment variable*, in the Deployment Guide.

Default QoS

The constant PARTICIPANT_QOS_DEFAULT can be used as parameter qos to create a DomainParticipant with the default DomainParticipantQos as set in the Domainparticipantfactory. The effect of using PARTICIPANT_QOS_DEFAULT is the same as calling the operation get_default_participant_qos and using the resulting DomainParticipantQos to create the DomainParticipant.

Communication Status

For each communication status, the StatusChangedFlag flag is initially set to FALSE. It becomes TRUE whenever that communication status changes. For each communication status activated in the mask, the associated DomainParticipantListener operation is invoked and the communication status is reset to FALSE, as the listener implicitly accesses the status which is passed as a parameter to that operation. The fact that the status is reset prior to calling the listener means that if the application calls the get_<status_name>_status from inside the listener it will see the status already reset.

The following statuses are applicable to the DomainParticipantListener:

- INCONSISTENT_TOPIC_STATUS *(propagated)*
- OFFERED_DEADLINE_MISSED_STATUS *(propagated)*
- REQUESTED_DEADLINE_MISSED_STATUS *(propagated)*
- OFFERED_INCOMPATIBLE_QOS_STATUS *(propagated)*
- REQUESTED_INCOMPATIBLE_QOS_STATUS *(propagated)*
- SAMPLE_LOST_STATUS *(propagated)*
- SAMPLE_REJECTED_STATUS *(propagated)*

- DATA_ON_READERS_STATUS *(propagated)*
- DATA_AVAILABLE_STATUS *(propagated)*
- LIVELINESS_LOST_STATUS *(propagated)*
- LIVELINESS_CHANGED_STATUS *(propagated)*
- PUBLICATION_MATCHED_STATUS *(propagated)*
- SUBSCRIPTION_MATCHED_STATUS *(propagated).*

Be aware that the PUBLICATION_MATCHED_STATUS and SUBSCRIPTION_MATCHED_STATUS are not applicable when the infrastructure does not have the information available to determine connectivity. This is the case when OpenSplice is configured not to maintain discovery information in the Networking Service. (See the description for the NetworkingService/Discovery/enabled property in the Deployment Manual for more information about this subject.) In this case the operation will return NULL.

Status bits are declared as a constant and can be used by the application in an OR operation to create a tailored mask. The special constant STATUS_MASK_NONE can be used to indicate that the created entity should not respond to any of its available statuses. The DDS will therefore attempt to propagate these statuses to its factory. The special constant STATUS_MASK_ANY_V1_2 can be used to select all applicable statuses specified in the "Data Distribution Service for Real-time Systems Version 1.2" specification which are applicable to the PublisherListener.

Status Propagation

The Data Distribution Service will trigger the most specific and relevant Listener. In other words, in case a communication status is also activated on the Listener of a contained entity, the Listener on that contained entity is invoked instead of the DomainParticipantListener. This means that a status change on a contained entity only invokes the DomainParticipantListener if the contained entity itself does not handle the trigger event generated by the status change.

The statuses DATA_ON_READERS_STATUS and DATA_AVAILABLE_STATUS are "Read Communication Statuses" and are an exception to all other plain communication statuses: they have no corresponding status structure that can be obtained with a get_<status_name>_status operation and they are mutually exclusive. When new information becomes available to a DataReader, the Data Distribution Service will first look in an attached and activated SubscriberListener or DomainParticipantListener (in that order) for the DATA_ON_READERS_STATUS. In case the DATA_ON_READERS_STATUS can not be handled, the Data Distribution Service will look in an attached and activated DataReaderListener, SubscriberListener or DomainParticipant Listener for the DATA_AVAILABLE_STATUS (in that order).

3.2.2.2 delete_participant

Scope

`DDS::DomainParticipantFactory`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   delete_participant
      (DomainParticipant_ptr a_participant);
```

Description

This operation deletes a `DomainParticipant`.

Parameters

`in DomainParticipant_ptr a_participant` - a pointer to the `DomainParticipant`, which is to be deleted.

Return Value

`ReturnCode_t` - return codes can be `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_BAD_PARAMETER`, `RETCODE_OUT_OF_RESOURCES` or `RETCODE_PRECONDITION_NOT_MET`.

Detailed Description

This operation deletes a `DomainParticipant`. A `DomainParticipant` cannot be deleted when it has any attached `Entity` objects. When the operation is called on a `DomainParticipant` with existing `Entity` objects, the operation returns `RETCODE_PRECONDITION_NOT_MET`.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the `DomainParticipant` is deleted
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_BAD_PARAMETER`* - the parameter `a_participant` is not a valid `DomainParticipant_ptr`
- *`RETCODE_OUT_OF_RESOURCES`* - the Data Distribution Service ran out of resources to complete this operation.
- *`RETCODE_PRECONDITION_NOT_MET`* - the `DomainParticipant` contains one or more `Entity` objects.

3.2.2.3 get_default_participant_qos

Scope

`DDS::DomainParticipantFactory`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_default_participant_qos
      (DomainParticipantQos& qos);
```

Description

This operation gets the default `DomainParticipantQos` of the `DomainParticipantFactory`.

Parameters

`inout DomainParticipantQos& qos` - a reference to the `DomainParticipantQos` struct (provided by the application) in which the default `DomainParticipantQos` for the `DomainParticipant` is written.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR` or `RETCODE_OUT_OF_RESOURCES`.

Detailed Description

This operation gets the default `DomainParticipantQos` of the `DomainParticipantFactory` (that is the struct with the `QosPolicy` settings) which is used for newly created `DomainParticipant` objects, in case the constant `PARTICIPANT_QOS_DEFAULT` is used. The default `DomainParticipantQos` is only used when the constant is supplied as parameter `qos` to specify the `DomainParticipantQos` in the `create_participant` operation. The application must provide the `DomainParticipantQos` struct in which the `QosPolicy` settings can be stored and provide a reference to the struct. The operation writes the default `QosPolicy` settings to the struct referenced to by `qos`. Any settings in the struct are overwritten.

The values retrieved by this operation match the set of values specified on the last successful call to `set_default_participant_qos`, or, if the call was never made, the default values as specified for each `QosPolicy` setting as defined in Table 2 on page 38

Return Code

When the operation returns:

- *RETCODE_OK* - the default DomainParticipant QosPolicy settings of this DomainParticipantFactory have successfully been copied into the specified DomainParticipantQos parameter.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.2.2.4 get_instance

Scope

DDS::DomainParticipantFactory

Synopsis

```
#include <ccpp_dds_dcps.h>
static DomainParticipantFactory_ptr
   get_instance
      (void);
```

Description

This operation returns the DomainParticipantFactory singleton.

Parameters

<none>

Return Value

DomainParticipantFactory_ptr - a pointer to the DomainParticipantFactory.

Detailed Description

This operation returns the DomainParticipantFactory singleton. The operation is idempotent, that is, it can be called multiple times without side-effects and it returns the same DomainParticipantFactory instance.

The operation is static and must be called upon its class (DomainParticipantFactory::get_instance).

The pre-defined value TheParticipantFactory can also be used as an alias for the singleton factory returned by the operation get_instance.

3.2.2.5 get_qos

Scope

DDS::DomainParticipantFactory

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_qos
      (DomainParticipantFactoryQos& qos);
```

Description

This operation allows access to the existing set of QoS policies for a DomainParticipantFactory.

Parameters

inout DomainParticipantFactoryQos& qos - a reference to the destination DomainparticipantFactoryQos struct in which the QosPolicy settings will be copied.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation allows access to the existing set of QoS policies of a DomainParticipantFactory on which this operation is used. This DomainparticipantFactoryQos is stored at the location pointed to by the qos parameter.

Return Code

When the operation returns:

- *RETCODE_OK* - the existing set of QoS policy values applied to this DomainParticipantFactory has successfully been copied into the specified DomainParticipantFactoryQos parameter.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.2.2.6 lookup_participant

Scope

DDS::DomainParticipantFactory

Synopsis

```
#include <ccpp_dds_dcps.h>
DomainParticipant_ptr
```

```
lookup_participant
   (DomainId_t domainId);
```

Description

This operation retrieves a previously created `DomainParticipant` belonging to the specified `domainId`.

Parameters

`in const DomainId_t domainId` - the ID of the Domain for which a joining `DomainParticipant` should be retrieved. This should be the ID as specified in the configuration file.

Return Value

`DomainParticipant_ptr` - Return value is a pointer to the `DomainParticipant` retrieved. When no such `DomainParticipant` is found, the `NULL` pointer is returned.

Detailed Description

This operation retrieves a previously created `DomainParticipant` belonging to the specified `domainId`. If no such `DomainParticipant` exists, the operation will return `NULL`.

The `domainId` used to search for a specific `DomainParticipant` must be identical to the `domainId` that was used to create that specific `DomainParticipant`.

If multiple `DomainParticipant` entities belonging to the specified `domainId` exist, then the operation will return one of them. It is not specified which one. See also section 3.2.2.1, *create_participant*, on page 182.

3.2.2.7 set_default_participant_qos

Scope

`DDS::DomainParticipantFactory`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   set_default_participant_qos
      (const DomainParticipantQos& qos);
```

Description

This operation sets the default `DomainParticipantQos` of the `DomainParticipantFactory`.

Parameters

in const DomainParticipantQos& qos - the DomainParticipantQos struct, which contains the new default DomainParticipantQos for the newly created DomainParticipants.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation sets the default DomainParticipantQos of the DomainParticipantFactory (that is the struct with the QosPolicy settings) which is used for newly created DomainParticipant objects, in case the constant PARTICIPANT_QOS_DEFAULT is used. The default DomainParticipantQos is only used when the constant is supplied as parameter qos to specify the DomainParticipantQos in the create_participant operation. The DomainParticipantQos is always self consistent, because its policies do not depend on each other. This means this operation never returns the RETCODE_INCONSISTENT_POLICY.

The values set by this operation are returned by get_default_participant_qos.

Return Code

When the operation returns:

- *RETCODE_OK* - the new default DomainParticipantQos is set
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.2.2.8 set_qos

Scope

DDS::DomainParticipantFactory

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   set_qos
      (const DomainParticipantFactoryQos& qos);
```

Description

This operation replaces the existing set of QosPolicy settings for a DomainParticipantFactory.

Parameters

in const DomainParticipantFactoryQos& qos - must contain the new set of QosPolicy settings for the DomainParticipantFactory.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation replaces the existing set of QosPolicy settings for a DomainParticipantFactory. The parameter qos must contain the struct with the QosPolicy settings.

The set of QosPolicy settings specified by the qos parameter are applied on top of the existing QoS, replacing the values of any policies previously set (provided the operation returned RETCODE_OK).

Return Code

When the operation returns:

- *RETCODE_OK* - the new DomainParticipantFactoryQos is set.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.2.2.9 delete_domain

Synopsis

```
#include <ccpp_dds_dcps.h>
   ReturnCode_t
      delete_domain
         (Domain_ptr a_domain);
```

Description

This operation deletes a Domain proxy.

Parameters

in Domain_ptr a_domain - a pointer to the Domain proxy, which is to be deleted.

Return Value

ReturnCode_t - Possible return codes of the operation are:
RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation deletes a Domain proxy.

Return Code

When the operation returns:

- *RETCODE_OK* - the Domain proxy is deleted.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - the parameter a_domain is not a valid Domain proxy.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.2.2.10 lookup_domain

Synopsis

```
#include <ccpp_dds_dcps.h>
Domain_ptr
lookup_domain
   (const DomainId_t domainId);
```

Description

This operation retrieves a previously created Domain proxy belonging to the specified domainId or creates a new Domain proxy if no Domain proxy yet exists but the Domain itself is available.

Parameters

in const DomainId_t domainId - the ID of the Domain for which a Domain proxy should be retrieved. This should be the ID as specified in the configuration file.

Return Value

Domain_ptr - Return value is a pointer to the Domain proxy retrieved. When no such Domain proxy is found or could be created, the NULL pointer is returned.

Detailed Description

This operation retrieves a previously created Domain proxy belonging to the specified `domainId` or creates a new Domain proxy if no Domain proxy was found, but the `DomainId` does refer to a valid Domain. If no such Domain exists or could be created, the operation will return `NULL`. See also section 3.2.2.1, *create_participant*, on page 182.

3.2.2.11 delete_contained_entities

Scope

`DDS::DomainParticipantFactory`

Synopsis

```
#include <ccpp_dds_dcps.h>
   ReturnCode_t
      delete_contained_entities
         (void);
```

Description

This operation deletes all of the `Entity` objects that were created on the `DomainParticipantFactory`.

Parameters

<none>

Return Value

`ReturnCode_t` - Possible return codes of the operation are:
`RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_OUT_OF_RESOURCES` or `RETCODE_PRECONDITION_NOT_MET`.

Detailed Description

This operation deletes all of the `Entity` objects that were created on the `DomainParticipantFactory` (it deletes all contained `DomainParticipant` objects). Prior to deleting each contained `Entity`, this operation regressively calls the corresponding `delete_contained_entities` operation on each `Participant`. In other words, this operation cleans up *all* `Entity` objects in the process.

NOTE: The operation will return `PRECONDITION_NOT_MET` if the any of the contained entities is in a state where it cannot be deleted. This will occur, for example, if a contained `DataReader` cannot be deleted because the application has called a `read` or `take` operation and has not called the corresponding

`return_loan` operation to return the loaned samples. In such cases, the operation does not roll back any entity deletions performed prior to the detection of the problem.

Return Code

When the operation returns:

- *`RETCODE_OK`* - all of the contained `Entity` objects are deleted.
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_OUT_OF_RESOURCES`* - the Data Distribution Service ran out of resources to complete this operation.
- *`RETCODE_PRECONDITION_NOT_MET`* - one or more of the contained entities are in a state where they cannot be deleted.

3.2.2.12 detach_all_domains

Scope

`DDS::DomainParticipantFactory`

Synopsis

```
#include <ccpp_dds_dcps.h>
   ReturnCode_t
      detach_all_domains(
         Boolean block_operations, Boolean delete_entities);
```

Description

This operation will safely detach the application from all domains it is currently participating in.

Parameters

`in Boolean block_operations –`
Indicates whether the application wants any operations that are called while detaching to be blocked or not.

`in Boolean delete_entities –`
Indicates whether the application DDS entities in the ‘connected’ domains must be deleted synchronously during detaching.

Return Value

`ReturnCode_t` - Possible return codes of the operation are:
`RETCODE_OK`

Detailed Description

This operation safely detaches the application from all domains it is currently participating in. When this operation has been performed successfully, the application is no longer connected to any Domain.

- For *Federated* domains, finishing this operation successfully means that all shared memory segments have been safely un-mapped from the application process.
- For *SingleProcess* mode domains, this means that all services for all domains have been stopped. This allows graceful termination of the OSPL services that run as threads within the application. Graceful termination of services in this mode would for instance allow durability flushing of persistent data and networking termination announcement over the network.

When this call returns, further access to all domains will be denied and it will not be possible for the application to open or re-open any DDS domain.

The behavior of the `detach_all_domains` operation is determined by the *`block_operations`* and *`delete_entities`* parameters.

`block_operations` – This parameter specifies whether the application wants any DDS operation to be blocked or not while detaching. When `TRUE`, any DDS operation called during this operation will be blocked and remain blocked forever (so also after the detach operation has completed and returns to the caller). When `FALSE`, any DDS operation called during this operation may return `RETCODE_ALREADY_DELETED`.
Please note that a listener callback is *not* considered an operation in progress. Of course, if a DDS operation is called from *within* the listener callback, that operation *will* be blocked during the detaching if this attribute is set to `TRUE`.

`delete_entities` – This parameter specifies whether the application wants the DDS entities created by the application to be deleted (synchronously) while detaching from the domain or not. If `TRUE`, all application entities are guaranteed to be deleted when the call returns. If `FALSE`, application entities will not explicitly be deleted by this operation.
In *federated* mode, the splice-daemon will delete them asynchronously after this operation has returned successfully. In *SingleProcess* mode this attribute is ignored and clean up will always be performed, as this cannot be delegated to a different process.

NOTE: In *federated* mode when the `detach_all_domain` operation is called with *`block_operations`* set to `FALSE` and *`delete_entities`* also `FALSE` then the DDS operations which are in progress and which are waiting for some condition to become true (or waiting for an event to occur) while the detach operation is performed *may* be blocked.

Return Code

When the operation returns:

- *RETCODE_OK* – the application is detached from all domains.

3.2.3 Class Domain

The purpose of this class is to represent the Domain and allow certain Domain-wide operations to be performed. In essence it is a proxy to the Domain.

A Domain is a distributed concept that links all the applications that must be able to communicate with each other. It represents a communication plane: only the Publishers and the Subscribers attached to the same Domain can interact.

This class currently implements one function:

- It allows for a snapshot to be taken of all persistent data available within this Domain on local node level.

The interface description of this class is as follows:

```
/*
* interface Domain
*/
class Domain {
   ReturnCode_t
      create_persistent_snapshot(
         const char* partition_expression,
         const char* topic_expression,
         const char* URI);
};
```

The following sections describe the usage of all Domain operations.

3.2.3.1 create_persistent_snapshot

Synopsis

```
#include <ccpp_dds_dcps.h>
   ReturnCode_t
      create_persistent_snapshot(
         const char* partition_expression,
         const char* topic_expression,
         const char* URI);
```

Description

This operation will create a snapshot of all persistent data matching the provided partition and topic expressions and store the snapshot at the location indicated by the URI. Only persistent data available on the local node is considered.

Parameters

in char partition_expression* - The expression of all partitions involved in the snapshot; this may contain wildcards.

in char topic_expression* - The expression of all topics involved in the snapshot; this may contain wildcards.

in char uri* - The location where to store the snapshot. Currently only directories are supported.

Return Value

ReturnCode_t - Possible return codes of the operation are:
RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_ALREADY_DELETED or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation will create a snapshot of all persistent data matching the provided partition and topic expressions and store the snapshot at the location indicated by the URI. Only persistent data available on the local node is considered. This operation will fire an event to trigger the snapshot creation by the durability service and then return while the durability service fulfills the snapshot request; if no durability service is available then there is no persistent data available and the operation will return OK as a snapshot of an empty store is an empty store.

The created snapshot can then be used as the persistent store for the durability service next time it starts up by configuring the location of the snapshot as the persistent store in the configuration file. The durability service will then use the snapshot as the regular store (and can thus also alter its contents).

Return Code

When the operation returns:

- *RETCODE_OK* – The persistent snapshot is (being) created.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - the parameter partition_expression, topic_expression or uri is NULL.
- *RETCODE_ALREADY_DELETED* - the Domain proxy has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.2.4 DomainParticipantListener interface

Since a DomainParticipant is an Entity, it has the ability to have a Listener associated with it. In this case, the associated Listener should be of type DomainParticipantListener. This interface must be implemented by the application. A user-defined class must be provided by the application which must extend from the DomainParticipantListener class. **All** DomainParticipantListener operations **must** be implemented in the user-defined class, it is up to the application whether an operation is empty or contains some functionality.

All operations for this interface must be implemented in the user-defined class, it is up to the application whether an operation is empty or contains some functionality.

The DomainParticipantListener provides a generic mechanism (actually a callback function) for the Data Distribution Service to notify the application of relevant asynchronous status change events, such as a missed deadline, violation of a QosPolicy setting, etc. The DomainParticipantListener is related to changes in communication status StatusConditions.

The interface description of this class is as follows:

```
class DomainParticipantListener
{
//
// inherited from TopicListener
//
// void
//    on_inconsistent_topic
//       (Topic_ptr the_topic,
//       const InconsistentTopicStatus& status) = 0;
//
// inherited from PublisherListener
//
// void
//    on_offered_deadline_missed
//       (DataWriter_ptr writer,
//       const OfferedDeadlineMissedStatus& status) = 0;

// void
//    on_offered_incompatible_qos
//       (DataWriter_ptr writer,
//       const OfferedIncompatibleQosStatus& status) = 0;

// void
//    on_liveliness_lost
//       (DataWriter_ptr writer,
//       const LivelinessLostStatus& status) = 0;
```

```
// void
//    on_publication_matched
//       (DataWriter_ptr writer,
//       const PublicationMatchedStatus& status) = 0;
//
// inherited from SubscriberListener
//
// void
//    on_data_on_readers
//       (Subscriber_ptr subs) = 0;
// void
//    on_requested_deadline_missed
//       (DataReader_ptr reader,
//       const RequestedDeadlineMissedStatus& status) = 0;

// void
//    on_requested_incompatible_qos
//       (DataReader_ptr reader,
//       const RequestedIncompatibleQosStatus& status) = 0;

// void
//    on_sample_rejected
//       (DataReader_ptr reader,
//       const SampleRejectedStatus& status) = 0;

// void
//    on_liveliness_changed
//       (DataReader_ptr reader,
//       const LivelinessChangedStatus& status) = 0;

// void
//    on_data_available
//       (DataReader_ptr reader) = 0;

// void
//    on_subscription_matched
//       (DataReader_ptr reader,
//       const SubscriptionMatchedStatus& status) = 0;

// void
//    on_sample_lost
//       (DataReader_ptr reader,
//       const SampleLostStatus& status) = 0;
//
// implemented API operations
//       <no operations>
//
};
```

The next paragraphs list all DomainParticipantListener operations. Since these operations are all inherited, they are listed but not fully described because they are not implemented in this class. The full description of these operations is given in the classes from which they are inherited.

3.2.4.1 on_data_available (inherited, abstract)

This operation is inherited and therefore not described here. See the class DataReaderListener for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_data_available
      (DataReader_ptr reader) = 0;
```

3.2.4.2 on_data_on_readers (inherited, abstract)

This operation is inherited and therefore not described here. See the class SubscriberListener for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_data_on_readers
      (Subscriber_ptr subs) = 0;
```

3.2.4.3 on_inconsistent_topic (inherited, abstract)

This operation is inherited and therefore not described here. See the class TopicListener for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_inconsistent_topic
      (Topic_ptr the_topic,
        const InconsistentTopicStatus& status) = 0;
```

3.2.4.4 on_liveliness_changed (inherited, abstract)

This operation is inherited and therefore not described here. See the class DataReaderListener for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_liveliness_changed
```

```
      (DataReader_ptr reader,
        const LivelinessChangedStatus& status) = 0;
```

3.2.4.5 on_liveliness_lost (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataWriterListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_liveliness_lost
      (DataWriter_ptr writer,
        const LivelinessLostStatus& status) = 0;
```

3.2.4.6 on_offered_deadline_missed (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataWriterListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_offered_deadline_missed
      (DataWriter_ptr writer,
        const OfferedDeadlineMissedStatus& status) = 0;
```

3.2.4.7 on_offered_incompatible_qos (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataWriterListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_offered_incompatible_qos
      (DataWriter_ptr writer,
        const OfferedIncompatibleQosStatus& status) = 0;
```

3.2.4.8 on_publication_matched (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataWriterListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_publication_matched
      (DataWriter_ptr writer,
```

```
      const PublicationMatchedStatus& status) = 0;
```

3.2.4.9 on_requested_deadline_missed (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataReaderListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_requested_deadline_missed
      (DataReader_ptr reader,
        const RequestedDeadlineMissedStatus& status) = 0;
```

3.2.4.10 on_requested_incompatible_qos (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataReaderListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_requested_incompatible_qos
      (DataReader_ptr reader,
        const RequestedIncompatibleQosStatus& status) = 0;
```

3.2.4.11 on_sample_lost (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataReaderListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_sample_lost
      (DataReader_ptr reader,
        const SampleLostStatus& status) = 0;
```

3.2.4.12 on_sample_rejected (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataReaderListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_sample_rejected
      (DataReader_ptr reader,
        const SampleRejectedStatus& status) = 0;
```

3.2.4.13 on_subscription_matched (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataReaderListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_subscription_matched
      (DataReader_ptr reader,
          const SubscriptionMatchedStatus& status) = 0;
```

3.2.5 ExtDomainParticipantListener interface

The `ExtDompainParticipantListener` interface is a subtype of both `DomainParticipantListener` and `ExtTopicListener` and thereby provides an additional OpenSplice-specific callback, `on_all_disposed_data`, usable from the `DomainParticipant`.

All operations for this interface must be implemented in the user-defined class, it is up to the application whether an operation is empty or contains some functionality.

The interface description of this class is as follows:

```
class ExtDomainParticipantListener : ExtTopicListener,
DomainParticiantListener
{
//
// inherited from TopicListener
//
// void
// on_inconsistent_topic
// (Topic_ptr the_topic,
// const InconsistentTopicStatus& status) = 0;

// inherited from ExtTopicListener
//
// void
// on_all_data_disposed
// (Topic_ptr the_topic) = 0;
//
// inherited from PublisherListener
//
// void
// on_offered_deadline_missed
// (DataWriter_ptr writer,
// const OfferedDeadlineMissedStatus& status) = 0;
// void
// on_offered_incompatible_qos
```

```
// (DataWriter_ptr writer,
// const OfferedIncompatibleQosStatus& status) = 0;
// void
// on_liveliness_lost
// (DataWriter_ptr writer,
// const LivelinessLostStatus& status) = 0;
// void
// on_publication_matched
// (DataWriter_ptr writer,
// const PublicationMatchedStatus& status) = 0;
//
// inherited from SubscriberListener
//
// void
// on_data_on_readers
// (Subscriber_ptr subs) = 0;
// void
// on_requested_deadline_missed
// (DataReader_ptr reader,
// const RequestedDeadlineMissedStatus& status) = 0;
// void
// on_requested_incompatible_qos
// (DataReader_ptr reader,
// const RequestedIncompatibleQosStatus& status) = 0;
// void
// on_sample_rejected
// (DataReader_ptr reader,
// const SampleRejectedStatus& status) = 0;
// void
// on_liveliness_changed
// (DataReader_ptr reader,
// const LivelinessChangedStatus& status) = 0;
// void
// on_data_available
// (DataReader_ptr reader) = 0;
// void
// on_subscription_matched
// (DataReader_ptr reader,
// const SubscriptionMatchedStatus& status) = 0;
// void
// on_sample_lost
// (DataReader_ptr reader,
// const SampleLostStatus& status) = 0;
//
// implemented API operations
// <no operations>
//
};
```

The following paragraphs list all `ExtDomainParticipantListener` operations. Since these operations are all inherited, they are listed but not fully described because they are not implemented in this class. The full descriptions of these operations are given in the classes from which they are inherited.

3.2.5.1 on_all_data_disposed (inherited, abstract)

This operation is inherited and therefore not described here. See the class `ExtTopicListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_all_data_disposed
      (Topic_ptr the_topic) = 0;
```

3.2.5.2 on_data_available (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataReaderListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_data_available
      (DataReader_ptr reader) = 0;
```

3.2.5.3 on_data_on_readers (inherited, abstract)

This operation is inherited and therefore not described here. See the class `SubscriberListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_data_on_readers
      (Subscriber_ptr subs) = 0;
```

3.2.5.4 on_inconsistent_topic (inherited, abstract)

This operation is inherited and therefore not described here. See the class `TopicListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_inconsistent_topic
      (Topic_ptr the_topic,
```

```
      const InconsistentTopicStatus& status) = 0;
```

3.2.5.5 on_liveliness_changed (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataReaderListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_liveliness_changed
      (DataReader_ptr reader,
        const LivelinessChangedStatus& status) = 0;
```

3.2.5.6 on_liveliness_lost (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataWriterListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_liveliness_lost
      (DataWriter_ptr writer,
        const LivelinessLostStatus& status) = 0;
```

3.2.5.7 on_offered_deadline_missed (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataWriterListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_offered_deadline_missed
      (DataWriter_ptr writer,
        const OfferedDeadlineMissedStatus& status) = 0;
```

3.2.5.8 on_offered_incompatible_qos (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataWriterListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_offered_incompatible_qos
      (DataWriter_ptr writer,
        const OfferedIncompatibleQosStatus& status) = 0;
```

3.2.5.9 on_publication_matched (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataWriterListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_publication_matched
      (DataWriter_ptr writer,
        const PublicationMatchedStatus& status) = 0;
```

3.2.5.10 on_requested_deadline_missed (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataReaderListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_requested_deadline_missed
      (DataReader_ptr reader,
        const RequestedDeadlineMissedStatus& status) = 0;
```

3.2.5.11 on_requested_incompatible_qos (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataReaderListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_requested_incompatible_qos
      (DataReader_ptr reader,
        const RequestedIncompatibleQosStatus& status) = 0;
```

3.2.5.12 on_sample_lost (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataReaderListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_sample_lost
      (DataReader_ptr reader,
        const SampleLostStatus& status) = 0;
```

3.2.5.13 on_sample_rejected (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataReaderListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_sample_rejected
      (DataReader_ptr reader,
        const SampleRejectedStatus& status) = 0;
```

3.2.5.14 on_subscription_matched (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataReaderListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_subscription_matched
      (DataReader_ptr reader,
          const SubscriptionMatchedStatus& status) = 0;
```

3.3 Topic-Definition Module

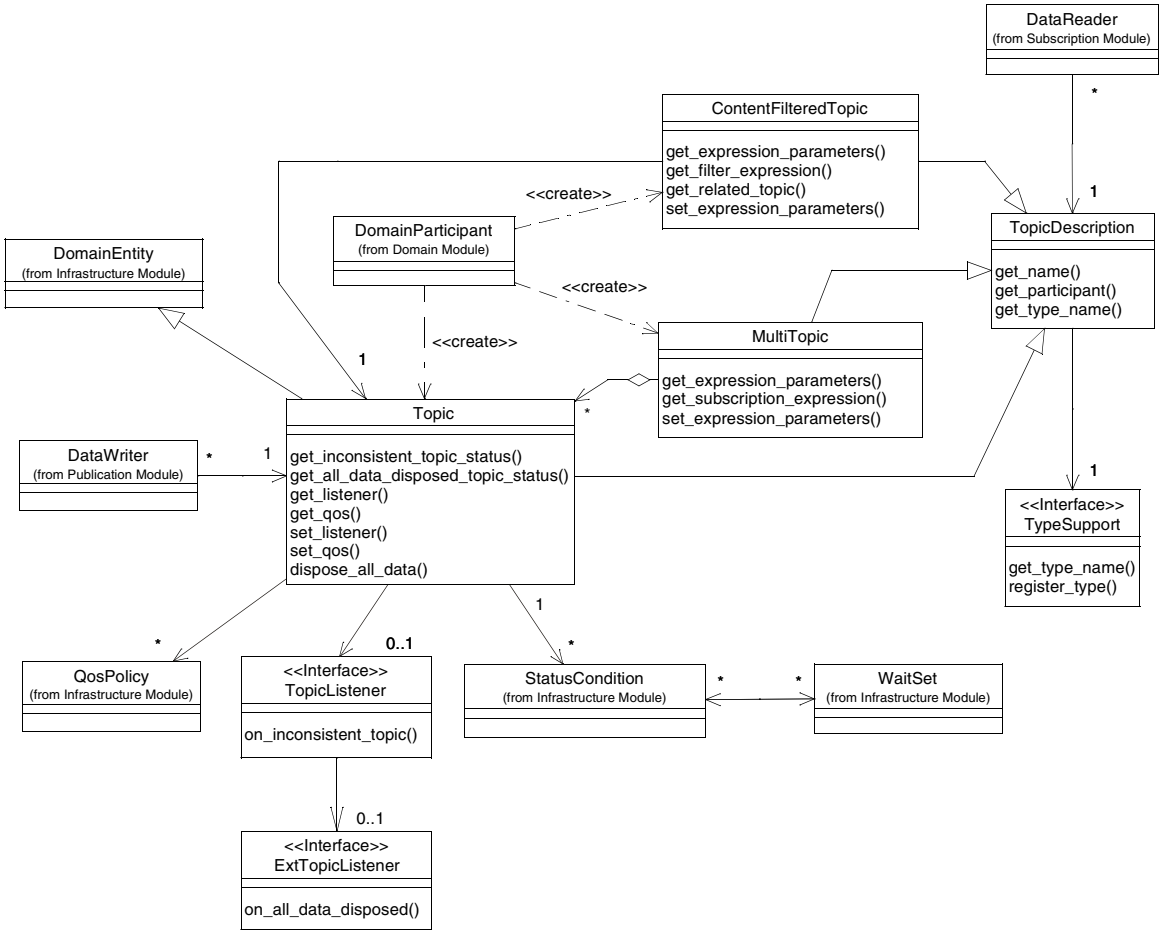

Figure 16 DCPS Topic-Definition Module's Class Model

This module contains the following classes:

- `TopicDescription` (abstract)
- `Topic`
- `ContentFilteredTopic`
- `MultiTopic`
- `TopicListener` (interface)
- Topic-Definition type specific classes.

"Topic-Definition type specific classes" contains the generic class and the generated data type specific classes. For each data type, a data type specific class `<type>TypeSupport` is generated (based on IDL) by calling the pre-processor.

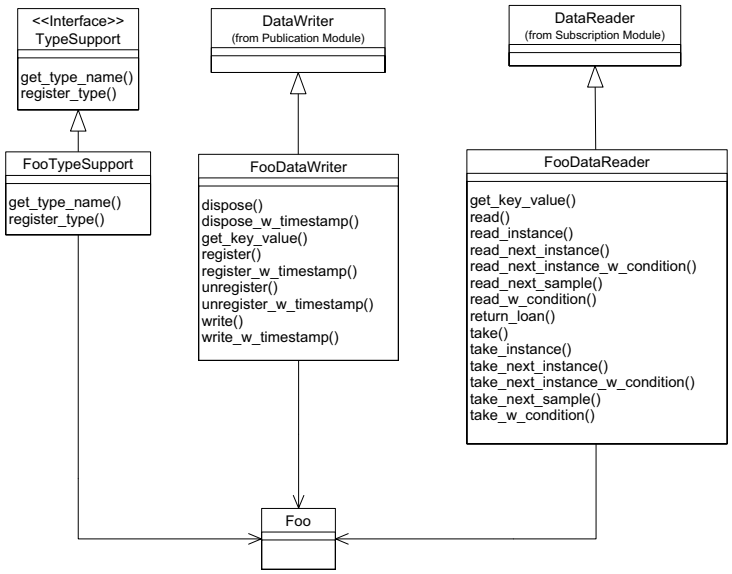

Figure 17 Data Type "Foo" Typed Classes Pre-processor Generation

For instance, for the fictional data type `Foo` (this also applies to other types) "Topic-Definition type specific classes" contains the following classes:

- `TypeSupport` (abstract)
- `FooTypeSupport`.

`Topic` objects conceptually fit between publications and subscriptions. Publications must be known in such a way that subscriptions can refer to them unambiguously. A `Topic` is meant to fulfil that purpose: it associates a name (unique in the `Domain`), a data type, and `TopicQos` related to the data itself.

3.3.1 Class TopicDescription (abstract)

This class is an abstract class. It is the base class for `Topic`, `ContentFilteredTopic` and `MultiTopic`.

The `TopicDescription` attribute `type_name` defines an unique data type that is made available to the Data Distribution Service via the `TypeSupport`. `TopicDescription` has also a `name` that allows it to be retrieved locally.

```
The interface description of this class is as follows:
    class TopicDescription
    {
    //
```

```
    // implemented API operations
    //
        char*
           get_type_name
              (void);
        char*
           get_name
              (void);
        DomainParticipant_ptr
           get_participant
              (void);
    };
```

The next paragraphs describe the usage of all `TopicDescription` operations.

3.3.1.1 get_name

Scope

`DDS::TopicDescription`

Synopsis

```
#include <ccpp_dds_dcps.h>
char*
   get_name
      (void);
```

Description

This operation returns the name used to create the `TopicDescription`.

Parameters

<none>

Return Value

`char*` - is the name of the `TopicDescription`.

Detailed Description

This operation returns the name used to create the `TopicDescription`.

3.3.1.2 get_participant

Scope

`DDS::TopicDescription`

Synopsis

```
#include <ccpp_dds_dcps.h>
DomainParticipant_ptr
```

```
get_participant
   (void);
```

Description

This operation returns the `DomainParticipant` associated with the `TopicDescription` or the `NULL` pointer.

Parameters

<none>

Return Value

`DomainParticipant_ptr` - a pointer to the `DomainParticipant` associated with the `TopicDescription` or the `NULL` pointer.

Detailed Description

This operation returns the `DomainParticipant` associated with the `TopicDescription`. Note that there is exactly one `DomainParticipant` associated with each `TopicDescription`. When the `TopicDescription` was already deleted (there is no associated `DomainParticipant` any more), the `NULL` pointer is returned.

3.3.1.3 get_type_name

Scope

`DDS::TopicDescription`

Synopsis

```
#include <ccpp_dds_dcps.h>
char*
   get_type_name
      (void);
```

Description

This operation returns the registered name of the data type associated with the `TopicDescription`.

Parameters

<none>

Return Value

`char*` - the name of the data type of the `TopicDescription`.

Detailed Description

This operation returns the registered name of the data type associated with the `TopicDescription`.

3.3.2 Class Topic

`Topic` is the most basic description of the data to be published and subscribed.

A `Topic` is identified by its `name`, which must be unique in the whole `Domain`. In addition (by virtue of extending `TopicDescription`) it fully identifies the type of data that can be communicated when publishing or subscribing to the `Topic`.

`Topic` is the only `TopicDescription` that can be used for publications and therefore a specialized `DataWriter` is associated to the `Topic`.

The interface description of this class is as follows:

```
 class Topic
{
//
// inherited from class Entity
//
// StatusCondition_ptr
//    get_statuscondition
//       (void);
// StatusMask
//    get_status_changes
//       (void);
// ReturnCode_t
//    enable
//       (void);
//
// inherited from class TopicDescription
//
// char*
//    get_type_name
//       (void);

// char*
//    get_name
//       (void);

// DomainParticipant_ptr
//    get_participant
//       (void);
//
// implemented API operations
//
   ReturnCode_t
      set_qos
         (const TopicQos& qos);
```

```
    ReturnCode_t
       get_qos
          (TopicQos& qos);
    ReturnCode_t
       set_listener
          (TopicListener_ptr a_listener,
          StatusMask mask);
    TopicListener_ptr
       get_listener
          (void);
    ReturnCode_t
       get_inconsistent_topic_status
          (InconsistentTopicStatus& a_status);
    ReturnCode_t
       get_all_data_disposed_topic_status
          (AllDataDisposedTopicStatus& a_status);
    ReturnCode_t dispose_all_data ();
};
```

The next paragraphs describe the usage of all `Topic` operations. The inherited operations are listed but not fully described because they are not implemented in this class. The full description of these operations is given in the classes from which they are inherited.

3.3.2.1 enable (inherited)

This operation is inherited and therefore not described here. See the class `Entity` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   enable
      (void);
```

NOTE: This operation is not yet implemented. It is scheduled for a future release.

3.3.2.2 get_inconsistent_topic_status

Scope

```
DDS::Topic
```

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_inconsistent_topic_status
      (InconsistentTopicStatus& a_status);
```

Description

This operation obtains the `InconsistentTopicStatus` of the `Topic`.

Parameters

`inout InconsistentTopicStatus& a_status` - the contents of the `InconsistentTopicStatus` struct of the `Topic` will be copied into the location specified by `a_status`.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_ALREADY_DELETED` or `RETCODE_OUT_OF_RESOURCES`.

Detailed Description

This operation obtains the `InconsistentTopicStatus` of the `Topic`. The `InconsistentTopicStatus` can also be monitored using a `TopicListener` or by using the associated `StatusCondition`.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the current `InconsistentTopicStatus` of this `Topic` has successfully been copied into the specified `a_status` parameter.
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_ALREADY_DELETED`* - the `Topic` has already been deleted.
- *`RETCODE_OUT_OF_RESOURCES`* - the Data Distribution Service ran out of resources to complete this operation.

3.3.2.3 get_all_data_disposed_topic_status

Scope

`DDS::Topic`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_all_data_disposed_topic_status
      (AllDataDisposedTopicStatus& a_status);
```

Description

This operation obtains the `AllDataDisposedTopicStatus` of the `Topic`.

Parameters

inout AllDataDisposedTopicStatus& a_status – the contents of the AllDataDisposedTopicStatus struct of the Topic will be copied into the location specified by a_status.

Return Value

ReturnCode_t – Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ALREADY_DELETED or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation obtains the AllDataDisposedTopicStatus of the Topic. The AllDataDisposedTopicStatus can also be monitored using a ExtTopicListener or by using the associated StatusCondition.

Return Code

When the operation returns:

RETCODE_OK – the current AllDataDisposedTopicStatus of this Topic has successfully been copied into the specified status parameter.

RETCODE_ERROR – an internal error has occurred.

RETCODE_ALREADY_DELETED – the Topic has already been deleted.

RETCODE_OUT_OF_RESOURCES – the Data Distribution Service ran out of resources to complete this operation.

3.3.2.4 dispose_all_data

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t dispose_all_data ();
```

Description

This operation allows the application to dispose of all of the instances for a particular topic without the network overhead of using a separate dispose call for each instance.

Parameters

<none>

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_OUT_OF_RESOURCES, RETCODE_ALREADY_DELETED, RETCODE_NOT_ENABLED.

DetailedDescription

This operation allows the application to dispose of all of the instances for a particular topic without the network overhead of using a separate dispose call for each instance. Its effect is equivalent to invoking a separate dispose operation for each individual instance on the DataWriter that owns it. (See the description of FooDataWriter.dispose in Section 3.4.2.33, *dispose*, on page 297.)

(The dispose_all_data is an asynchronous C&M operation that is not part of a coherent update; it operates on the DataReaders history cache and not on the incomplete transactions. The dispose_all_data is effectuated as soon as a transaction becomes complete and is inserted into the DataReaders history cache; at that point messages will be inserted according to the destination_order qos policy. For BY_SOURCE_TIMESTAMP all messages older than the dispose_all_data will be disposed and all newer will be alive; for BY_RECEPTION_TIMESTAMP all messages will be alive if the transaction is completed after receiving the dispose_all_data command.)

This operation *only* sets the instance state of the instances concerned to NOT_ALIVE_DISPOSED. It does *not* unregister the instances, and so does not automatically clean up the memory that is claimed by the instances in both the DataReaders and DataWriters.

Blocking

The blocking (or nonblocking) behaviour of this call is undefined.

Concurrency

If there are subsequent calls to this function before the action has been completed (completion of the disposes on all nodes, not simply return from the function), then the behaviour is undefined.

Other notes

The effect of this call on disposed_generation_count, generation_rank and absolute_generation_rank is undefined.

Return Code

- *RETCODE_OK* - a request to dispose the topic has been sucessfully queued.
- *RETCODE_ERROR* - and internal error has occured.

- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_ALREADY_DELETED* - the Topic has already been deleted.
- *RETCODE_NOT_ENABLED* - the Topic is not enabled.

3.3.2.5 get_listener

Scope

`DDS::Topic`

Synopsis

```
#include <ccpp_dds_dcps.h>
TopicListener_ptr
   get_listener
      (void);
```

Description

This operation allows access to a `TopicListener`.

Parameters

<none>

Return Value

`TopicListener_ptr` - result is a pointer to the `TopicListener` attached to the `Topic`.

Detailed Description

This operation allows access to a `TopicListener` attached to the `Topic`. When no `TopicListener` was attached to the `Topic`, the `NULL` pointer is returned.

3.3.2.6 get_name (inherited)

This operation is inherited and therefore not described here. See the class `TopicDescription` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
char*
   get_name
      (void);
```

3.3.2.7 get_participant (inherited)

This operation is inherited and therefore not described here. See the class `TopicDescription` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
DomainParticipant_ptr
   get_participant
      (void);
```

3.3.2.8 get_qos

Scope

`DDS::Topic`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_qos
      (TopicQos& qos);
```

Description

This operation allows access to the existing set of QoS policies for a `Topic`.

Parameters

`inout TopicQos& qos` - a reference to the destination `TopicQos` struct in which the `QosPolicy` settings will be copied.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_ALREADY_DELETED` or `RETCODE_OUT_OF_RESOURCES`.

Detailed Description

This operation allows access to the existing set of QoS policies of a `Topic` on which this operation is used. This `TopicQos` is stored at the location pointed to by the `qos` parameter.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the existing set of QoS policy values applied to this `Topic` has successfully been copied into the specified `TopicQos` parameter.
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_ALREADY_DELETED`* - the `Topic` has already been deleted.

- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.3.2.9 get_status_changes (inherited)

This operation is inherited and therefore not described here. See the class `Entity` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
StatusMask
   get_status_changes
      (void);
```

3.3.2.10 get_statuscondition (inherited)

This operation is inherited and therefore not described here. See the class `Entity` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
StatusCondition_ptr
   get_statuscondition
      (void);
```

3.3.2.11 get_type_name (inherited)

This operation is inherited and therefore not described here. See the class `TopicDescription` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
char*
   get_type_name
      (void);
```

3.3.2.12 set_listener

Scope

```
DDS::Topic
```

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   set_listener
      (TopicListener_ptr a_listener,
        StatusMask mask);
```

Description

This operation attaches a `TopicListener` to the `Topic`.

Parameters

`in TopicListener_ptr a_listener` - a pointer to the `TopicListener` instance, which will be attached to the `Topic`.

`in StatusMask mask` - a bit mask in which each bit enables the invocation of the `TopicListener` for a certain status.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_ALREADY_DELETED` or `RETCODE_OUT_OF_RESOURCES`.

Detailed Description

This operation attaches a `TopicListener` to the `Topic`. Only one `TopicListener` can be attached to each `Topic`. If a `TopicListener` was already attached, the operation will replace it with the new one. When `a_listener` is the `NULL` pointer, it represents a listener that is treated as a NOOP[1] for all statuses activated in the bit mask.

Communication Status

For each communication status, the `StatusChangedFlag` flag is initially set to `FALSE`. It becomes `TRUE` whenever that plain communication status changes. For each plain communication status activated in the `mask`, the associated `TopicListener` operation is invoked and the communication status is reset to `FALSE`, as the listener implicitly accesses the status which is passed as a parameter to that operation. The status is reset prior to calling the listener, so if the application calls the `get_<status_name>` from inside the listener it will see the status already reset. An exception to this rule is the `NULL` listener, which does not reset the communication statuses for which it is invoked.

The following statuses are applicable to the `TopicListener`:

- `INCONSISTENT_TOPIC_STATUS`.

Status bits are declared as a constant and can be used by the application in an OR operation to create a tailored mask. The special constant `STATUS_MASK_NONE` can be used to indicate that the created entity should not respond to any of its available statuses. The DDS will therefore attempt to propagate these statuses to its factory.

1. Short for **No-Op**eration, an instruction that does nothing.

The special constant STATUS_MASK_ANY_V1_2 can be used to select all statuses specified in the "Data Distribution Service for Real-time Systems Version 1.2" specification which are applicable to the PublisherListener.

Status Propagation

In case a communication status is not activated in the mask of the TopicListener, the DomainParticipantListener of the containing DomainParticipant is invoked (if attached and activated for the status that occurred). This allows the application to set a default behaviour in the DomainParticipantListener of the containing DomainParticipant and a Topic specific behaviour when needed. In case the DomainParticipantListener is also not attached or the communication status is not activated in its mask, the application is not notified of the change.

Return Code

When the operation returns:

- *RETCODE_OK* - the TopicListener is attached
- *RETCODE_ERROR* - an internal error has occurred
- *RETCODE_ALREADY_DELETED* - the Topic has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.3.2.13 set_qos

Scope

DDS::Topic

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   set_qos
      (const TopicQos& qos);
```

Description

This operation replaces the existing set of QosPolicy settings for a Topic.

Parameters

in const TopicQos& qos - the new set of QosPolicy settings for the Topic.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_UNSUPPORTED, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES, RETCODE_IMMUTABLE_POLICY or RETCODE_INCONSISTENT_POLICY.

Detailed Description

This operation replaces the existing set of QosPolicy settings for a Topic. The parameter qos contains the struct with the QosPolicy settings which is checked for self-consistency and mutability. When the application tries to change a QosPolicy setting for an enabled Topic, which can only be set before the Topic is enabled, the operation will fail and a RETCODE_IMMUTABLE_POLICY is returned. In other words, the application must provide the currently set QosPolicy settings in case of the immutable QosPolicy settings. Only the mutable QosPolicy settings can be changed. When qos contains conflicting QosPolicy settings (not self-consistent), the operation will fail and a RETCODE_INCONSISTENT_POLICY is returned.

The set of QosPolicy settings specified by the qos parameter are applied on top of the existing QoS, replacing the values of any policies previously set (provided, the operation returned RETCODE_OK).

Return Code

When the operation returns:

- *RETCODE_OK* - the new TopicQos is set
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - the parameter qos is not a valid TopicQos. It contains a QosPolicy setting with an invalid Duration_t value or an enum value that is outside its legal boundaries.
- *RETCODE_UNSUPPORTED* - one or more of the selected QosPolicy values are currently not supported by OpenSplice.
- *RETCODE_ALREADY_DELETED* - the Topic has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_IMMUTABLE_POLICY* - the parameter qos contains an immutable QosPolicy setting with a different value than set during enabling of the Topic
- *RETCODE_INCONSISTENT_POLICY* - the parameter qos contains conflicting QosPolicy settings, e.g. a history depth that is higher than the specified resource limits.

3.3.3 Class ContentFilteredTopic

`ContentFilteredTopic` is a specialization of `TopicDescription` that allows for content based subscriptions.

`ContentFilteredTopic` describes a more sophisticated subscription that indicates the `Subscriber` does not necessarily want to see all values of each instance published under the `Topic`. Rather, it only wants to see the values whose contents satisfy certain criteria. Therefore this class must be used to request content-based subscriptions.

The selection of the content is done using the SQL based filter with parameters to adapt the filter clause.

The interface description of this class is as follows:

```
class ContentFilteredTopic
{
//
// inherited from class TopicDescription
//
// char*
//     get_type_name
//         (void);

// char*
//     get_name
//         (void);

// DomainParticipant_ptr
//     get_participant
//         (void);
//
// implemented API operations
//
    char*
       get_filter_expression
           (void);

    ReturnCode_t
       get_expression_parameters
           (StringSeq& expression_parameters);


    ReturnCode_t
       set_expression_parameters
           (const StringSeq& expression_parameters);
    Topic_ptr
       get_related_topic
           (void);
};
```

The next paragraphs describe the usage of all `ContentFilteredTopic` operations.

3.3.3.1 get_expression_parameters

Scope

`DDS::ContentFilteredTopic`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_expression_parameters
      (StringSeq& expression_parameters);
```

Description

This operation obtains the expression parameters associated with the `ContentFilteredTopic`.

Parameters

`inout StringSeq& expression_parameters` - a reference to a sequence of strings that will be used to store the parameters used in the SQL expression.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_ALREADY_DELETED` or `RETCODE_OUT_OF_RESOURCES`.

Detailed Description

This operation obtains the expression parameters associated with the `ContentFilteredTopic`. That is, the parameters specified on the last successful call to `set_expression_parameters`, or if `set_expression_parameters` was never called, the parameters specified when the `ContentFilteredTopic` was created.

The resulting reference holds a sequence of strings with the parameters used in the SQL expression (i.e., the %n tokens in the expression). The number of parameters in the result sequence will exactly match the number of %n tokens in the filter expression associated with the `ContentFilteredTopic`.

Return Code

When the operation returns:

- *RETCODE_OK* - the existing set of expression parameters applied to this ContentFilteredTopic has successfully been copied into the specified expression_parameters parameter.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the ContentFilteredTopic has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.3.3.2 get_filter_expression

Scope

DDS::ContentFilteredTopic

Synopsis

```
#include <ccpp_dds_dcps.h>
char*
   get_filter_expression
      (void);
```

Description

This operation returns the filter_expression associated with the ContentFilteredTopic.

Parameters

<none>

Return Value

*char** - a handle to a string which holds the SQL filter expression.

Detailed Description

This operation returns the filter_expression associated with the ContentFilteredTopic. That is, the expression specified when the ContentFilteredTopic was created.

The filter expression result is a string that specifies the criteria to select the data samples of interest. It is similar to the WHERE clause of an SQL expression.

3.3.3.3 get_name (inherited)

This operation is inherited and therefore not described here. See the class TopicDescription for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
char*
   get_name
      (void);
```

3.3.3.4 get_participant (inherited)

This operation is inherited and therefore not described here. See the class `TopicDescription` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
DomainParticipant_ptr
   get_participant
      (void);
```

3.3.3.5 get_related_topic

Scope

```
DDS::ContentFilteredTopic
```

Synopsis

```
#include <ccpp_dds_dcps.h>
Topic_ptr
   get_related_topic
      (void);
```

Description

This operation returns the `Topic` associated with the `ContentFilteredTopic`.

Parameters

<none>

Return Value

`Topic_ptr` - a pointer to the base topic on which the filtering will be applied.

Detailed Description

This operation returns the `Topic` associated with the `ContentFilteredTopic`. That is, the `Topic` specified when the `ContentFilteredTopic` was created. This `Topic` is the base topic on which the filtering will be applied.

3.3.3.6 get_type_name (inherited)

This operation is inherited and therefore not described here. See the class `TopicDescription` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
char*
   get_type_name
      (void);
```

3.3.3.7 set_expression_parameters

Scope

`DDS::ContentFilteredTopic`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   set_expression_parameters
      (const StringSeq& expression_parameters);
```

Description

This operation changes the expression parameters associated with the `ContentFilteredTopic`.

Parameters

`in const StringSeq& expression_parameters` - a reference to a sequence of strings with the parameters used in the SQL expression (i.e., the number of %n tokens in the expression). The number of values in `expression_parameters` must be equal or greater than the highest referenced %n token in the `subscription_expression`.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_BAD_PARAMETER`, `RETCODE_ALREADY_DELETED` or `RETCODE_OUT_OF_RESOURCES`.

Detailed Description

This operation changes the expression parameters associated with the `ContentFilteredTopic`. The parameter `expression_parameters` is a handle to a sequence of strings with the parameters used in the SQL expression. The number of values in `expression_parameters` must be equal or greater than the highest referenced %n token in the `filter_expression` (for example, if `%1` and

`%8` are used as parameter in the `filter_expression`, the `expression_parameters` should at least contain `n+1 = 9` values). This is the filter expression specified when the `ContentFilteredTopic` was created.

Return Code

When the operation returns:

- *RETCODE_OK* - the new expression parameters are set
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - the number of parameters in `expression_parameters` does not match the number of "%n" tokens in the expression for this `ContentFilteredTopic` or one of the parameters is an illegal parameter
- *RETCODE_ALREADY_DELETED* - the `ContentFilteredTopic` has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.3.4 Class MultiTopic

`MultiTopic` is a specialization of `TopicDescription` that allows subscriptions to combine, filter and/or rearrange data coming from several `Topics`.

`MultiTopic` allows a more sophisticated subscription that can select and combine data received from multiple `Topics` into a single data type (specified by the inherited `type_name`). The data will then be filtered (selection) and possibly re-arranged (aggregation and/or projection) according to an SQL expression with parameters to adapt the filter clause.

The interface description of this class is as follows:

```
class MultiTopic
{
//
// inherited from class TopicDescription
//
// char*
//    get_type_name
//       (void);

// char*
//    get_name
//       (void);

// DomainParticipant_ptr
//    get_participant
//       (void);
```

```
    //
    // implemented API operations
    //
        char*
            get_subscription_expression
               (void);

        ReturnCode_t
            get_expression_parameters
               (StringSeq& expression_parameters);

        ReturnCode_t
            set_expression_parameters
               (const StringSeq& expression_parameters);
    };
```

The next paragraphs describe the usage of all `MultiTopic` operations. The inherited operations are listed but not fully described because they are not implemented in this class. The full description of these operations is given in the classes from which they are inherited.

NOTE: `MultiTopic` operations have not been yet been implemented. Multitopic functionality is scheduled for a future release.

3.3.4.1 get_expression_parameters

Scope

`DDS::MultiTopic`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_expression_parameters
      (StringSeq& expression_parameters);
```

NOTE: This operation is not yet implemented. It is scheduled for a future release.

Description

This operation returns the expression parameters associated with the `MultiTopic`.

Parameters

`inout StringSeq& expression_parameters` - a reference to a sequence of strings that will be used to store the parameters used in the SQL expression.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ALREADY_DELETED or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation obtains the expression parameters associated with the MultiTopic. That is, the parameters specified on the last successful call to set_expression_parameters, or if set_expression_parameters was never called, the parameters specified when the MultiTopic was created.

The resulting reference holds a sequence of strings with the values of the parameters used in the SQL expression (i.e., the %n tokens in the expression). The number of parameters in the result sequence will exactly match the number of %n tokens in the filter expression associated with the MultiTopic.

Return Code

When the operation returns:

- *RETCODE_OK* - the existing set of expression parameters applied to this MultiTopic has successfully been copied into the specified expression_parameters parameter.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the MultiTopic has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.3.4.2 get_name (inherited)

This operation is inherited and therefore not described here. See the class TopicDescription for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
char*
   get_name
      (void);
```

NOTE: This operation is not yet implemented. It is scheduled for a future release.

3.3.4.3 get_participant (inherited)

This operation is inherited and therefore not described here. See the class TopicDescription for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
DomainParticipant_ptr
   get_participant
      (void);
```

NOTE: This operation is not yet implemented. It is scheduled for a future release.

3.3.4.4 get_subscription_expression

Scope

`DDS::MultiTopic`

Synopsis

```
#include <ccpp_dds_dcps.h>
char*
   get_subscription_expression
      (void);
```

NOTE: This operation is not yet implemented. It is scheduled for a future release.

Description

This operation returns the subscription expression associated with the `MultiTopic`.

Parameters

`<none>`

Return Value

`char*` - result is a handle to a string which holds the SQL subscription expression.

Detailed Description

This operation returns the subscription expression associated with the `MultiTopic`. That is, the expression specified when the `MultiTopic` was created.

The subscription expression result is a string that specifies the criteria to select the data samples of interest. In other words, it identifies the selection and rearrangement of data from the associated `Topics`. It is an SQL expression where the `SELECT` clause provides the fields to be kept, the `FROM` part provides the names of the `Topics` that are searched for those fields, and the `WHERE` clause gives the content filter. The `Topics` combined may have different types but they are restricted in that the type of the fields used for the `NATURAL JOIN` operation must be the same.

3.3.4.5 get_type_name (inherited)

This operation is inherited and therefore not described here. See the class `TopicDescription` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
char*
   get_type_name
      (void);
```

NOTE: This operation is not yet implemented. It is scheduled for a future release.

3.3.4.6 set_expression_parameters

Scope

`DDS::MultiTopic`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   set_expression_parameters
      (const StringSeq& expression_parameters);
```

NOTE: This operation is not yet implemented. It is scheduled for a future release.

Description

This operation changes the expression parameters associated with the `MultiTopic`.

Parameters

`in const StringSeq& expression_parameters` - the handle to a sequence of strings with the parameters used in the SQL expression.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_BAD_PARAMETER`, `RETCODE_ALREADY_DELETED` or `RETCODE_OUT_OF_RESOURCES`.

Detailed Description

This operation changes the expression parameters associated with the `MultiTopic`. The parameter `expression_parameters` is a handle to a sequence of strings with the parameters used in the SQL expression. The number of parameters in `expression_parameters` must exactly match the number of %n tokens in the subscription expression associated with the `MultiTopic`. This is the subscription expression specified when the `MultiTopic` was created.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the new expression parameters are set

- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - the number of parameters in `expression_parameters` does not match the number of "%n" tokens in the expression for this `MultiTopic` or one of the parameters is an illegal parameter.
- *RETCODE_ALREADY_DELETED* - the `MultiTopic` has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.3.5 TopicListener interface

Since a `Topic` is an `Entity`, it has the ability to have a `Listener` associated with it. In this case, the associated `Listener` should be of type `TopicListener`. This interface must be implemented by the application. A user-defined class must be provided by the application which must extend from the `TopicListener` class. **All** `TopicListener` operations **must** be implemented in the user-defined class, it is up to the application whether an operation is empty or contains some functionality.

All operations for this interface must be implemented in the user-defined class, it is up to the application whether an operation is empty or contains some functionality.

The `TopicListener` provides a generic mechanism (actually a callback function) for the Data Distribution Service to notify the application of relevant asynchronous status change events, such as an inconsistent `Topic`. The `TopicListener` is related to changes in communication status.

The interface description of this class is as follows:

```
class TopicListener
{
//
// abstract external operations
//
   void
      on_inconsistent_topic
         (Topic_ptr the_topic,
         const InconsistentTopicStatus& status) = 0;
//
// implemented API operations
//       <no operations>
//
};
```

The next paragraph describes the usage of the `TopicListener` operation. This abstract operation is fully described since it must be implemented by the application.

3.3.5.1 on_inconsistent_topic (abstract)

Scope

`DDS::TopicListener`

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_inconsistent_topic
      (Topic_ptr the_topic,
        const InconsistentTopicStatus& status) = 0;
```

Description

This operation must be implemented by the application and is called by the Data Distribution Service when the `InconsistentTopicStatus` changes.

Parameters

in `Topic_ptr the_topic` - contain a pointer to the `Topic` on which the conflict occurred (this is an input to the application).

in `const InconsistentTopicStatus& status` - contain the `InconsistentTopicStatus` struct (this is an input to the application).

Return Value

<none>

Detailed Description

This operation is the external operation (interface, which must be implemented by the application) that is called by the Data Distribution Service when the `InconsistentTopicStatus` changes. The implementation may be left empty when this functionality is not needed. This operation will only be called when the relevant `TopicListener` is installed and enabled for the `InconsistentTopicStatus`. The `InconsistentTopicStatus` will change when another `Topic` exists with the same `topic_name` but different characteristics.

The Data Distribution Service will call the `TopicListener` operation with a parameter `the_topic`, which will contain a reference to the `Topic` on which the conflict occurred and a parameter `status`, which will contain the `InconsistentTopicStatus` struct.

3.3.6 ExtTopicListener interface

The `ExtTopicListener` interface is a subtype of `TopicListener` and provides an OpenSplice-specific callback `on_all_disposed_data`.

All operations for this interface must be implemented in the user-defined class, it is up to the application whether an operation is empty or contains some functionality.

The interface description of this class is as follows:

```
class ExtTopicListener : TopicListener
{
//
// abstract external operations
//
   void
      on_all_data_disposed(Topic_ptr the_topic) = 0;
//
// implemented API operations
// <no operations>
//
};
```

3.3.6.1 on_all_data_disposed (abstract)

Scope

`DDS::ExtTopicListener`

Synopsis

```
#include <ccpp_dds_dcps.h>
   void
      on_all_data_disposed(Topic_ptr the_topic) = 0;
```

Description

This operation must be implemented by the application and is called by the Data Distribution Service when the node has completed disposal of data as a result of a call to `DDS::Topic::dispose_all_data()`.

Parameters

`in Topic_ptr the_topic` - contains a pointer to the Topic which has been disposed.

Return Value

`<none>`

Detailed Description

This operation is the external operation (interface, which must be implemented by the application) that is called by the Data Distribution Service when the node has completed disposal of data as a result of a call to `DDS::Topic::dispose_all_data()`.

The implementation may be left empty when this functionality is not needed. This operation will only be called when the relevant `ExtTopicListener` is installed.

Concurrency

The threading behaviour of calls to this method are undefined, so:

- Subsequent disposal via `Topic::dispose_all_data`, and the associated callbacks may be blocked until this method returns.
- This method may be called concurrently by OpenSplice if other `dispose_all_data` operations complete before this method returns.

3.3.7 Topic-Definition Type Specific Classes

This paragraph describes the generic `TypeSupport` class and the derived application type specific `<type>TypeSupport` classes which together implement the application `Topic` interface. For each application type, used as `Topic` data type, the pre-processor generates a `<type>DataReader` class from an IDL type description. The `FooTypeSupport` class that would be generated by the pre-processor for a fictional type `Foo` describes the `<type>TypeSupport` classes.

3.3.7.1 Class TypeSupport (abstract)

The `Topic`, `MultiTopic` or `ContentFilteredTopic` is bound to a data type described by the type name argument. Prior to creating a `Topic`, `MultiTopic` or `ContentFilteredTopic`, the data type must have been registered with the Data Distribution Service. This is done using the data type specific `register_type` operation on a derived class of the `TypeSupport` interface. A derived class is generated for each data type used by the application, by calling the pre-processor.

The interface description of this class is as follows:

```
class TypeSupport
{
//
// abstract operations
//
// ReturnCode_t
//    register_type
//       (Domainparticipant_ptr domain,
//         const char* type_name);
// char*
//    get_type_name
//       (void);
//
// implemented API operations
//       <no operations>
//
};
```

The next paragraph list the TypeSupport operation. This abstract operation is listed but not fully described since it is not implemented in this class. The full description of this operation is given in the FooTypeSupport class (for the data type example Foo), which contains the data type specific implementation of this operation.

3.3.7.2 get_type_name (abstract)

This abstract operation is defined as a generic operation, which is implemented by the <type>TypeSupport class. For further explanation see the description for the fictional data type Foo derived FooTypeSupport class.

Synopsis

```
#include <ccpp_dds_dcps.h>
char*
   get_type_name
      (void);
```

3.3.7.3 register_type (abstract)

This abstract operation is defined as a generic operation, which is implemented by the <type>TypeSupport class. For further explanation see the description for the fictional data type Foo derived FooTypeSupport class.

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   register_type
      (Domainparticipant_ptr domain,
        const char* type_name);
```

3.3.7.4 Class FooTypeSupport

The pre-processor generates from IDL type descriptions the application <type>TypeSupport classes. For each application data type that is used as Topic data type, a typed class <type>TypeSupport is derived from the TypeSupport class. In this paragraph, the class FooTypeSupport describes the operations of these derived <type>TypeSupport classes as an example for the fictional application type Foo (defined in the module SPACE).

For instance, for an application, the definitions are located in the Space.idl file. The pre-processor will generate a ccpp_Space.h include file.

i **General note**: The name ccpp_Space.h is derived from the IDL file Space.idl, that defines SPACE::Foo, for all relevant SPACE::FooDataWriter operations.

The Topic, MultiTopic or ContentFilteredTopic is bound to a data type described by the type_name argument. Prior to creating a Topic, MultiTopic or ContentFilteredTopic, the data type must have been registered with the Data Distribution Service. This is done using the data type specific register_type operation on the <type>TypeSupport class for each data type. A derived class is generated for each data type used by the application, by calling the pre-processor.

The interface description of this class is as follows:

```
class FooTypeSupport
{
//
// implemented API operations
//
    ReturnCode_t
       register_type
          (DomainParticipant_ptr domain,
            const char* type_name);
    char*
       get_type_name
          (void);
};
```

The next paragraph describes the usage of the FooTypeSupport operation.

3.3.7.5 get_type_name

Scope

SPACE::FooTypeSupport

Synopsis

```
#include <ccpp_Space.h>
char*
   get_type_name
      (void);
```

Description

This operation returns the default name of the data type associated with the FooTypeSupport.

Parameters

<none>

Return Value

*char** - the name of the data type of the FooTypeSupport.

Detailed Description

This operation returns the default name of the data type associated with the `FooTypeSupport`. The default name is derived from the type name as specified in the IDL definition. It is composed of the scope names and the type name, each separated by "`::`", in order of lower scope level to deeper scope level followed by the type name.

3.3.7.6 register_type

Scope

`SPACE::FooTypeSupport`

Synopsis

```
#include <ccpp_Space.h>
ReturnCode_t
   register_type
      (DomainParticipant_ptr domain,
        const char* type_name);
```

Description

This operation registers a new data type name to a `DomainParticipant`.

Parameters

`in DomainParticipant_ptr domain` - a pointer to a `DomainParticipant` object to which the new data type is registered.

`in const char* type_name` - a local alias of the new data type to be registered.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_BAD_PARAMETER`, `RETCODE_OUT_OF_RESOURCES` or `RETCODE_PRECONDITION_NOT_MET`.

Detailed Description

This operation registers a new data type name to a `DomainParticipant`. This operation informs the Data Distribution Service, in order to allow it to manage the new registered data type. This operation also informs the Data Distribution Service about the key definition, which allows the Data Distribution Service to distinguish different instances of the same data type.

Precondition

A `type_name` cannot be registered with two different `<type>TypeSupport` classes (that is, of a different data type) with the same `DomainParticipant`. When the operation is called on the same `DomainParticipant` with the same `type_name` for a different `<type>TypeSupport` class, the operation returns `RETCODE_PRECONDITION_NOT_MET`. However, it is possible to register the same `<type>TypeSupport` classes with the same `DomainParticipant` and the same or different `type_name` multiple times. All registrations return `RETCODE_OK`, but any subsequent registrations with the same `type_name` are ignored.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the `FooTypeSupport` class is registered with the new data type name to the `DomainParticipant` or the `FooTypeSupport` class was already registered
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_BAD_PARAMETER`* - one or both of the parameters is invalid, the `domain` parameter is a `NULL` pointer, or the parameter `type_name` has zero length.
- *`RETCODE_OUT_OF_RESOURCES`* - the Data Distribution Service ran out of resources to complete this operation.
- *`RETCODE_PRECONDITION_NOT_MET`* - this `type_name` is already registered with this `DomainParticipant` for a different `<type>TypeSupport` class.

3.4 Publication Module

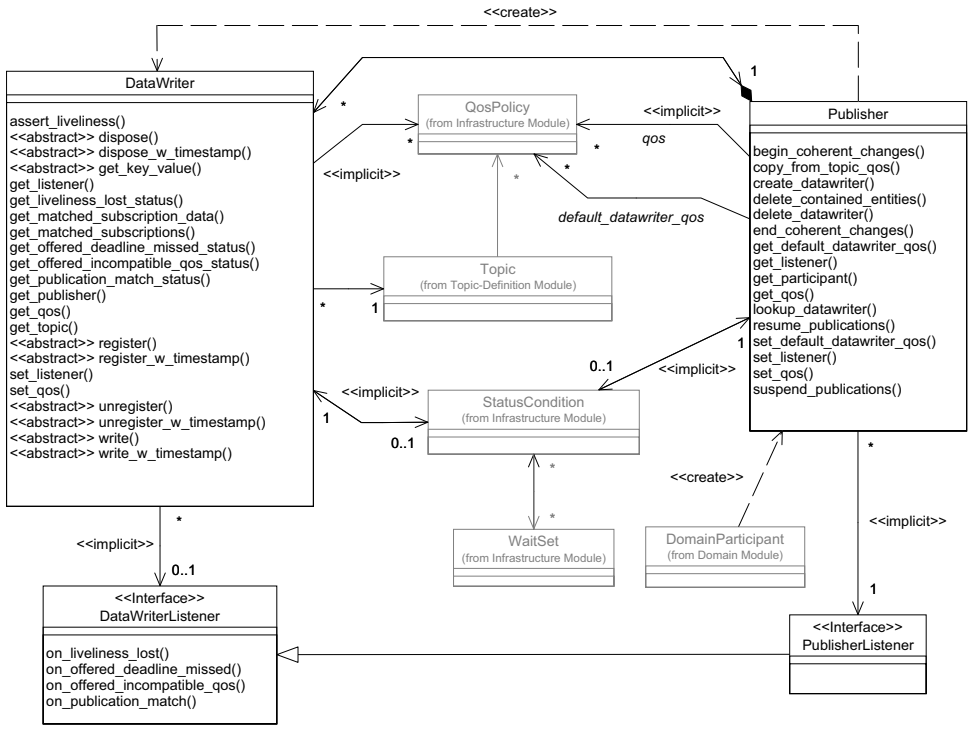

Figure 18 DCPS Publication Module's Class Model

This module contains the following classes:

- `Publisher`
- Publication type specific classes
- `PublisherListener` (interface)
- `DataWriterListener` (interface).

The paragraph "Publication type specific classes" contains the generic class and the generated data type specific classes. For each data type, a data type specific class `<type>DataWriter` is generated (based on IDL) by calling the pre-processor.

For instance, for the fictional data type `Foo` (this also applies to other types) "Publication type specific classes" contains the following classes:

- `DataWriter` (abstract)
- `FooDataWriter`.

A Publisher is an object responsible for data distribution. It may publish data of different data types. A DataWriter acts as a typed accessor to a Publisher. The DataWriter is the object the application must use to communicate the existence and value of data-objects of a given data type to a Publisher. When data-object values have been communicated to the Publisher through the appropriate DataWriter, it is the Publisher's responsibility to perform the distribution. The Publisher will do this according to its own PublisherQos, and the DataWriterQos attached to the corresponding DataWriter. A publication is defined by the association of a DataWriter to a Publisher. This association expresses the intent of the application to publish the data described by the DataWriter in the context provided by the Publisher.

3.4.1 Class Publisher

The Publisher acts on behalf of one or more DataWriter objects that belong to it. When it is informed of a change to the data associated with one of its DataWriter objects, it decides when it is appropriate to actually process the sample-update message. In making this decision, it considers the PublisherQos and the DataWriterQos.

The interface description of this class is as follows:

```
class Publisher
{
//
// inherited from class Entity
//
// StatusCondition_ptr
//    get_statuscondition
//       (void);
// StatusMask
//    get_status_changes
//       (void);
// ReturnCode_t
//    enable
//       (void);
//
// implemented API operations
//
   DataWriter_ptr
      create_datawriter
         (Topic_ptr a_topic,
         const DataWriterQos& qos,
         DataWriterListener_ptr a_listener,
         StatusMask mask);

   ReturnCode_t
      delete_datawriter
```

```
      (DataWriter_ptr a_datawriter);

DataWriter_ptr
   lookup_datawriter
      (const char* topic_name);
ReturnCode_t
   delete_contained_entities
      (void);

ReturnCode_t
   set_qos
      (const PublisherQos& qos);
ReturnCode_t
   get_qos
      (PublisherQos& qos);
ReturnCode_t
   set_listener
      (PublisherListener_ptr a_listener,
        StatusMask mask);
PublisherListener_ptr
   get_listener
      (void);
ReturnCode_t
   suspend_publications
      (void);

ReturnCode_t
   resume_publications
      (void);

ReturnCode_t
   begin_coherent_changes
      (void);

ReturnCode_t
   end_coherent_changes
      (void);

ReturnCode_t
   wait_for_acknowledgments
      (const Duration_t& max_wait);

DomainParticipant_ptr
   get_participant
      (void);

ReturnCode_t
   set_default_datawriter_qos
      (const DataWriterQos& qos);
```

```
        ReturnCode_t
           get_default_datawriter_qos
              (DataWriterQos& qos);

        ReturnCode_t
           copy_from_topic_qos
              (DataWriterQos& a_datawriter_qos,
              const TopicQos& a_topic_qos);
    };
```

The next paragraphs describe the usage of all `Publisher` operations. The inherited operations are listed but not fully described because they are not implemented in this class. The full description of these operations is given in the classes from which they are inherited.

3.4.1.1 begin_coherent_changes

Scope

`DDS::Publisher`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   begin_coherent_changes
      (void);
```

Description

This operation requests that the application will begin a 'coherent set' of modifications using `DataWriter` objects attached to this `Publisher`. The 'coherent set' will be completed by a matching call to `end_coherent_changes`.

Parameters

<none>

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_ALREADY_DELETED` or `RETCODE_PRECONDITION_NOT_MET`.

Detailed Description

This operation requests that the application will begin a 'coherent set' of modifications using `DataWriter` objects attached to this `Publisher`. The 'coherent set' will be completed by a matching call to `end_coherent_changes`.

A 'coherent set' is a set of modifications that must be propagated in such a way that they are interpreted at the receivers' side as a consistent set of modifications; that is, the receiver will only be able to access the data after all the modifications in the set are available at the receiver end.

A precondition for making coherent changes is that the `PresentationQos` of the `Publisher` has its `coherent_access` attribute set to `TRUE`. If this is not the case, the Publisher will not accept any coherent start requests and return `RETCODE_PRECONDITION_NOT_MET`.

A connectivity change may occur in the middle of a set of coherent changes; for example, the set of partitions used by the `Publisher` or one of its connected `Subscribers` may change, a late-joining `DataReader` may appear on the network, or a communication failure may occur. In the event that such a change prevents an entity from receiving the entire set of coherent changes, that entity must behave as if it had received none of the set.

These calls can be nested. In that case, the coherent set terminates only with the last call to `end_coherent_changes`.

The support for 'coherent changes' enables a publishing application to change the value of several data-instances that could belong to the same or different topics and have those changes be seen 'atomically' by the readers. This is useful in cases where the values are inter-related (for example, if there are two data-instances representing the 'altitude' and 'velocity vector' of the same aircraft and both are changed, it may be useful to communicate those values in a way the reader can see both together; otherwise, it may e.g., erroneously interpret that the aircraft is on a collision course).

Return Code

When the operation returns:

- *`RETCODE_OK`* - a new coherent change has successfully been started.
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_ALREADY_DELETED`* - the `Publisher` has already been deleted.
- *`RETCODE_PRECONDITION_NOT_MET`* - the `Publisher` is not able to handle coherent changes because its `PresentationQos` has not set `coherent_access` to `TRUE`.

3.4.1.2 copy_from_topic_qos

Scope

`DDS::Publisher`

Synopsis

```
#include <ccpp_dds_dcps.h>
```

```
ReturnCode_t
   copy_from_topic_qos
      (DataWriterQos& a_datawriter_qos,
        const TopicQos& a_topic_qos);
```

Description

This operation will copy policies in `a_topic_qos` to the corresponding policies in `a_datawriter_qos`.

Parameters

`inout DataWriterQos& a_datawriter_qos` - the destination `DataWriterQos` struct to which the `QosPolicy` settings should be copied.

`in const TopicQos& a_topic_qos` - the source `TopicQos` struct, which should be copied.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_ALREADY_DELETED` or `RETCODE_OUT_OF_RESOURCES`.

Detailed Description

This operation will copy the `QosPolicy` settings in `a_topic_qos` to the corresponding `QosPolicy` settings in `a_datawriter_qos` (replacing the values in `a_datawriter_qos`, if present). This will only apply to the common `QosPolicy` settings in each `<Entity>Qos`.

This is a "convenience" operation, useful in combination with the operations `get_default_datawriter_qos` and `Topic::get_qos`. The operation `copy_from_topic_qos` can be used to merge the `DataWriter` default `QosPolicy` settings with the corresponding ones on the `TopicQos`. The resulting `DataWriterQos` can then be used to create a new `DataWriter`, or set its `DataWriterQos`.

This operation does not check the resulting `a_datawriter_qos` for consistency. This is because the "merged" `a_datawriter_qos` may not be the final one, as the application can still modify some `QosPolicy` settings prior to applying the `DataWriterQos` to the `DataWriter`.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the `QosPolicy` settings are copied from the `Topic` to the `DataWriter`
- *`RETCODE_ERROR`* - an internal error has occurred.

- *RETCODE_ALREADY_DELETED* - the Publisher has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.4.1.3 create_datawriter

Scope

DDS::Publisher

Synopsis

```
#include <ccpp_dds_dcps.h>
DataWriter_ptr
   create_datawriter
      (Topic_ptr a_topic,
        const DataWriterQos& qos,
        DataWriterListener_ptr a_listener,
        StatusMask mask);
```

Description

This operation creates a DataWriter with the desired DataWriterQos, for the desired Topic and attaches the optionally specified DataWriterListener to it.

Parameters

in Topic_ptr a_topic - a pointer to the topic for which the DataWriter is created.

in const DataWriterQos& qos - the DataWriterQos for the new DataWriter. In case these settings are not self consistent, no DataWriter is created.

in DataWriterListener_ptr a_listener - a pointer to the DataWriterListener instance which will be attached to the new DataWriter. It is permitted to use NULL as the value of the listener: this behaves as a DataWriterListener whose operations perform no action.

Return Value

DataWriter_ptr - Return value is a pointer to the newly created DataWriter. In case of an error, the NULL pointer is returned.

Detailed Description

This operation creates a DataWriter with the desired DataWriterQos, for the desired Topic and attaches the optionally specified DataWriterListener to it. The returned DataWriter is attached (and belongs) to the Publisher on which this operation is being called. To delete the DataWriter the operation

delete_datawriter or delete_contained_entities must be used. If no write rights are defined for the specific topic then the creation of the DataWriter will fail.

Application Data Type

The DataWriter returned by this operation is an object of a derived class, specific to the data type associated with the Topic. For each application-defined data type <type> there is a class <type>DataWriter generated by calling the pre-processor. This data type specific class extends DataWriter and contains the operations to write data of data type <type>.

QosPolicy

The possible application pattern to construct the DataWriterQos for the DataWriter is to:

- Retrieve the QosPolicy settings on the associated Topic by means of the get_qos operation on the Topic
- Retrieve the default DataWriterQos by means of the get_default_datawriter_qos operation on the Publisher
- Combine those two lists of QosPolicy settings and selectively modify QosPolicy settings as desired
- Use the resulting DataWriterQos to construct the DataWriter.

In case the specified QosPolicy settings are not consistent, no DataWriter is created and the NULL pointer is returned.

Default QoS

The constant DATAWRITER_QOS_DEFAULT can be used as parameter qos to create a DataWriter with the default DataWriterQos as set in the Publisher. The effect of using DATAWRITER_QOS_DEFAULT is the same as calling the operation get_default_datawriter_qos and using the resulting DataWriterQos to create the DataWriter.

The special DATAWRITER_QOS_USE_TOPIC_QOS can be used to create a DataWriter with a combination of the default DataWriterQos and the TopicQos. The effect of using DATAWRITER_QOS_USE_TOPIC_QOS is the same as calling the operation get_default_datawriter_qos and retrieving the TopicQos (by means of the operation Topic::get_qos) and then combining these two QosPolicy settings using the operation copy_from_topic_qos, whereby any common policy that is set on the TopicQos "overrides" the corresponding policy on the default DataWriterQos. The resulting DataWriterQos is then applied to create the DataWriter.

Communication Status

For each communication status, the `StatusChangedFlag` flag is initially set to `FALSE`. It becomes `TRUE` whenever that communication status changes. For each communication status activated in the `mask`, the associated `DataWriterListener` operation is invoked and the communication status is reset to `FALSE`, as the listener implicitly accesses the status which is passed as a parameter to that operation. The fact that the status is reset prior to calling the listener means that if the application calls the `get_<status_name>_status` from inside the listener it will see the status already reset.

The following statuses are applicable to the `DataWriterListener`:

- `OFFERED_DEADLINE_MISSED_STATUS`
- `OFFERED_INCOMPATIBLE_QOS_STATUS`
- `LIVELINESS_LOST_STATUS`
- `PUBLICATION_MATCHED_STATUS`.

Be aware that the `PUBLICATION_MATCHED_STATUS` is not applicable when the infrastructure does not have the information available to determine connectivity. This is the case when OpenSplice is configured not to maintain discovery information in the Networking Service. (See the description for the `NetworkingService/Discovery/enabled` property in the Deployment Manual for more information about this subject.) In this case the operation will return `NULL`.

Status bits are declared as a constant and can be used by the application in an OR operation to create a tailored mask. The special constant `STATUS_MASK_NONE` can be used to indicate that the created entity should not respond to any of its available statuses. The DDS will therefore attempt to propagate these statuses to its factory. The special constant `STATUS_MASK_ANY_V1_2` can be used to select all applicable statuses specified in the “Data Distribution Service for Real-time Systems Version 1.2” specification which are applicable to the `PublisherListener`.

Status Propagation

In case a communication status is not activated in the `mask` of the `DataWriterListener`, the `PublisherListener` of the containing `Publisher` is invoked (if attached and activated for the status that occurred). This allows the application to set a default behaviour in the `PublisherListener` of the containing `Publisher` and a `DataWriter` specific behaviour when needed. In case the communication status is not activated in the `mask` of the `PublisherListener` as well, the communication status will be propagated to the `DomainParticipantListener` of the containing `DomainParticipant`. In case the `DomainParticipantListener` is also not attached or the communication status is not activated in its `mask`, the application is not notified of the change.

3.4.1.4 delete_contained_entities

Scope

`DDS::Publisher`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   delete_contained_entities
      (void);
```

Description

This operation deletes all the `DataWriter` objects that were created by means of one of the `create_datawriter` operations on the `Publisher`.

Parameters

<none>

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_ALREADY_DELETED`, `RETCODE_OUT_OF_RESOURCES` or `RETCODE_PRECONDITION_NOT_MET`.

Detailed Description

This operation deletes all the `DataWriter` objects that were created by means of one of the `create_datawriter` operations on the `Publisher`. In other words, it deletes all contained `DataWriter` objects.

NOTE: The operation will return `PRECONDITION_NOT_MET` if the any of the contained entities is in a state where it cannot be deleted. In such cases, the operation does not roll back any entity deletions performed prior to the detection of the problem.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the contained `Entity` objects are deleted and the application may delete the `Publisher`
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_ALREADY_DELETED`* - the `Publisher` has already been deleted.
- *`RETCODE_OUT_OF_RESOURCES`* - the Data Distribution Service ran out of resources to complete this operation.

- *RETCODE_PRECONDITION_NOT_MET* - one or more of the contained entities are in a state where they cannot be deleted.

3.4.1.5 delete_datawriter

Scope

`DDS::Publisher`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   delete_datawriter
      (DataWriter_ptr a_datawriter);
```

Description

This operation deletes a `DataWriter` that belongs to the `Publisher`.

Parameters

in DataWriter_ptr a_datawriter - a pointer to the `DataWriter`, which is to be deleted.

Return Value

ReturnCode_t - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_BAD_PARAMETER`, `RETCODE_ALREADY_DELETED`, `RETCODE_OUT_OF_RESOURCES` or `RETCODE_PRECONDITION_NOT_MET`.

Detailed Description

This operation deletes a `DataWriter` that belongs to the `Publisher`. When the operation is called on a different `Publisher`, as used when the `DataWriter` was created, the operation has no effect and returns `RETCODE_PRECONDITION_NOT_MET`. The deletion of the `DataWriter` will automatically unregister all instances. Depending on the settings of `WriterDataLifecycleQosPolicy`, the deletion of the `DataWriter` may also dispose of all instances.

Return Code

When the operation returns:

- *RETCODE_OK* - the `DataWriter` is deleted
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - the parameter `a_datawriter` is not a valid `DataWriter_ptr`

- *RETCODE_ALREADY_DELETED* - the `Publisher` has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_PRECONDITION_NOT_MET* - the operation is called on a different `Publisher`, as used when the `DataWriter` was created.

3.4.1.6 enable (inherited)

This operation is inherited and therefore not described here. See the class `Entity` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   enable
      (void);
```

3.4.1.7 end_coherent_changes

Scope

`DDS::Publisher`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   end_coherent_changes
      (void);
```

Description

This operation terminates the 'coherent set' initiated by the matching call to `begin_coherent_changes`.

Parameters

<none>

Return Value

ReturnCode_t - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_ALREADY_DELETED` or `RETCODE_PRECONDITION_NOT_MET`.

Detailed Description

This operation terminates the 'coherent set' initiated by the matching call to `begin_coherent_changes`. If there is no matching call to `begin_coherent_changes`, the operation will return the error `PRECONDITION_NOT_MET`.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the coherent change has successfully been closed.
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_ALREADY_DELETED`* - the `Publisher` has already been deleted.
- *`RETCODE_PRECONDITION_NOT_MET`* - there is no matching `begin_coherent_changes` call that can be closed.

3.4.1.8 get_default_datawriter_qos

Scope

`DDS::Publisher`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_default_datawriter_qos
      (DataWriterQos& qos);
```

Description

This operation gets the default `DataWriterQos` of the `Publisher`.

Parameters

`inout DataWriterQos& qos` - a reference to the `DataWriterQos` struct (provided by the application) in which the default `DataWriterQos` for the `DataWriter` is written.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_ALREADY_DELETED` or `RETCODE_OUT_OF_RESOURCES`.

Detailed Description

This operation gets the default DataWriterQos of the Publisher (that is the struct with the QosPolicy settings) which is used for newly created DataWriter objects, in case the constant DATAWRITER_QOS_DEFAULT is used. The default DataWriterQos is only used when the constant is supplied as parameter qos to specify the DataWriterQos in the create_datawriter operation. The application must provide the DataWriterQos struct in which the QosPolicy settings can be stored and pass the qos reference to the operation. The operation writes the default DataWriterQos to the struct referenced to by qos. Any settings in the struct are overwritten.

The values retrieved by this operation match the set of values specified on the last successful call to set_default_datawriter_qos, or, if the call was never made, the default values as specified for each QosPolicy setting as defined in Table 2 on page 38.

Return Code

When the operation returns:

- *RETCODE_OK* - the default DataWriter QosPolicy settings of this Publisher have successfully been copied into the specified DataWriterQos parameter.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the Publisher has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.4.1.9 get_listener

Scope

DDS::Publisher

Synopsis

```
#include <ccpp_dds_dcps.h>
PublisherListener_ptr
   get_listener
      (void);
```

Description

This operation allows access to a PublisherListener.

Parameters

<none>

Return Value

PublisherListener_ptr - result is a pointer to the PublisherListener attached to the Publisher.

Detailed Description

This operation allows access to a PublisherListener attached to the Publisher. When no PublisherListener was attached to the Publisher, the NULL pointer is returned.

3.4.1.10 get_participant

Scope

DDS::Publisher

Synopsis

```
#include <ccpp_dds_dcps.h>
DomainParticipant_ptr
   get_participant
      (void);
```

Description

This operation returns the DomainParticipant associated with the Publisher or the NULL pointer.

Parameters

<none>

Return Value

DomainParticipant_ptr - a pointer to the DomainParticipant associated with the Publisher or the NULL pointer.

Detailed Description

This operation returns the DomainParticipant associated with the Publisher. Note that there is exactly one DomainParticipant associated with each Publisher. When the Publisher was already deleted (there is no associated DomainParticipant any more), the NULL pointer is returned.

3.4.1.11 get_qos

Scope

DDS::Publisher

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_qos
      (PublisherQos& qos);
```

Description

This operation allows access to the existing set of QoS policies for a `Publisher`.

Parameters

`inout PublisherQos& qos` - a reference to the destination `PublisherQos` struct in which the `QosPolicy` settings will be copied.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_ALREADY_DELETED` or `RETCODE_OUT_OF_RESOURCES`.

Detailed Description

This operation allows access to the existing set of QoS policies of a `Publisher` on which this operation is used. This `PublisherQos` is stored at the location pointed to by the `qos` parameter.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the existing set of QoS policy values applied to this `Publisher` has successfully been copied into the specified `PublisherQos` parameter.
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_ALREADY_DELETED`* - the `Publisher` has already been deleted.
- *`RETCODE_OUT_OF_RESOURCES`* - the Data Distribution Service ran out of resources to complete this operation.

3.4.1.12 get_status_changes (inherited)

This operation is inherited and therefore not described here. See the class `Entity` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
StatusMask
   get_status_changes
      (void);
```

3.4.1.13 get_statuscondition (inherited)

This operation is inherited and therefore not described here. See the class `Entity` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
StatusCondition_ptr
   get_statuscondition
      (void);
```

3.4.1.14 lookup_datawriter

Scope

`DDS::Publisher`

Synopsis

```
#include <ccpp_dds_dcps.h>
DataWriter_ptr
   lookup_datawriter
      (const char* topic_name);
```

Description

This operation returns a previously created `DataWriter` belonging to the `Publisher` which is attached to a `Topic` with the matching `topic_name`.

Parameters

`in const char* topic_name` - the name of the `Topic`, which is attached to the `DataWriter` to look for.

Return Value

`DataWriter_ptr` - Return value is a pointer to the `DataWriter` found. When no such `DataWriter` is found, the `NULL` pointer is returned.

Detailed Description

This operation returns a previously created `DataWriter` belonging to the `Publisher` which is attached to a `Topic` with the matching `topic_name`. When multiple `DataWriter` objects (which satisfy the same condition) exist, this operation will return one of them. It is not specified which one.

3.4.1.15 resume_publications

Scope

`DDS::Publisher`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   resume_publications
      (void);
```

Description

This operation resumes a previously suspended publication.

Parameters

<none>

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES, RETCODE_NOT_ENABLED or RETCODE_PRECONDITION_NOT_MET

Detailed Description

If the Publisher is suspended, this operation will resume the publication of all DataWriter objects contained by this Publisher. All data held in the history buffer of the DataWriter's is actively published to the consumers. When the operation returns all DataWriter's have resumed the publication of suspended updates.

Return Code

When the operation returns:

- *RETCODE_OK* - the Publisher has been suspended
- *RETCODE_ERROR* - an internal error has occurred
- *RETCODE_ALREADY_DELETED* - the Publisher has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_NOT_ENABLED* - the Publisher is not enabled.
- *RETCODE_PRECONDITION_NOT_MET* - the Publisher is not suspended

3.4.1.16 set_default_datawriter_qos

Scope

DDS::Publisher

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   set_default_datawriter_qos
      (const DataWriterQos& qos);
```

Description

This operation sets the default `DataWriterQos` of the `Publisher`.

Parameters

`in const DataWriterQos& qos` - the `DataWriterQos` struct, which contains the new default `DataWriterQos` for the newly created `DataWriters`.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_BAD_PARAMETER`, `RETCODE_UNSUPPORTED`, `RETCODE_ALREADY_DELETED`, `RETCODE_OUT_OF_RESOURCES` or `RETCODE_INCONSISTENT_POLICY`.

Detailed Description

This operation sets the default `DataWriterQos` of the `Publisher` (that is the struct with the `QosPolicy` settings) which is used for newly created `DataWriter` objects, in case the constant `DATAWRITER_QOS_DEFAULT` is used. The default `DataWriterQos` is only used when the constant is supplied as parameter `qos` to specify the `DataWriterQos` in the `create_datawriter` operation. The `set_default_datawriter_qos` operation checks if the `DataWriterQos` is self consistent. If it is not, the operation has no effect and returns `RETCODE_INCONSISTENT_POLICY`.

The values set by this operation are returned by `get_default_datawriter_qos`.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the new default `DataWriterQos` is set
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_BAD_PARAMETER`* - the parameter `qos` is not a valid `DataWriterQos`. It contains a `QosPolicy` setting with an invalid `Duration_t` value or an enum value that is outside its legal boundaries.
- *`RETCODE_ALREADY_DELETED`* - the `Publisher` has already been deleted

- *RETCODE_INCONSISTENT_POLICY* - the parameter qos contains conflicting QosPolicy settings, e.g. a history depth that is higher than the specified resource limits.

3.4.1.17 set_listener

Scope

DDS::Publisher

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   set_listener
      (PublisherListener_ptr a_listener,
        StatusMask mask);
```

Description

This operation attaches a PublisherListener to the Publisher.

Parameters

in PublisherListener_ptr a_listener - a pointer to the PublisherListener instance, which will be attached to the Publisher.

in StatusMask mask - a bit mask in which each bit enables the invocation of the PublisherListener for a certain status.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_UNSUPPORTED, RETCODE_ALREADY_DELETED or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation attaches a PublisherListener to the Publisher. Only one PublisherListener can be attached to each Publisher. If a PublisherListener was already attached, the operation will replace it with the new one. When a_listener is the NULL pointer, it represents a listener that is treated as a NOOP[1] for all statuses activated in the bit mask.

Communication Status

For each communication status, the StatusChangedFlag flag is initially set to FALSE. It becomes TRUE whenever that communication status changes. For each communication status activated in the mask, the associated PublisherListener

1. Short for **No-Op**eration, an instruction that does nothing.

operation is invoked and the communication status is reset to FALSE, as the listener implicitly accesses the status which is passed as a parameter to that operation. The status is reset prior to calling the listener, so if the application calls the get_<status_name>_status from inside the listener it will see the status already reset. An exception to this rule is the NULL listener, which does not reset the communication statuses for which it is invoked.

The following statuses are applicable to the PublisherListener:

- OFFERED_DEADLINE_MISSED_STATUS *(propagated)*
- OFFERED_INCOMPATIBLE_QOS_STATUS *(propagated)*
- LIVELINESS_LOST_STATUS *(propagated)*
- PUBLICATION_MATCHED_STATUS *(propagated)*.

Be aware that the PUBLICATION_MATCHED_STATUS is not applicable when the infrastructure does not have the information available to determine connectivity. This is the case when OpenSplice is configured not to maintain discovery information in the Networking Service. (See the description for the NetworkingService/Discovery/enabled property in the Deployment Manual for more information about this subject.) In this case the operation will return RETCODE_UNSUPPORTED.

Status bits are declared as a constant and can be used by the application in an OR operation to create a tailored mask. The special constant STATUS_MASK_NONE can be used to indicate that the created entity should not respond to any of its available statuses. The DDS will therefore attempt to propagate these statuses to its factory. The special constant STATUS_MASK_ANY_V1_2 can be used to select all applicable statuses specified in the "Data Distribution Service for Real-time Systems Version 1.2" specification which are applicable to the PublisherListener.

Status Propagation

The Data Distribution Service will trigger the most specific and relevant Listener. In other words, in case a communication status is also activated on the DataWriterListener of a contained DataWriter, the DataWriterListener on that contained DataWriter is invoked instead of the PublisherListener. This means, that a status change on a contained DataWriter only invokes the PublisherListener if the contained DataWriter itself does not handle the trigger event generated by the status change.

In case a status is not activated in the mask of the PublisherListener, the DomainParticipantListener of the containing DomainParticipant is invoked (if attached and activated for the status that occurred). This allows the application to set a default behaviour in the DomainParticipantListener of the containing DomainParticipant and a Publisher specific behaviour when

needed. In case the DomainParticipantListener is also not attached or the communication status is not activated in its mask, the application is not notified of the change.

Return Code

When the operation returns:

- *RETCODE_OK* - the PublisherListener is attached
- *RETCODE_ERROR* - an internal error has occurred
- *RETCODE_UNSUPPORTED* - a status was selected that cannot be supported because the infrastructure does not maintain the required connectivity information.
- *RETCODE_ALREADY_DELETED* - the Publisher has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.4.1.18 set_qos

Scope

DDS::Publisher

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   set_qos
      (const PublisherQos& qos);
```

Description

This operation replaces the existing set of QosPolicy settings for a Publisher.

Parameters

in const PublisherQos& qos - the new set of QosPolicy settings for the Publisher.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_UNSUPPORTED, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES, or RETCODE_IMMUTABLE_POLICY or RETCODE_PRECONDITION_NOT_MET.

Detailed Description

This operation replaces the existing set of QosPolicy settings for a Publisher. The parameter qos contains the QosPolicy settings which is checked for self-consistency and mutability. When the application tries to change a QosPolicy setting for an enabled Publisher, which can only be set before the Publisher is enabled, the operation will fail and a RETCODE_IMMUTABLE_POLICY is returned. In other words, the application must provide the currently set QosPolicy settings in case of the immutable QosPolicy settings. Only the mutable QosPolicy settings can be changed. When qos contains conflicting QosPolicy settings (not self-consistent), the operation will fail and a RETCODE_INCONSISTENT_POLICY is returned.

The set of QosPolicy settings specified by the qos parameter are applied on top of the existing QoS, replacing the values of any policies previously set (provided, the operation returned RETCODE_OK). If one or more of the partitions in the QoS structure have insufficient access rights configured then the set_qos function will fail with a RETCODE_PRECONDITION_NOT_MET error code.

Return Code

When the operation returns:

- *RETCODE_OK* - the new PublisherQos is set
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - the parameter qos is not a valid PublisherQos. It contains a QosPolicy setting with an enum value that is outside its legal boundaries.
- RETCODE_UNSUPPORTED - one or more of the selected QosPolicy values are currently not supported by OpenSplice.
- *RETCODE_ALREADY_DELETED* - the Publisher has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_IMMUTABLE_POLICY* - the parameter qos contains an immutable QosPolicy setting with a different value than set during enabling of the Publisher.
- *RETCODE_PRECONDITION_NOT_MET* - returned when insufficient access rights exist for the partition(s) listed in the QoS structure.

3.4.1.19 suspend_publications

Scope

DDS::Publisher

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   suspend_publications
      (void);
```

Description

This operation will suspend the dissemination of the publications by all contained *DataWriter* objects.

Parameters

<none>

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES or RETCODE_NOT_ENABLED.

Detailed Description

This operation suspends the publication of all DataWriter objects contained by this Publisher. The data written, disposed or unregistered by a DataWriter is stored in the history buffer of the DataWriter and therefore, depending on its QoS settings, the following operations may block (see the operation descriptions for more information):

- DDS::DataWriter.dispose
- DDS::DataWriter.dispose_w_timestamp
- DDS::DataWriter.write
- DDS::DataWriter.write_w_timestamp
- DDS::DataWriter.writedispose
- DDS::DataWriter.writedispose_w_timestamp
- DDS::DataWriter.unregister_instance
- DDS::DataWriter.unregister_instance_w_timestamp

Subsequent calls to this operation have no effect. When the Publisher is deleted before resume_publications is called, all suspended updates are discarded.

Return Code

When the operation returns:

- *RETCODE_OK* - the Publisher has been suspended
- *RETCODE_ERROR* - an internal error has occurred

- *RETCODE_ALREADY_DELETED* - the Publisher has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_NOT_ENABLED* - the Publisher is not enabled.

3.4.1.20 wait_for_acknowledgments

Scope

DDS::Publisher

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   wait_for_acknowledgments
      (const Duration_t& max_wait);
```

Description

This operation blocks the calling thread until either all data written by all contained DataWriters is acknowledged by the local infrastructure, or until the duration specified by max_wait parameter elapses, whichever happens first.

Parameters

in const Duration_t& max_wait - the maximum duration to block for the wait_for_acknowledgments, after which the application thread is unblocked. The special constant DURATION_INFINITE can be used when the maximum waiting time does not need to be bounded.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES, RETCODE_NOT_ENABLED or RETCODE_TIMEOUT.

Detailed Description

This operation blocks the calling thread until either all data written by all contained DataWriters is acknowledged by the local infrastructure, or until the duration specified by max_wait parameter elapses, whichever happens first.

Data is acknowledged by the local infrastructure when it does not need to be stored in its DataWriter's local history. When a locally-connected subscription (including the networking service) has no more resources to store incoming samples it will start to reject these samples, resulting in their source DataWriters to store them temporarily in their own local history to be retransmitted at a later moment in time. In such scenarios, the wait_for_acknowledgments operation will block until all

contained DataWriters have retransmitted their entire history, which is therefore effectively empty, or until the max_wait timeout expires, whichever happens first. In the first case the operation will return RETCODE_OK, in the latter it will return RETCODE_TIMEOUT.

Be aware that in case the operation returns RETCODE_OK, the data has only been acknowledged by the local infrastructure: it does not mean all remote subscriptions have already received the data. However, delivering the data to remote nodes is then the sole responsibility of the networking service: even when the publishing application would terminate, all data that has not yet been received may be considered 'on-route' and will therefore eventually arrive (unless the networking service itself will crash). In contrast, if a DataWriter would still have data in it's local history buffer when it terminates, this data is considered 'lost'.

This operation is intended to be used only if one or more of the contained DataWriters has its ReliabilityQosPolicyKind set to RELIABLE_RELIABILITY_QOS. Otherwise the operation will return immediately with RETCODE_OK, since best-effort DataWriters will never store rejected samples in their local history: they will just drop them and continue business as usual.

Return Code

When the operation returns:

- *RETCODE_OK* - the data of all contained DataWriters has been acknowledged by the local infrastructure.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the Publisher has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_NOT_ENABLED* - the Publisher is not enabled.
- *RETCODE_TIMEOUT* - not all data is acknowledged before max_wait elapsed.

3.4.2 Publication Type Specific Classes

This paragraph describes the generic DataWriter class and the derived application type specific <type>DataWriter classes which together implement the application publication interface. For each application type, used as Topic data type, the pre-processor generates a <type>DataWriter class from an IDL type description. The FooDataWriter class that would be generated by the pre-processor for a fictional type Foo describes the <type>DataWriter classes.

3.4.2.1 Class DataWriter (abstract)

`DataWriter` allows the application to set the value of the sample to be published under a given `Topic`.

A `DataWriter` is attached to exactly one `Publisher` which acts as a factory for it.

A `DataWriter` is bound to exactly one `Topic` and therefore to exactly one data type. The `Topic` must exist prior to the `DataWriter's` creation.

`DataWriter` is an abstract class. It must be specialized for each particular application data type. For a fictional application data type `Foo` (defined in the module `SPACE`) the specialized class would be `SPACE::FooDataWriter`.

The interface description of this class is as follows:

```
class DataWriter
{
//
// inherited from class Entity
//
// StatusCondition_ptr
//    get_statuscondition
//       (void);
// StatusMask
//    get_status_changes
//       (void);
// ReturnCode_t
//    enable
//       (void);
//
// abstract operations (implemented in the data type specific
// DataWriter)
//
// InstanceHandle_t
//    register_instance
//       (const <data>& instance_data);
//
// InstanceHandle_t
//    register_instance_w_timestamp
//       (const <data>& instance_data,
//         const Time_t& source_timestamp);
//
// ReturnCode_t
//    unregister_instance
//       (const <data>& instance_data,
//         InstanceHandle_t handle);
//
// ReturnCode_t
//    unregister_instance_w_timestamp
//       (const <data>& instance_data,
//         InstanceHandle_t handle,
```

```
//          const Time_t& source_timestamp);
//
// ReturnCode_t
//    write
//       (const <data>& instance_data,
//         InstanceHandle_t handle);
//
// ReturnCode_t
//    write_w_timestamp
//       (const <data>& instance_data,
//         InstanceHandle_t handle,
//         const Time_t& source_timestamp);
//
// ReturnCode_t
//    dispose
//       (const <data>& instance_data,
//         InstanceHandle_t instance_handle);
//
// ReturnCode_t
//    dispose_w_timestamp
//       (const <data>& instance_data,
//         InstanceHandle_t instance_handle,
//         const Time_t& source_timestamp);
//
// ReturnCode_t
//    writedispose
//       (const <data>& instance_data,
//         InstanceHandle_t instance_handle);
//
// ReturnCode_t
//    writedispose_w_timestamp
//       (const <data>& instance_data,
//         InstanceHandle_t instance_handle,
//         const Time_t& source_timestamp);
//
// ReturnCode_t
//    get_key_value
//       (<data>& key_holder,
//         InstanceHandle_t handle);
//
// InstanceHandle_t
//    lookup_instance
//       (const <data>& instance_data);
//
// implemented API operations
//
   ReturnCode_t
      set_qos
         (const DataWriterQos& qos);
```

```
ReturnCode_t
   get_qos
      (DataWriterQos& qos);

ReturnCode_t
   set_listener
      (DataWriterListener_ptr a_listener,
      StatusMask mask);

DataWriterListener_ptr
   get_listener
      (void);

Topic_ptr
   get_topic
      (void);

Publisher_ptr
   get_publisher
      (void);

ReturnCode_t
   wait_for_acknowledgments
      (const Duration_t& max_wait);

ReturnCode_t
   get_liveliness_lost_status
      (LivelinessLostStatus& status);

ReturnCode_t
   get_offered_deadline_missed_status
      (OfferedDeadlineMissedStatus& status);

ReturnCode_t
   get_offered_incompatible_qos_status
      (OfferedIncompatibleQosStatus& status);

ReturnCode_t
   get_publication_matched_status
      (PublicationMatchedStatus& status);

ReturnCode_t
   assert_liveliness
      (void);

ReturnCode_t
   get_matched_subscriptions
      (InstanceHandleSeq& subscription_handles);

ReturnCode_t
```

```
        get_matched_subscription_data
           (SubscriptionBuiltinTopicData& subscription_data,
           InstanceHandle_t subscription_handle);
};
```

The next paragraphs describe the usage of all `DataWriter` operations. The inherited operations are listed but not fully described because they are not implemented in this class. The full description of these operations is given in the classes from which they are inherited. The abstract operations are listed but not fully described because they are not implemented in this specific class. The full description of these operations is located in the subclasses, which contain the data type specific implementation of these operations.

3.4.2.2 assert_liveliness

Scope

`DDS::DataWriter`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   assert_liveliness
      (void);
```

Description

This operation asserts the liveliness for the `DataWriter`.

Parameters

<none>

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_ALREADY_DELETED`, `RETCODE_OUT_OF_RESOURCES` or `RETCODE_NOT_ENABLED`.

Detailed Description

This operation will manually assert the liveliness for the `DataWriter`. This way, the Data Distribution Service is informed that the corresponding `DataWriter` is still alive. This operation is used in combination with the `LivelinessQosPolicy` set to `MANUAL_BY_PARTICIPANT_LIVELINESS_QOS` or `MANUAL_BY_TOPIC_LIVELINESS_QOS`. See Section 3.1.3.10, *LivelinessQosPolicy*, on page 58, for more information on `LivelinessQosPolicy`.

Writing data via the write operation of a DataWriter will assert the liveliness on the DataWriter itself and its containing DomainParticipant. Therefore, assert_liveliness is only needed when **not** writing regularly.

The liveliness should be asserted by the application, depending on the LivelinessQosPolicy. Asserting the liveliness for this DataWriter can also be achieved by asserting the liveliness to the DomainParticipant.

Return Code

When the operation returns:

- *RETCODE_OK* - the liveliness of this DataWriter has successfully been asserted.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the DataWriter has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_NOT_ENABLED* - the DataWriter is not enabled.

3.4.2.3 dispose (abstract)

This abstract operation is defined as a generic operation, which is implemented by the <type>DataWriter class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type Foo derived FooDataWriter class.

Synopsis

```
#include <ccpp_dds_dcps.h>
       ReturnCode_t
          dispose
            (const <data>& instance_data,
              InstanceHandle_t instance_handle);
```

3.4.2.4 dispose_w_timestamp (abstract)

This abstract operation is defined as a generic operation, which is implemented by the <type>DataWriter class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type Foo derived FooDataWriter class.

Synopsis

```
#include <ccpp_dds_dcps.h>
       ReturnCode_t
          dispose_w_timestamp
```

```
(const <data>& instance_data,
  InstanceHandle_t instance_handle,
  const Time_t& source_timestamp);
```

3.4.2.5 enable (inherited)

This operation is inherited and therefore not described here. See the class `Entity` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   enable
      (void);
```

3.4.2.6 get_key_value (abstract)

This abstract operation is defined as a generic operation, which is implemented by the `<type>DataWriter` class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type `Foo` derived `FooDataWriter` class.

Synopsis

```
#include <ccpp_dds_dcps.h>
       ReturnCode_t
          get_key_value
            (<data>& key_holder,
              InstanceHandle_t handle);
```

3.4.2.7 get_listener

Scope

```
DDS::DataWriter
```

Synopsis

```
#include <ccpp_dds_dcps.h>
DataWriterListener_ptr
   get_listener
      (void);
```

Description

This operation allows access to a `DataWriterListener`.

Parameters

<none>

Return Value

DataWriterListener_ptr - result is a pointer to the DataWriterListener attached to the DataWriter.

Detailed Description

This operation allows access to a DataWriterListener attached to the DataWriter. When no DataWriterListener was attached to the DataWriter, the NULL pointer is returned.

3.4.2.8 get_liveliness_lost_status

Scope

DDS::DataWriter

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_liveliness_lost_status
      (LivelinessLostStatus& status);
```

Description

This operation obtains the LivelinessLostStatus struct of the DataWriter.

Parameters

inout LivelinessLostStatus& status - the contents of the LivelinessLostStatus struct of the DataWriter will be copied into the location specified by status.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ALREADY_DELETED or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation obtains the LivelinessLostStatus struct of the DataWriter. This struct contains the information whether the liveliness (that the DataWriter has committed through its LivelinessQosPolicy) was respected.

This means that the status represents whether the DataWriter failed to actively signal its liveliness within the offered liveliness period. If the liveliness is lost, the DataReader objects will consider the DataWriter as no longer “alive”.

The LivelinessLostStatus can also be monitored using a DataWriterListener or by using the associated StatusCondition.

Return Code

When the operation returns:

- *RETCODE_OK* - the current LivelinessLostStatus of this DataWriter has successfully been copied into the specified status parameter.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the DataWriter has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.4.2.9 get_matched_subscription_data

Scope

DDS::DataWriter

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_matched_subscription_data
      (SubscriptionBuiltinTopicData& subscription_data,
        InstanceHandle_t subscription_handle);
```

Description

This operation retrieves information on the specified subscription that is currently "associated" with the DataWriter.

Parameters

inout SubscriptionBuiltinTopicData& subscription_data - a reference to the sample in which the information about the specified subscription is to be stored.

in InstanceHandle_t subscription_handle - a handle to the subscription whose information needs to be retrieved.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_UNSUPPORTED, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES or RETCODE_NOT_ENABLED.

Detailed Description

This operation retrieves information on the specified subscription that is currently "associated" with the `DataWriter`. That is, a subscription with a matching Topic and compatible QoS that the application has not indicated should be "ignored" by means of the `ignore_subscription` operation on the `DomainParticipant` class.

The `subscription_handle` must correspond to a subscription currently associated with the `DataWriter`, otherwise the operation will fail and return `RETCODE_BAD_PARAMETER`. The operation `get_matched_subscriptions` can be used to find the subscriptions that are currently matched with the `DataWriter`.

The operation may also fail if the infrastructure does not hold the information necessary to fill in the `subscription_data`. This is the case when OpenSplice is configured not to maintain discovery information in the Networking Service. (See the description for the `NetworkingService/Discovery/enabled` property in the Deployment Manual for more information about this subject.) In such cases the operation will return `RETCODE_UNSUPPORTED`.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the information on the specified subscription has successfully been retrieved.
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_UNSUPPORTED`* - OpenSplice is configured not to maintain the information about "associated" subscriptions.
- *`RETCODE_ALREADY_DELETED`* - the `DataWriter` has already been deleted.
- *`RETCODE_OUT_OF_RESOURCES`* - the Data Distribution Service ran out of resources to complete this operation.
- *`RETCODE_NOT_ENABLED`* - the `DataWriter` is not enabled.

3.4.2.10 get_matched_subscriptions

Scope

`DDS::DataWriter`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_matched_subscriptions
      (InstanceHandleSeq& subscription_handles);
```

Description

This operation retrieves the list of subscriptions currently “associated” with the `DataWriter`.

Parameters

`inout InstanceHandleSeq& subscription_handles` - a sequence which is used to pass the list of all associated subscriptions.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_UNSUPPORTED`, `RETCODE_ALREADY_DELETED`, `RETCODE_OUT_OF_RESOURCES` or `RETCODE_NOT_ENABLED`.

Detailed Description

This operation retrieves the list of subscriptions currently “associated” with the `DataWriter`. That is, subscriptions that have a matching Topic and compatible QoS that the application has not indicated should be “ignored” by means of the `ignore_subscription` operation on the `DomainParticipant` class.

The `subscription_handles` sequence and its buffer may be pre-allocated by the application and therefore must either be re-used in a subsequent invocation of the `get_matched_subscriptions` operation or be released by invoking its destructor either implicitly or explicitly. If the pre-allocated sequence is not big enough to hold the number of associated subscriptions, the sequence will automatically be (re-)allocated to fit the required size.

The handles returned in the `subscription_handles` sequence are the ones that are used by the DDS implementation to locally identify the corresponding matched DataReader entities. You can access more detailed information about a particular subscription by passing its `subscription_handle` to either the `get_matched_subscription_data` operation or to the `read_instance` operation on the built-in reader for the “DCPSSubscription” topic.

Be aware that since `InstanceHandle_t` is an opaque datatype, it does not necessarily mean that the handles obtained from the `get_matched_subscriptions` operation have the same value as the ones that appear in the `instance_handle` field of the `SampleInfo` when retrieving the subscription info through corresponding "DCPSSubscriptions" built-in reader. You can’t just compare two handles to determine whether they represent the same subscription. If you want to know whether two handles actually do represent the same subscription, use both handles to retrieve their corresponding `SubscriptionBuiltinTopicData` samples and then compare the `key` field of both samples.

The operation may fail if the infrastructure does not locally maintain the connectivity information. This is the case when OpenSplice is configured not to maintain discovery information in the Networking Service. (See the description for the `NetworkingService/Discovery/enabled` property in the Deployment Manual for more information about this subject.) In such cases the operation will return `RETCODE_UNSUPPORTED`.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the list of associated subscriptions has successfully been obtained.
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_UNSUPPORTED`* - OpenSplice is configured not to maintain the information about "associated" subscriptions.
- *`RETCODE_ALREADY_DELETED`* - the `DataWriter` has already been deleted.
- *`RETCODE_OUT_OF_RESOURCES`* - the Data Distribution Service ran out of resources to complete this operation.
- *`RETCODE_NOT_ENABLED`* - the `DataWriter` is not enabled.

3.4.2.11 get_offered_deadline_missed_status

Scope

`DDS::DataWriter`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_offered_deadline_missed_status
      (OfferedDeadlineMissedStatus& status);
```

Description

This operation obtains the `OfferedDeadlineMissedStatus` struct of the `DataWriter`.

Parameters

`inout OfferedDeadlineMissedStatus& status` - the contents of the `OfferedDeadlineMissedStatus` struct of the `DataWriter` will be copied into the location specified by `status`.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ALREADY_DELETED or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation obtains the OfferedDeadlineMissedStatus struct of the DataWriter. This struct contains the information whether the deadline (that the DataWriter has committed through its DeadlineQosPolicy) was respected for each instance.

The OfferedDeadlineMissedStatus can also be monitored using a DataWriterListener or by using the associated StatusCondition.

Return Code

When the operation returns:

- *RETCODE_OK* - the current LivelinessLostStatus of this DataWriter has successfully been copied into the specified status parameter.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the DataWriter has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.4.2.12 get_offered_incompatible_qos_status

Scope

DDS::DataWriter

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_offered_incompatible_qos_status
      (OfferedIncompatibleQosStatus& status);
```

Description

This operation obtains the OfferedIncompatibleQosStatus struct of the DataWriter.

Parameters

inout OfferedIncompatibleQosStatus& status - the contents of the OfferedIncompatibleQosStatus struct of the DataWriter will be copied into the location specified by status.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ALREADY_DELETED or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation obtains the OfferedIncompatibleQosStatus struct of the DataWriter. This struct contains the information whether a QosPolicy setting was incompatible with the requested QosPolicy setting.

This means that the status represents whether a DataReader object has been discovered by the DataWriter with the same Topic and a requested DataReaderQos that was incompatible with the one offered by the DataWriter.

The OfferedIncompatibleQosStatus can also be monitored using a DataWriterListener or by using the associated StatusCondition.

Return Code

When the operation returns:

- *RETCODE_OK* - the current OfferedIncompatibleQosStatus of this DataWriter has successfully been copied into the specified status parameter.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the DataWriter has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.4.2.13 get_publication_matched_status

Scope

DDS::DataWriter

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_publication_matched_status
      (PublicationMatchedStatus& status);
```

Description

This operation obtains the PublicationMatchedStatus struct of the DataWriter.

Parameters

inout PublicationMatchedStatus& status - the contents of the PublicationMatchedStatus struct of the DataWriter will be copied into the location specified by status.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_UNSUPPORTED, RETCODE_ALREADY_DELETED or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation obtains the PublicationMatchedStatus struct of the DataWriter. This struct contains the information whether a new match has been discovered for the current publication, or whether an existing match has ceased to exist.

This means that the status represents that either a DataReader object has been discovered by the DataWriter with the same Topic and a compatible Qos, or that a previously discovered DataReader has ceased to be matched to the current DataWriter. A DataReader may cease to match when it gets deleted, when it changes its Qos to a value that is incompatible with the current DataWriter or when either the DataWriter or the DataReader has chosen to put its matching counterpart on its ignore-list using the ignore_subcription or ignore_publication operations on the DomainParticipant.

The operation may fail if the infrastructure does not hold the information necessary to fill in the PublicationMatchedStatus. This is the case when OpenSplice is configured not to maintain discovery information in the Networking Service. (See the description for the NetworkingService/Discovery/enabled property in the Deployment Manual for more information about this subject.) In this case the operation will return RETCODE_UNSUPPORTED.

The PublicationMatchedStatus can also be monitored using a DataWriterListener or by using the associated StatusCondition.

Return Code

When the operation returns:

- *RETCODE_OK* - the current PublicationMatchedStatus of this DataWriter has successfully been copied into the specified status parameter.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_UNSUPPORTED* - OpenSplice is configured not to maintain the information about “associated” subscriptions.

- *RETCODE_ALREADY_DELETED* - the `DataWriter` has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.4.2.14 get_publisher

Scope

`DDS::DataWriter`

Synopsis

```
#include <ccpp_dds_dcps.h>
Publisher_ptr
   get_publisher
      (void);
```

Description

This operation returns the `Publisher` to which the `DataWriter` belongs.

Parameters

<none>

Return Value

Publiher_ptr - Return value is a pointer to the `Publisher` to which the `DataWriter` belongs.

Detailed Description

This operation returns the `Publisher` to which the `DataWriter` belongs, thus the `Publisher` that has created the `DataWriter`. If the `DataWriter` is already deleted, the `NULL` pointer is returned.

3.4.2.15 get_qos

Scope

`DDS::DataWriter`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_qos
      (DataWriterQos& qos);
```

Description

This operation allows access to the existing list of QosPolicy settings for a DataWriter.

Parameters

inout DataWriterQos& qos - a reference to the destination DataWriterQos struct in which the QosPolicy settings will be copied.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ALREADY_DELETED or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation allows access to the existing list of QosPolicy settings of a DataWriter on which this operation is used. This DataWriterQos is stored at the location pointed to by the qos parameter.

Return Code

When the operation returns:

- *RETCODE_OK* - the existing set of QoS policy values applied to this DataWriter has successfully been copied into the specified DataWriterQos parameter.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the DataWriter has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.4.2.16 get_status_changes (inherited)

This operation is inherited and therefore not described here. See the class Entity for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
StatusMask
   get_status_changes
      (void);
```

3.4.2.17 get_statuscondition (inherited)

This operation is inherited and therefore not described here. See the class Entity for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
StatusCondition_ptr
   get_statuscondition
      (void);
```

3.4.2.18 get_topic

Scope

```
DDS::DataWriter
```

Synopsis

```
#include <ccpp_dds_dcps.h>
Topic_ptr
   get_topic
      (void);
```

Description

This operation returns the `Topic` which is associated with the `DataWriter`.

Parameters

<none>

Return Value

`Topic_ptr` - Return value is a pointer to the `Topic` which is associated with the `DataWriter`.

Detailed Description

This operation returns the `Topic` which is associated with the `DataWriter`, thus the `Topic` with which the `DataWriter` is created. If the `DataWriter` is already deleted, the `NULL` pointer is returned.

3.4.2.19 lookup_instance (abstract)

This abstract operation is defined as a generic operation, which is implemented by the `<type>DataWriter` class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type `Foo` derived `FooDataWriter` class.

Synopsis

```
#include <ccpp_dds_dcps.h>
InstanceHandle_t
   lookup_instance
```

```
        (const <data>& instance_data);
```

3.4.2.20 register_instance (abstract)

This abstract operation is defined as a generic operation, which is implemented by the `<type>DataWriter` class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type `Foo` derived `FooDataWriter` class.

Synopsis

```
#include <ccpp_dds_dcps.h>
       InstanceHandle_t
          register_instance
             (const <data>& instance_data);
```

3.4.2.21 register_instance_w_timestamp (abstract)

This abstract operation is defined as a generic operation, which is implemented by the `<type>DataWriter` class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type `Foo` derived `FooDataWriter` class.

Synopsis

```
#include <ccpp_dds_dcps.h>
       InstanceHandle_t
          register_instance_w_timestamp
             (const <data>& instance_data,
               const Time_t& source_timestamp);
```

3.4.2.22 set_listener

Scope

```
DDS::DataWriter
```

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   set_listener
      (DataWriterListener_ptr a_listener,
        StatusMask mask);
```

Description

This operation attaches a `DataWriterListener` to the `DataWriter`.

Parameters

in DataWriterListener_ptr a_listener - a pointer to the DataWriterListener instance, which will be attached to the DataWriter.

in StatusMask mask - a bit mask in which each bit enables the invocation of the DataWriterListener for a certain status.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_UNSUPPORTED, RETCODE_ALREADY_DELETED or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation attaches a DataWriterListener to the DataWriter. Only one DataWriterListener can be attached to each DataWriter. If a DataWriterListener was already attached, the operation will replace it with the new one. When a_listener is the NULL pointer, it represents a listener that is treated as a NOOP[1] for all statuses activated in the bit mask.

Communication Status

For each communication status, the StatusChangedFlag flag is initially set to FALSE. It becomes TRUE whenever that communication status changes. For each communication status activated in the mask, the associated DataWriterListener operation is invoked and the communication status is reset to FALSE, as the listener implicitly accesses the status which is passed as a parameter to that operation. The status is reset prior to calling the listener, so if the application calls the get_<status_name>_status from inside the listener it will see the status already reset. An exception to this rule is the NULL listener, which does not reset the communication statuses for which it is invoked.

The following statuses are applicable to the DataWriterListener:

- OFFERED_DEADLINE_MISSED_STATUS
- OFFERED_INCOMPATIBLE_QOS_STATUS
- LIVELINESS_LOST_STATUS
- PUBLICATION_MATCHED_STATUS.

Be aware that the PUBLICATION_MATCHED_STATUS is not applicable when the infrastructure does not have the information available to determine connectivity. This is the case when OpenSplice is configured not to maintain discovery information in the Networking Service. (See the description for the

1. Short for **No-Op**eration, an instruction that does nothing.

NetworkingService/Discovery/enabled property in the Deployment Manual for more information about this subject.) In this case the operation will return RETCODE_UNSUPPORTED.

Status bits are declared as a constant and can be used by the application in an OR operation to create a tailored mask. The special constant STATUS_MASK_NONE can be used to indicate that the created entity should not respond to any of its available statuses. The DDS will therefore attempt to propagate these statuses to its factory. The special constant STATUS_MASK_ANY_V1_2 can be used to select all applicable statuses specified in the "Data Distribution Service for Real-time Systems Version 1.2" specification which are applicable to the PublisherListener.

Status Propagation

In case a communication status is not activated in the mask of the DataWriterListener, the PublisherListener of the containing Publisher is invoked (if attached and activated for the status that occurred). This allows the application to set a default behaviour in the PublisherListener of the containing Publisher and a DataWriter specific behaviour when needed. In case the communication status is not activated in the mask of the PublisherListener as well, the communication status will be propagated to the DomainParticipantListener of the containing DomainParticipant. In case the DomainParticipantListener is also not attached or the communication status is not activated in its mask, the application is not notified of the change.

Return Code

When the operation returns:

- *RETCODE_OK* - the DataWriterListener is attached
- *RETCODE_ERROR* - an internal error has occurred
- *RETCODE_UNSUPPORTED* - a status was selected that cannot be supported because the infrastructure does not maintain the required connectivity information.
- *RETCODE_ALREADY_DELETED* - the DataWriter has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.4.2.23 set_qos

Scope

DDS::DataWriter

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
```

```
set_qos
   (const DataWriterQos& qos);
```

Description

This operation replaces the existing set of QosPolicy settings for a DataWriter.

Parameters

in const DataWriterQos& qos - new set of QosPolicy settings for the DataWriter.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_UNSUPPORTED, RETCODE_ALLREADY_DELETED, RETCODE_OUT_OF_RESOURCES, RETCODE_IMMUTABLE_POLICY or RETCODE_INCONSISTENT_POLICY.

Detailed Description

This operation replaces the existing set of QosPolicy settings for a DataWriter. The parameter qos contains the struct with the QosPolicy settings which is checked for self-consistency and mutability. When the application tries to change a QosPolicy setting for an enabled DataWriter, which can only be set before the DataWriter is enabled, the operation will fail and a RETCODE_IMMUTABLE_POLICY is returned. In other words, the application must provide the presently set QosPolicy settings in case of the immutable QosPolicy settings. Only the mutable QosPolicy settings can be changed. When qos contains conflicting QosPolicy settings (not self-consistent), the operation will fail and a RETCODE_INCONSISTENT_POLICY is returned.

The set of QosPolicy settings specified by the qos parameter are applied on top of the existing QoS, replacing the values of any policies previously set (provided, the operation returned RETCODE_OK).

Return Code

When the operation returns:

- *RETCODE_OK* - the new default DataWriterQos is set
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - the parameter qos is not a valid DataWriterQos. It contains a QosPolicy setting with an invalid Duration_t value or an enum value that is outside its legal boundaries.
- *RETCODE_UNSUPPORTED* - one or more of the selected QosPolicy values are currently not supported by OpenSplice.

- *RETCODE_ALREADY_DELETED* - the DataWriter has already been deleted
- *RETCODE_IMMUTABLE_POLICY* - the parameter qos contains an immutable QosPolicy setting with a different value than set during enabling of the DataWriter.
- *RETCODE_INCONSISTENT_POLICY* - the parameter qos contains an inconsistent QosPolicy settings, e.g. a history depth that is higher than the specified resource limits.

3.4.2.24 unregister_instance (abstract)

This abstract operation is defined as a generic operation, which is implemented by the <type>DataWriter class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type Foo derived FooDataWriter class.

Synopsis

```
#include <ccpp_dds_dcps.h>
       ReturnCode_t
          unregister_instance
             (const <data>& instance_data,
               InstanceHandle_t handle);
```

3.4.2.25 unregister_instance_w_timestamp (abstract)

This abstract operation is defined as a generic operation, which is implemented by the <type>DataWriter class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type Foo derived FooDataWriter class.

Synopsis

```
#include <ccpp_dds_dcps.h>
       ReturnCode_t
          unregister_instance_w_timestamp
            (const <data>& instance_data,
              InstanceHandle_t handle,
              const Time_t& source_timestamp);
```

3.4.2.26 wait_for_acknowledgments

Scope

```
DDS::DataWriter
```

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   wait_for_acknowledgments
      (const Duration_t& max_wait);
```

Description

This operation blocks the calling thread until either all data written by the DataWriter is acknowledged by the local infrastructure, or until the duration specified by max_wait parameter elapses, whichever happens first.

Parameters

in const Duration_t& max_wait - the maximum duration to block for the wait_for_acknowledgments, after which the application thread is unblocked. The special constant DURATION_INFINITE can be used when the maximum waiting time does not need to be bounded.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES, RETCODE_NOT_ENABLED or RETCODE_TIMEOUT.

Detailed Description

This operation blocks the calling thread until either all data written by the DataWriter is acknowledged by the local infrastructure, or until the duration specified by max_wait parameter elapses, whichever happens first.

Data is acknowledged by the local infrastructure when it does not need to be stored in its DataWriter's local history. When a locally-connected subscription (including the networking service) has no more resources to store incoming samples it will start to reject these samples, resulting in its source DataWriter to store them temporarily in its own local history to be retransmitted at a later moment in time. In such scenarios, the wait_for_acknowledgments operation will block until the DataWriter has retransmitted its entire history, which is therefore effectively empty, or until the max_wait timeout expires, whichever happens first. In the first case the operation will return RETCODE_OK, in the latter it will return RETCODE_TIMEOUT.

Be aware that in case the operation returns RETCODE_OK, the data has only been acknowledged by the local infrastructure: it does not mean all remote subscriptions have already received the data. However, delivering the data to remote nodes is then the sole responsibility of the networking service: even when the publishing application would terminate, all data that has not yet been received may be

considered 'on-route' and will therefore eventually arrive (unless the networking service itself will crash). In contrast, if the DataWriter would still have data in it's local history buffer when it terminates, this data is considered 'lost'.

This operation is intended to be used only if the DataWriter has its ReliabilityQosPolicyKind set to RELIABLE_RELIABILITY_QOS. Otherwise the operation will return immediately with RETCODE_OK, since best-effort DataWriters will never store rejected samples in their local history: they will just drop them and continue business as usual.

Return Code

When the operation returns:

- *RETCODE_OK* - the data of the DataWriter has been acknowledged by the local infrastructure.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the DataWriter has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_NOT_ENABLED* - the DataWriter is not enabled.
- *RETCODE_TIMEOUT* - not all data is acknowledged before max_wait elapsed.

3.4.2.27 write (abstract)

This abstract operation is defined as a generic operation, which is implemented by the <type>DataWriter class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type Foo derived FooDataWriter class.

Synopsis

```
#include <ccpp_dds_dcps.h>
       ReturnCode_t
          write
            (const <data>& instance_data,
              InstanceHandle_t handle);
```

3.4.2.28 write_w_timestamp (abstract)

This abstract operation is defined as a generic operation, which is implemented by the <type>DataWriter class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type Foo derived FooDataWriter class.

Synopsis

```
#include <ccpp_dds_dcps.h>
       ReturnCode_t
          write_w_timestamp
            (const <data>& instance_data,
              InstanceHandle_t handle,
              const Time_t& source_timestamp);
```

3.4.2.29 writedispose (abstract)

This abstract operation is defined as a generic operation, which is implemented by the `<type>DataWriter` class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type `Foo` derived `FooDataWriter` class.

Synopsis

```
#include <ccpp_dds_dcps.h>
       ReturnCode_t
          writedispose
            (const <data>& instance_data,
              InstanceHandle_t handle);
```

3.4.2.30 writedispose_w_timestamp (abstract)

This abstract operation is defined as a generic operation, which is implemented by the `<type>DataWriter` class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type `Foo` derived `FooDataWriter` class.

Synopsis

```
#include <ccpp_dds_dcps.h>
       ReturnCode_t
          writedispose_w_timestamp
            (const <data>& instance_data,
              InstanceHandle_t handle,
              const Time_t& source_timestamp);
```

3.4.2.31 Class FooDataWriter

The pre-processor generates from IDL type descriptions the application `<type>DataWriter` classes. For each application data type that is used as `Topic` data type, a typed class `<type>DataWriter` is derived from the `DataWriter` class. In this paragraph, the class `FooDataWriter` in the namespace `SPACE` describes the operations of these derived `<type>DataWriter` classes as an example for the fictional application type `Foo` (defined in the module `SPACE`).

For instance, for an application, the definitions are located in the `Space.idl` file. The pre-processor will generate a `ccpp_Space.h` include file.

i **General note**: The name `ccpp_Space.h` is derived from the IDL file `Space.idl`, that defines `SPACE::Foo`, for all relevant `SPACE::FooDataWriter` operations.

A `FooDataWriter` is attached to exactly one `Publisher` which acts as a factory for it. The `FooDataWriter` is bound to exactly one `Topic` that has been registered to use a data type `Foo`. The `Topic` must exist prior to the `FooDataWriter` creation.

The interface description of this class is as follows:

```
class FooDataWriter
{
//
// inherited from class Entity
//
// StatusCondition_ptr
//    get_statuscondition
//       (void);
// StatusMask
//    get_status_changes
//       (void);
// ReturnCode_t
//    enable
//       (void);
//
// inherited from class DataWriter
//
// ReturnCode_t
//    set_qos
//       (const DataWriterQos& qos);

// ReturnCode_t
//    get_qos
//       (DataWriterQos& qos);

// ReturnCode_t
//    set_listener
//       (DataWriterListener_ptr a_listener,
//       StatusMask mask);

// DataWriterListener_ptr
//    get_listener
//       (void);

// Topic_ptr
//    get_topic
//       (void);
```

```
// Publisher_ptr
//    get_publisher
//       (void);

// ReturnCode_t
//    wait_for_acknowledgments
//       (const Duration_t& max_wait);

// ReturnCode_t
//    get_liveliness_lost_status
//       (LivelinessLostStatus& status);

// ReturnCode_t
//    get_offered_deadline_missed_status
//       (OfferedDeadlineMissedStatus& status);

// ReturnCode_t
//    get_offered_incompatible_qos_status
//       (OfferedIncompatibleQosStatus& status);

// ReturnCode_t
//    get_publication_matched_status
//       (PublicationMatchedStatus& status);

// ReturnCode_t
//    assert_liveliness
//       (void);

// ReturnCode_t
//    get_matched_subscriptions
//       (InstanceHandleSeq& subscription_handles);

// ReturnCode_t
//    get_matched_subscription_data
//       (SubscriptionBuiltinTopicData& subscription_data,
//       InstanceHandle_t subscription_handle);
//
// implemented API operations
//
   InstanceHandle_t
      register_instance
         (const Foo& instance_data);
   InstanceHandle_t
      register_instance_w_timestamp
         (const Foo& instance_data,
           const Time_t& time_stamp);
   ReturnCode_t
      unregister_instance
         (const Foo& instance_data,
           InstanceHandle_t handle);
```

```
        ReturnCode_t
           unregister_instance_w_timestamp
              (const Foo& instance_data,
               InstanceHandle_t handle,
               const Time_t& time_stamp);
        ReturnCode_t
           write
              (const Foo& instance_data,
               InstanceHandle_t handle);
        ReturnCode_t
           write_w_timestamp
              (const Foo& instance_data,
               InstanceHandle_t handle,
               const Time_t& time_stamp);
        ReturnCode_t
           dispose
              (const Foo& instance_data,
               InstanceHandle_t instance_handle);
        ReturnCode_t
           dispose_w_timestamp
              (const Foo& instance_data,
               InstanceHandle_t instance_handle,
               const Time_t& time_stamp);
        ReturnCode_t
           writedispose
              (const Foo& instance_data,
               InstanceHandle_t instance_handle);
        ReturnCode_t
           writedispose_w_timestamp
              (const Foo& instance_data,
               InstanceHandle_t instance_handle,
               const Time_t& time_stamp);
        ReturnCode_t
           get_key_value
              (Foo& key_holder,
               InstanceHandle_t handle);
        InstanceHandle_t
           lookup_instance
              (const Foo& instance_data);
    };
```

The next paragraphs describe the usage of all `FooDataWriter` operations. The inherited operations are listed but not fully described because they are not implemented in this class. The full description of these operations is given in the classes from which they are inherited.

3.4.2.32 assert_liveliness (inherited)

This operation is inherited and therefore not described here. See the class `DataWriter` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
ReturnCode_t
   assert_liveliness
      (void);
```

3.4.2.33 dispose

Scope

```
SPACE::FooDataWriter
```

Synopsis

```
#include <ccpp_Space.h>
       ReturnCode_t
          dispose
            (const Foo& instance_data,
              InstanceHandle_t instance_handle);
```

Description

This operation requests the Data Distribution Service to mark the instance for deletion.

Parameters

in const Foo& instance_data - the actual instance to be disposed of.

in InstanceHandle_t instance_handle - the handle to the instance to be disposed of.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES, RETCODE_NOT_ENABLED RETCODE_PRECONDITION_NOT_MET or RETCODE_TIMEOUT.

Detailed Description

This operation requests the Data Distribution Service to mark the instance for deletion. Copies of the instance and its corresponding samples, which are stored in every connected DataReader and, dependent on the QoSPolicy settings, also in the Transient and Persistent stores, will be marked for deletion by setting their InstanceStateKind to NOT_ALIVE_DISPOSED_INSTANCE_ STATE.

When this operation is used, the Data Distribution Service will automatically supply the value of the source_timestamp that is made available to connected DataReader objects. This timestamp is important for the interpretation of the DestinationOrderQosPolicy.

As a side effect, this operation asserts liveliness on the DataWriter itself and on the containing DomainParticipant.

Effects on DataReaders

Actual deletion of the instance administration in a connected DataReader will be postponed until the following conditions have been met:

- the instance must be unregistered (either implicitly or explicitly) by all connected DataWriters that have previously registered it.
  - A DataWriter can register an instance explicitly by using one of the special operations register_instance or register_instance_w_timestamp.
  - A DataWriter can register an instance implicitly by using the special constant HANDLE_NIL in any of the other DataWriter operations.
  - A DataWriter can unregister an instance explicitly by using one of the special operations unregister_instance or unregister_instance_w_timestamp.
  - A DataWriter will unregister all its contained instances implicitly when it is deleted.
  - When a DataReader detects a loss of liveliness in one of its connected DataWriters, it will consider all instances registered by that DataWriter as being implicitly unregistered.
- ***and*** the application must have consumed all samples belonging to the instance, either implicitly or explicitly.
  - An application can consume samples explicitly by invoking the take operation, or one of its variants, on its DataReaders.
  - The DataReader can consume disposed samples implicitly when the autopurge_disposed_samples_delay of the ReaderDataLifecycleQosPolicy has expired.

The DataReader may also remove instances that haven't been disposed first: this happens when the autopurge_nowriter_samples_delay of the ReaderDataLifecycleQosPolicy has expired after the instance is considered unregistered by all connected DataWriters (i.e. when it has a InstanceStateKind of NOT_ALIVE_NO_WRITERS). See also Section 3.1.3.15, *ReaderDataLifecycleQosPolicy*, on page 71.

Effects on Transient/Persistent Stores

Actual deletion of the instance administration in the connected Transient and Persistent stores will be postponed until the following conditions have been met:

- the instance must be unregistered (either implicitly or explicitly) by all connected `DataWriters` that have previously registered it. (See above.)
- ***and*** the period of time specified by the `service_cleanup_delay` attribute in the `DurabilityServiceQosPolicy` on the `Topic` must have elapsed after the instance is considered unregistered by all connected `DataWriters`.

See also Section 3.1.3.4, *DurabilityServiceQosPolicy*, on page 49.

Instance Handle

The `HANDLE_NIL` handle value can be used for the parameter `instance_handle`. This indicates the identity of the `instance` is automatically deduced from the `instance_data` (by means of the `key`).

If `instance_handle` is any value other than `HANDLE_NIL`, it must correspond to the value that was returned by either the `register_instance` operation or the `register_instance_w_timestamp` operation, when the instance (identified by its `key`) was registered. If there is no correspondence, the result of the operation is unspecified.

The sample that is passed as `instance_data` is only used to check for consistency between its `key` values and the supplied `instance_handle`: the sample itself will not actually be delivered to the connected `DataReaders`. Use the `writedispose` operation if the sample itself should be delivered together with the dispose request.

Blocking

If the `HistoryQosPolicy` is set to `KEEP_ALL_HISTORY_QOS`, the `dispose` operation on the `DataWriter` may block if the modification would cause data to be lost because one of the limits, specified in the `ResourceLimitsQosPolicy`, to be exceeded. Under these circumstances, the `max_blocking_time` attribute of the `ReliabilityQosPolicy` configures the maximum time the `dispose` operation may block (waiting for space to become available). If `max_blocking_time` elapses before the `DataWriter` is able to store the modification without exceeding the limits, the `SPACE_FooDataWriter_dispose` operation will fail and returns `RETCODE_TIMEOUT`.

Sample Validation

OpenSplice DDS offers the possibility to check the sample that is passed as `instance_data` for validity. Because validity checking might reduce the overall performance, it is by default disabled. This has been done by enclosing the validity checking with conditional compiler directives like this:

```
#ifdef OSPL_BOUNDS_CHECK
    // check a specific bound.
#endif
```

i By defining a macro called `OSPL_OSPL_BOUNDS_CHECK`, the validity checking will be included. On most compilers this macro can be defined by passing an additional command line parameter called `-DOSPL_BOUNDS_CHECK`.

Since the `dispose` operation merely uses the sample to check for consistency between its `key` values and the supplied `instance_handle`, only these keyfields will be validated against the restrictions imposed by the IDL to C++ language mapping, where:

- an enum may not exceed the value of its highest label
- a string (bounded or unbounded) may not be `NULL`. (Use `""` for an empty string instead)
- the length of a bounded string may not exceed the limit specified in IDL

If any of these restrictions is violated when validity checking is enabled, the operation will fail and return a `RETCODE_BAD_PARAMETER`. More specific information about the context of this error will be written to the error log. When validity checking is disabled, any of these violations may result in undefined behaviour.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the Data Distribution Service is informed that the instance data must be disposed of
- *`RETCODE_ERROR`* - an internal error has occurred
- *`RETCODE_BAD_PARAMETER`* - `instance_handle` is not a valid handle or `instance_data` is not a valid sample.
- *`RETCODE_ALREADY_DELETED`* - the `FooDataWriter` has already been deleted
- *`RETCODE_OUT_OF_RESOURCES`* - the Data Distribution Service ran out of resources to complete this operation.
- *`RETCODE_NOT_ENABLED`* - the `FooDataWriter` is not enabled.
- *`RETCODE_PRECONDITION_NOT_MET`* - the `instance_handle` has not been registered with this `FooDataWriter`.
- *`RETCODE_TIMEOUT`* - the current action overflowed the available resources as specified by the combination of the `ReliabilityQosPolicy`, `HistoryQosPolicy` and `ResourceLimitsQosPolicy`. This caused blocking of the `dispose` operation, which could not be resolved before `max_blocking_time` of the `ReliabilityQosPolicy` elapsed.

3.4.2.34 dispose_w_timestamp

Scope

`SPACE::FooDataWriter`

Synopsis

```
#include <ccpp_Space.h>
       ReturnCode_t
          dispose_w_timestamp
            (const Foo& instance_data,
              InstanceHandle_t instance_handle,
              const Time_t& source_timestamp);
```

Description

This operation requests the Data Distribution Service to mark the instance for deletion and provides a value for the `source_timestamp` explicitly.

Parameters

`in const Foo& instance_data` - the actual instance to be disposed of.

`in InstanceHandle_t instance_handle` - the handle to the instance to be disposed of.

`in Time_t source_timestamp` - `source_timestamp` is the timestamp which is provided for the `DataReader`.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_BAD_PARAMETER`, `RETCODE_ALREADY_DELETED`, `RETCODE_OUT_OF_RESOURCES`, `RETCODE_NOT_ENABLED` `RETCODE_PRECONDITION_NOT_MET` or `RETCODE_TIMEOUT`.

Detailed Description

This operation performs the same functions as `dispose` except that the application provides the value for the `source_timestamp` that is made available to connected `DataReader` objects. This timestamp is important for the interpretation of the `DestinationOrderQosPolicy`.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the Data Distribution Service is informed that the instance data must be disposed of
- *`RETCODE_ERROR`* - an internal error has occurred

- *RETCODE_BAD_PARAMETER* - `instance_handle` is not a valid handle or `instance_data` is not a valid sample.
- *RETCODE_ALREADY_DELETED* - the `FooDataWriter` has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_NOT_ENABLED* - the `FooDataWriter` is not enabled.
- *RETCODE_PRECONDITION_NOT_MET* - the `instance_handle` has not been registered with this `FooDataWriter`.
- *RETCODE_TIMEOUT* - the current action overflowed the available resources as specified by the combination of the `ReliabilityQosPolicy`, `HistoryQosPolicy` and `ResourceLimitsQosPolicy`. This caused blocking of the `dispose_w_timestamp` operation, which could not be resolved before `max_blocking_time` of the `ReliabilityQosPolicy` elapsed.

3.4.2.35 enable (inherited)

This operation is inherited and therefore not described here. See the class `Entity` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
ReturnCode_t
   enable
      (void);
```

3.4.2.36 get_key_value

Scope

```
SPACE::FooDataWriter
```

Synopsis

```
#include <ccpp_Space.h>
       ReturnCode_t
          get_key_value
            (Foo& key_holder,
              InstanceHandle_t handle);
```

Description

This operation retrieves the key value of a specific instance.

Parameters

inout Foo& key_holder - a reference to the sample in which the key values are stored.

in InstanceHandle_t handle - the handle to the instance from which to get the key value.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES, RETCODE_NOT_ENABLED or RETCODE_PRECONDITION_NOT_MET.

Detailed Description

This operation retrieves the key value of the instance referenced to by instance_handle. When the operation is called with a HANDLE_NIL handle value as an instance_handle, the operation will return RETCODE_BAD_PARAMETER. The operation will only fill the fields that form the key inside the key_holder instance. This means that the non-key fields are not applicable and may contain garbage.

The operation must only be called on registered instances. Otherwise the operation returns the error RETCODE_PRECONDITION_NOT_MET.

Return Code

When the operation returns:

- *RETCODE_OK* - the key_holder instance contains the key values of the instance;
- *RETCODE_ERROR* - an internal error has occurred
- *RETCODE_BAD_PARAMETER* - handle is not a valid handle
- *RETCODE_ALREADY_DELETED* - the FooDataWriter has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_NOT_ENABLED* - the FooDataWriter is not enabled.
- *RETCODE_PRECONDITION_NOT_MET* - this instance is not registered.

3.4.2.37 get_listener (inherited)

This operation is inherited and therefore not described here. See the class DataWriter for further explanation.

Synopsis

```
#include <ccpp_Space.h>
DataWriterListener_ptr
   get_listener
      (void);
```

3.4.2.38 get_liveliness_lost_status (inherited)

This operation is inherited and therefore not described here. See the class `DataWriter` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
ReturnCode_t
   get_liveliness_lost_status
      (LivelinessLostStatus& status);
```

3.4.2.39 get_matched_subscription_data (inherited)

This operation is inherited and therefore not described here. See the class `DataWriter` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
ReturnCode_t
   get_matched_subscription_data
      (SubscriptionBuiltinTopicData& subscription_data,
        InstanceHandle_t subscription_handle);
```

3.4.2.40 get_matched_subscriptions (inherited)

This operation is inherited and therefore not described here. See the class `DataWriter` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
ReturnCode_t
   get_matched_subscriptions
      (InstanceHandleSeq& subscription_handles);
```

3.4.2.41 get_offered_deadline_missed_status (inherited)

This operation is inherited and therefore not described here. See the class `DataWriter` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
ReturnCode_t
   get_offered_deadline_missed_status
      (OfferedDeadlineMissedStatus& status);
```

3.4.2.42 get_offered_incompatible_qos_status (inherited)

This operation is inherited and therefore not described here. See the class `DataWriter` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
ReturnCode_t
   get_offered_incompatible_qos_status
      (OfferedIncompatibleQosStatus& status);
```

3.4.2.43 get_publication_matched_status (inherited)

This operation is inherited and therefore not described here. See the class `DataWriter` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
ReturnCode_t
   get_publication_matched_status
      (PublicationMatchedStatus& status);
```

3.4.2.44 get_publisher (inherited)

This operation is inherited and therefore not described here. See the class `DataWriter` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
Publisher_ptr
   get_publisher
      (void);
```

3.4.2.45 get_qos (inherited)

This operation is inherited and therefore not described here. See the class `DataWriter` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
ReturnCode_t
   get_qos
      (DataWriterQos& qos);
```

3.4.2.46 get_status_changes (inherited)

This operation is inherited and therefore not described here. See the class `Entity` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
StatusMask
   get_status_changes
```

```
   (void);
```

3.4.2.47 get_statuscondition (inherited)

This operation is inherited and therefore not described here. See the class `Entity` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
StatusCondition_ptr
   get_statuscondition
      (void);
```

3.4.2.48 get_topic (inherited)

This operation is inherited and therefore not described here. See the class `DataWriter` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
Topic_ptr
   get_topic
      (void);
```

3.4.2.49 lookup_instance

Scope

```
SPACE::FooDataWriter
```

Synopsis

```
#include <ccpp_Space.h>
InstanceHandle_t
   lookup_instance
      (const Foo& instance_data);
```

Description

This operation returns the value of the instance handle which corresponds to the `instance_data`.

Parameters

`in const Foo& instance_data` - a reference to the instance for which the corresponding instance handle needs to be looked up.

Return Value

`InstanceHandle_t` - Result value is the instance handle which corresponds to the `instance_data`.

Detailed Description

This operation returns the value of the instance handle which corresponds to the `instance_data`. The `instance_data` parameter is only used for the purpose of examining the fields that define the `key`. The instance handle can be used in any `write`, `dispose` or `unregister` operations (or their time stamped variants) that operate on a specific instance. Note that `DataWriter` instance handles are local, and are not interchangeable with `DataReader` instance handles nor with instance handles of an other `DataWriter`.

This operation does not register the instance in question. If the instance has not been previously registered, if the `DataWriter` is already deleted or if for any other reason the Service is unable to provide an instance handle, the Service will return the special value `HANDLE_NIL`.

Sample Validation

OpenSplice DDS offers the possibility to check the sample that is passed as `instance_data` for validity. Because validity checking might reduce the overall performance, it is by default disabled. This has been done by enclosing the validity checking with conditional compiler directives like this:

```
#ifdef OSPL_BOUNDS_CHECK
    // check a specific bound.
#endif
```

By defining a macro called `OSPL_OSPL_BOUNDS_CHECK`, the validity checking will be included. On most compilers this macro can be defined by passing an additional command line parameter called `-DOSPL_BOUNDS_CHECK`.

Since the `lookup_instance` operation merely uses the sample to determine its identity based on the uniqueness of its `key` values, only the keyfields will be validated against the restrictions imposed by the IDL to C++ language mapping:

- an enum may not exceed the value of its highest label
- a string (bounded or unbounded) may not be `NULL`. (Use `""` for an empty string instead)
- the length of a bounded string may not exceed the limit specified in IDL

If any of these restrictions is violated when validity checking is enabled, the operation will fail and return a `HANDLE_NIL`. More specific information about the context of this error will be written to the error log. When validity checking is disabled, any of these violations may result in undefined behaviour.

3.4.2.50 register_instance

Scope

`SPACE::FooDataWriter`

Synopsis

```
#include <ccpp_Space.h>
       InstanceHandle_t
          register_instance
             (const Foo& instance_data);
```

Description

This operation informs the Data Distribution Service that the application will be modifying a particular instance.

Parameters

in const Foo& instance_data - the instance, which the application writes to or disposes of.

Return Value

InstanceHandle_t - Result value is the handle to the instance, which may be used for writing and disposing of. In case of an error, a HANDLE_NIL handle value is returned.

Detailed Description

This operation informs the Data Distribution Service that the application will be modifying a particular instance. This operation may be invoked prior to calling any operation that modifies the instance, such as write, write_w_timestamp, unregister_instance, unregister_instance_w_timestamp, dispose, dispose_w_timestamp, writedispose and writedispose_w_timestamp. When the application does register the instance before modifying, the Data Distribution Service will handle the instance more efficiently. It takes as a parameter (instance_data) an instance (to get the key value) and returns a handle that can be used in successive DataWriter operations. In case of an error, a HANDLE_NIL handle value is returned.

The explicit use of this operation is optional as the application can directly call the write, write_w_timestamp, unregister_instance, unregister_instance_w_timestamp, dispose, dispose_w_timestamp, writedispose and writedispose_w_timestamp operations and specify a HANDLE_NIL handle value to indicate that the sample should be examined to identify the instance.

When this operation is used, the Data Distribution Service will automatically supply the value of the source_timestamp that is made available to connected DataReader objects. This timestamp is important for the interpretation of the DestinationOrderQosPolicy.

Blocking

If the HistoryQosPolicy is set to KEEP_ALL_HISTORY_QOS, the register_instance operation on the DataWriter may block if the modification would cause data to be lost because one of the limits, specified in the ResourceLimitsQosPolicy, to be exceeded. In case the synchronous attribute value of the ReliabilityQosPolicy is set to TRUE for communicating DataWriters and DataReaders then the DataWriter will wait until all synchronous DataReaders have acknowledged the data. Under these circumstances, the max_blocking_time attribute of the ReliabilityQosPolicy configures the maximum time the register_instance operation may block (either waiting for space to become available or data to be acknowledged). If max_blocking_time elapses before the DataWriter is able to store the modification without exceeding the limits and all expected acknowledgements are received, the register_instance operation will fail and returns HANDLE_NIL.

Sample Validation

OpenSplice DDS offers the possibility to check the sample that is passed as instance_data for validity. Because validity checking might reduce the overall performance, it is by default disabled. This has been done by enclosing the validity checking with conditional compiler directives like this:

```
#ifdef OSPL_BOUNDS_CHECK
    // check a specific bound.
#endif
```

i By defining a macro called OSPL_OSPL_BOUNDS_CHECK, the validity checking will be included. On most compilers this macro can be defined by passing an additional command line parameter called -DOSPL_BOUNDS_CHECK.

Since the register_instance operation merely uses the sample to determine its identity based on the uniqueness of its key values, only the keyfields will be validated against the restrictions imposed by the IDL to C++ language mapping:

- an enum may not exceed the value of its highest label
- a string (bounded or unbounded) may not be NULL. (Use "" for an empty string instead)
- the length of a bounded string may not exceed the limit specified in IDL

If any of these restrictions is violated when validity checking is enabled, the operation will fail and return a HANDLE_NIL. More specific information about the context of this error will be written to the error log. When validity checking is disabled, any of these violations may result in undefined behaviour.

Multiple Calls

If this operation is called for an already registered instance, it just returns the already allocated instance handle. This may be used to look up and retrieve the handle allocated to a given instance.

3.4.2.51 register_instance_w_timestamp

Scope

`SPACE::FooDataWriter`

Synopsis

```
#include <ccpp_Space.h>
       InstanceHandle_t
          register_instance_w_timestamp
             (const Foo& instance_data,
               const Time_t& source_timestamp);
```

Description

This operation will inform the Data Distribution Service that the application will be modifying a particular instance and provides a value for the `source_timestamp` explicitly.

Parameters

`in Foo instance_data` - the instance, which the application will write to or dispose of.

`in const Time_t& source_timestamp` - the timestamp used.

Return Value

`InstanceHandle_t` - Result value is the handle to the `Instance`, which must be used for writing and disposing. In case of an error, a `HANDLE_NIL` handle value is returned.

Detailed Description

This operation performs the same functions as `register_instance` except that the application provides the value for the `source_timestamp` that is made available to connected `DataReader` objects. This timestamp is important for the interpretation of the `DestinationOrderQosPolicy`.

Multiple Calls

If this operation is called for an already registered instance, it just returns the already allocated instance handle. The source_timestamp is ignored in that case.

3.4.2.52 set_listener (inherited)

This operation is inherited and therefore not described here. See the class `DataWriter` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
ReturnCode_t
   set_listener
      (DataWriterListener_ptr a_listener,
        StatusMask mask);
```

3.4.2.53 set_qos (inherited)

This operation is inherited and therefore not described here. See the class `DataWriter` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
ReturnCode_t
   set_qos
      (const DataWriterQos& qos);
```

3.4.2.54 unregister_instance

Scope

```
SPACE::FooDataWriter
```

Synopsis

```
#include <ccpp_Space.h>
       ReturnCode_t
          unregister_instance
             (const Foo& instance_data,
               InstanceHandle_t handle);
```

Description

This operation informs the Data Distribution Service that the application will **not** be modifying a particular instance any more.

Parameters

in const Foo& instance_data - the instance to which the application was writing or disposing.

in InstanceHandle_t handle - the handle to the instance, which has been used for writing and disposing.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES, RETCODE_NOT_ENABLED, RETCODE_PRECONDITION_NOT_MET or RETCODE_TIMEOUT.

Detailed Description

This operation informs the Data Distribution Service that the application will **not** be modifying a particular instance any more. Therefore, this operation reverses the action of register_instance or register_instance_w_timestamp. It should only be called on an instance that is currently registered. This operation should be called just once per instance, regardless of how many times register_instance was called for that instance. This operation also indicates that the Data Distribution Service can locally remove all information regarding that instance. The application should not attempt to use the handle, previously allocated to that instance, after calling this operation.

When this operation is used, the Data Distribution Service will automatically supply the value of the source_timestamp that is made available to connected DataReader objects. This timestamp is important for the interpretation of the DestinationOrderQosPolicy.

Effects

If, after unregistering, the application wants to modify (write or dispose) the instance, it has to register the instance again, or it has to use the special handle value HANDLE_NIL.

This operation does not indicate that the instance should be deleted (that is the purpose of dispose). This operation just indicates that the DataWriter no longer has "anything to say" about the instance. If there is no other DataWriter that has registered the instance as well, then the InstanceStateKind in all connected DataReaders will be changed to NOT_ALIVE_NO_WRITERS_ INSTANCE_STATE, provided this InstanceStateKind was not already set to NOT_ALIVE_DISPOSED_INSTANCE_STATE. In the last case the InstanceStateKind will not be effected by the unregister_instance call, see also Figure 21, *State Chart of the instance_state for a Single Instance*, on page 564.

This operation can affect the ownership of the data instance. If the DataWriter was the exclusive owner of the instance, calling this operation will release that ownership, meaning ownership may be transferred to another, possibly lower strength, DataWriter.

The operation must be called only on registered instances. Otherwise the operation returns the error RETCODE_PRECONDITION_NOT_MET.

Instance Handle

The HANDLE_NIL handle value can be used for the parameter handle. This indicates that the identity of the instance is automatically deduced from the instance_data (by means of the key).

If handle is any value other than HANDLE_NIL, then it must correspond to the value returned by register_instance or register_instance_w_timestamp when the instance (identified by its key) was registered. If there is no correspondence, the result of the operation is unspecified.

The sample that is passed as instance_data is only used to check for consistency between its key values and the supplied instance_handle: the sample itself will not actually be delivered to the connected DataReaders.

Blocking

If the HistoryQosPolicy is set to KEEP_ALL_HISTORY_QOS, the unregister_instance operation on the DataWriter may block if the modification would cause data to be lost because one of the limits, specified in the ResourceLimitsQosPolicy, to be exceeded. In case the synchronous attribute value of the ReliabilityQosPolicy is set to TRUE for communicating DataWriters and DataReaders then the DataWriter will wait until all synchronous DataReaders have acknowledged the data. Under these circumstances, the max_blocking_time attribute of the ReliabilityQosPolicy configures the maximum time the unregister_instance operation may block (either waiting for space to become available or data to be acknowledged). If max_blocking_time elapses before the DataWriter is able to store the modification without exceeding the limits and all expected acknowledgements are received, the unregister_instance operation will fail and returns RETCODE_TIMEOUT.

Sample Validation

OpenSplice DDS offers the possibility to check the sample that is passed as instance_data for validity. Because validity checking might reduce the overall performance, it is by default disabled. This has been done by enclosing the validity checking with conditional compiler directives like this:

```
#ifdef OSPL_BOUNDS_CHECK
    // check a specific bound.
#endif
```

i By defining a macro called `OSPL_OSPL_BOUNDS_CHECK`, the validity checking will be included. On most compilers this macro can be defined by passing an additional command line parameter called `-DOSPL_BOUNDS_CHECK`.

Since the `unregister_instance` operation merely uses the sample to check for consistency between its `key` values and the supplied `instance_handle`, only these keyfields will be validated against the restrictions imposed by the IDL to C++ language mapping, where:

- an enum may not exceed the value of its highest label
- a string (bounded or unbounded) may not be `NULL`. (Use `""` for an empty string instead)
- the length of a bounded string may not exceed the limit specified in IDL

If any of these restrictions is violated when validity checking is enabled, the operation will fail and return a `RETCODE_BAD_PARAMETER`. More specific information about the context of this error will be written to the error log. When validity checking is disabled, any of these violations may result in undefined behaviour.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the Data Distribution Service is informed that the instance will not be modified any more
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_BAD_PARAMETER`* - `handle` is not a valid handle or `instance_data` is not a valid sample.
- *`RETCODE_ALREADY_DELETED`* - the `FooDataWriter` has already been deleted
- *`RETCODE_NOT_ENABLED`* - the `FooDataWriter` is not enabled.
- *`RETCODE_PRECONDITION_NOT_MET`* - the `handle` has not been registered with this `FooDataWriter`.
- *`RETCODE_TIMEOUT`* - either the current action overflowed the available resources as specified by the combination of the `ReliabilityQosPolicy`, `HistoryQosPolicy` and `ResourceLimitsQosPolicy`, or the current action was waiting for data delivery acknowledgement by synchronous `DataReaders`. This caused blocking of the `unregister_instance` operation, which could not be resolved before `max_blocking_time` of the `ReliabilityQosPolicy` elapsed.

3.4.2.55 unregister_instance_w_timestamp

Scope

`SPACE::FooDataWriter`

Synopsis

```
#include <ccpp_Space.h>
       ReturnCode_t
          unregister_instance_w_timestamp
            (const Foo& instance_data,
              InstanceHandle_t handle,
              const Time_t& source_timestamp);
```

Description

This operation will inform the Data Distribution Service that the application will **not** be modifying a particular instance any more and provides a value for the `source_timestamp` explicitly.

Parameters

`in Foo instance_data` - the instance to which the application was writing or disposing.

`in InstanceHandle_t handle` - the handle to the instance, which has been used for writing and disposing.

`in const Time_t& source_timestamp` - the timestamp used.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_BAD_PARAMETER`, `RETCODE_ALREADY_DELETED`, `RETCODE_OUT_OF_RESOURCES`, `RETCODE_NOT_ENABLED`, `RETCODE_PRECONDITION_NOT_MET` or `RETCODE_TIMEOUT`.

Detailed Description

This operation performs the same functions as `unregister_instance` except that the application provides the value for the `source_timestamp` that is made available to connected `DataReader` objects. This timestamp is important for the interpretation of the `DestinationOrderQosPolicy`.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the Data Distribution Service is informed that the instance will not be modified any more

- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - `handle` is not a valid handle or `instance_data` is not a valid sample.
- *RETCODE_ALREADY_DELETED* - the `FooDataWriter` has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_NOT_ENABLED* - the `FooDataWriter` is not enabled.
- *RETCODE_PRECONDITION_NOT_MET* - the `handle` has not been registered with this `FooDataWriter`.
- *RETCODE_TIMEOUT* - either the current action overflowed the available resources as specified by the combination of the `ReliabilityQosPolicy`, `HistoryQosPolicy` and `ResourceLimitsQosPolicy`, or the current action was waiting for data delivery acknowledgement by synchronous `DataReaders`. This caused blocking of the `unregister_instance_w_timestamp` operation, which could not be resolved before `max_blocking_time` of the `ReliabilityQosPolicy` elapsed.

3.4.2.56 wait_for_acknowledgments (inherited)

This operation is inherited and therefore not described here. See the class `DataWriter` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
ReturnCode_t
   wait_for_acknowledgments
      (const Duration_t& max_wait);
```

3.4.2.57 write

Scope

```
SPACE::FooDataWriter
```

Synopsis

```
#include <ccpp_Space.h>
       ReturnCode_t
          write
            (const Foo& instance_data,
              InstanceHandle_t handle);
```

Description

This operation modifies the value of a data instance.

Parameters

in const Foo& instance_data - the data to be written.

in InstanceHandle_t handle - the handle to the instance as supplied by register_instance.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES, RETCODE_NOT_ENABLED, RETCODE_PRECONDITION_NOT_MET or RETCODE_TIMEOUT.

Detailed Description

This operation modifies the value of a data instance. When this operation is used, the Data Distribution Service will automatically supply the value of the source_timestamp that is made available to connected DataReader objects. This timestamp is important for the interpretation of the DestinationOrderQosPolicy.

As a side effect, this operation asserts liveliness on the DataWriter itself and on the containing DomainParticipant.

Before writing data to an instance, the instance may be registered with the register_instance or register_instance_w_timestamp operation. The handle returned by one of the register_instance operations can be supplied to the parameter handle of the write operation. However, it is also possible to supply the special HANDLE_NIL handle value, which means that the identity of the instance is automatically deduced from the instance_data (identified by the key).

Instance Handle

The HANDLE_NIL handle value can be used for the parameter handle. This indicates the identity of the instance is automatically deduced from the instance_data (by means of the key).

If handle is any value other than HANDLE_NIL, it must correspond to the value returned by register_instance or register_instance_w_timestamp when the instance (identified by its key) was registered. Passing such a registered handle helps the Data Distribution Service to process the sample more efficiently. If there is no correspondence between handle and sample, the result of the operation is unspecified.

Blocking

If the HistoryQosPolicy is set to KEEP_ALL_HISTORY_QOS, the write operation on the DataWriter may block if the modification would cause data to be lost because one of the limits, specified in the ResourceLimitsQosPolicy, is exceeded. In case the synchronous attribute value of the ReliabilityQosPolicy is set to TRUE for communicating DataWriters and DataReaders then the DataWriter will wait until all synchronous DataReaders have acknowledged the data. Under these circumstances, the max_blocking_time attribute of the ReliabilityQosPolicy configures the maximum time the write operation may block (either waiting for space to become available or data to be acknowledged). If max_blocking_time elapses before the DataWriter is able to store the modification without exceeding the limits and all expected acknowledgements are received, the write operation will fail and returns RETCODE_TIMEOUT.

Sample Validation

OpenSplice DDS offers the possibility to check the sample that is passed as instance_data for validity. Because validity checking might reduce the overall performance, it is by default disabled. This has been done by enclosing the validity checking with conditional compiler directives like this:

```
#ifdef OSPL_BOUNDS_CHECK
    // check a specific bound.
#endif
```

i By defining a macro called OSPL_OSPL_BOUNDS_CHECK, the validity checking will be included. On most compilers this macro can be defined by passing an additional command line parameter called -DOSPL_BOUNDS_CHECK.

Before the sample is accepted by the DataWriter, it is validated against the restrictions imposed by the IDL to C++ language mapping, where:

- an enum may not exceed the value of its highest label
- a string (bounded or unbounded) may not be NULL. (Use "" for an empty string instead)
- the length of a bounded string may not exceed the limit specified in IDL
- the length of a bounded sequence may not exceed the limit specified in IDL

If any of these restrictions is violated when validity checking is enabled, the operation will fail and return a RETCODE_BAD_PARAMETER. More specific information about the context of this error will be written to the error log. When validity checking is disabled, any of these violations may result in undefined behaviour.

Be aware that it is not possible for the middleware to determine whether a union is correctly initialized, since according to the IDL-C++ language mapping a union just returns its current contents in the format of the requested branch without performing any checks. It is therefore the responsibility of the application programmer to make sure that the requested branch actually corresponds to the currently active branch. Not doing so may result in undefined behaviour as well.

Return Code

When the operation returns:

- *RETCODE_OK* - the value of a data instance is modified
- *RETCODE_ERROR* - an internal error has occurred
- *RETCODE_BAD_PARAMETER* - `handle` is not a valid handle or `instance_data` is not a valid sample.
- *RETCODE_ALREADY_DELETED* - the `FooDataWriter` has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_NOT_ENABLED* - the `FooDataWriter` is not enabled.
- *RETCODE_PRECONDITION_NOT_MET* - the `handle` has not been registered with this `FooDataWriter`.
- *RETCODE_TIMEOUT* - either the current action overflowed the available resources as specified by the combination of the `ReliabilityQosPolicy`, `HistoryQosPolicy` and `ResourceLimitsQosPolicy`, or the current action was waiting for data delivery acknowledgement by synchronous `DataReaders`. This caused blocking of the `write` operation, which could not be resolved before `max_blocking_time` of the `ReliabilityQosPolicy` elapsed.

3.4.2.58 write_w_timestamp

Scope

`SPACE::FooDataWriter`

Synopsis

```
#include <ccpp_Space.h>
       ReturnCode_t
          write_w_timestamp
            (const Foo& instance_data,
              InstanceHandle_t handle,
              const Time_t& source_timestamp);
```

Description

This operation modifies the value of a data instance and provides a value for the `source_timestamp` explicitly.

Parameters

`in const Foo& instance_data` - the data to be written.

`in InstanceHandle_t handle` - the handle to the instance as supplied by `register_instance`.

`in const Time_t& source_timestamp` - the timestamp used.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_BAD_PARAMETER`, `RETCODE_ALREADY_DELETED`, `RETCODE_OUT_OF_RESOURCES`, `RETCODE_NOT_ENABLED`, `RETCODE_PRECONDITION_NOT_MET` or `RETCODE_TIMEOUT`.

Detailed Description

This operation performs the same functions as `write` except that the application provides the value for the parameter `source_timestamp` that is made available to connected `DataReader` objects. This timestamp is important for the interpretation of the `DestinationOrderQosPolicy`.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the value of a data instance is modified
- *`RETCODE_ERROR`* - an internal error has occurred
- *`RETCODE_BAD_PARAMETER`* - `handle` is not a valid handle or `instance_data` is not a valid sample.
- *`RETCODE_ALREADY_DELETED`* - the `FooDataWriter` has already been deleted
- *`RETCODE_OUT_OF_RESOURCES`* - the Data Distribution Service ran out of resources to complete this operation.
- *`RETCODE_NOT_ENABLED`* - the `FooDataWriter` is not enabled.
- *`RETCODE_PRECONDITION_NOT_MET`* - the `handle` has not been registered with this `FooDataWriter`.
- *`RETCODE_TIMEOUT`* - either the current action overflowed the available resources as specified by the combination of the `ReliabilityQosPolicy`, `HistoryQosPolicy` and `ResourceLimitsQosPolicy`, or the current action was waiting for data delivery acknowledgement by synchronous `DataReaders`.

This caused blocking of the write_w_timestamp operation, which could not be resolved before max_blocking_time of the ReliabilityQosPolicy elapsed.

3.4.2.59 writedispose

Scope

SPACE::FooDataWriter

Synopsis

```
#include <ccpp_Space.h>
       ReturnCode_t
          writedispose
              (const Foo& instance_data,
               InstanceHandle_t handle);
```

Description

This operation modifies and disposes a data instance.

Parameters

in const Foo& instance_data - the data to be written and disposed.

in InstanceHandle_t handle - the handle to the instance as supplied by register_instance.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES, RETCODE_NOT_ENABLED, RETCODE_PRECONDITION_NOT_MET or RETCODE_TIMEOUT.

Detailed Description

This operation requests the Data Distribution Service to modify the instance and mark it for deletion. Copies of the instance and its corresponding samples, which are stored in every connected DataReader and, dependent on the QoSPolicy settings, also in the Transient and Persistent stores, will be modified and marked for deletion by setting their InstanceStateKind to NOT_ALIVE_DISPOSED_INSTANCE_STATE.

When this operation is used, the Data Distribution Service will automatically supply the value of the source_timestamp that is made available to connected DataReader objects. This timestamp is important for the interpretation of the DestinationOrderQosPolicy.

As a side effect, this operation asserts liveliness on the DataWriter itself and on the containing DomainParticipant.

Effects on DataReaders

Actual deletion of the instance administration in a connected DataReader will be postponed until the following conditions have been met:

- the instance must be unregistered (either implicitly or explicitly) by all connected DataWriters that have previously registered it.
  - A DataWriter can register an instance explicitly by using one of the special operations register_instance or register_instance_w_timestamp.
  - A DataWriter can register an instance implicitly by using the special constant HANDLE_NIL in any of the other DataWriter operations.
  - A DataWriter can unregister an instance explicitly by using one of the special operations unregister_instance or unregister_instance_w_timestamp.
  - A DataWriter will unregister all its contained instances implicitly when it is deleted.
  - When a DataReader detects a loss of liveliness in one of its connected DataWriters, it will consider all instances registered by that DataWriter as being implicitly unregistered.
- ***and*** the application must have consumed all samples belonging to the instance, either implicitly or explicitly.
  - An application can consume samples explicitly by invoking the take operation, or one of its variants, on its DataReaders.
  - The DataReader can consume disposed samples implicitly when the autopurge_disposed_samples_delay of the ReaderDataLifecycleQosPolicy has expired.

The DataReader may also remove instances that haven't been disposed first: this happens when the autopurge_nowriter_samples_delay of the ReaderDataLifecycleQosPolicy has expired after the instance is considered unregistered by all connected DataWriters (i.e. when it has a InstanceStateKind of NOT_ALIVE_NO_WRITERS). See also Section 3.1.3.15, *ReaderDataLifecycleQosPolicy*, on page 71.

Effects on Transient/Persistent Stores

Actual deletion of the instance administration in the connected Transient and Persistent stores will be postponed until the following conditions have been met:

- the instance must be unregistered (either implicitly or explicitly) by all connected DataWriters that have previously registered it. (See above.)

- ***and*** the period of time specified by the service_cleanup_delay attribute in the DurabilityServiceQosPolicy on the Topic must have elapsed after the instance is considered unregistered by all connected DataWriters.

See also Section 3.1.3.4, *DurabilityServiceQosPolicy*, on page 49.

Instance Handle

The HANDLE_NIL handle value can be used for the parameter handle. This indicates the identity of the instance is automatically deduced from the instance_data (by means of the key).

If handle is any value other than HANDLE_NIL, it must correspond to the value that was returned by either the register_instance operation or the register_instance_w_timestamp operation, when the instance (identified by its key) was registered. If there is no correspondence, the result of the operation is unspecified.

The sample that is passed as instance_data will actually be delivered to the connected DataReaders, but will immediately be marked for deletion.

Blocking

If the HistoryQosPolicy is set to KEEP_ALL_HISTORY_QOS, the writedispose operation on the DataWriter may block if the modification would cause data to be lost because one of the limits, specified in the ResourceLimitsQosPolicy, to be exceeded. In case the synchronous attribute value of the ReliabilityQosPolicy is set to TRUE for communicating DataWriters and DataReaders then the DataWriter will wait until all synchronous DataReaders have acknowledged the data. Under these circumstances, the max_blocking_time attribute of the ReliabilityQosPolicy configures the maximum time the writedispose operation may block (either waiting for space to become available or data to be acknowledged). If max_blocking_time elapses before the DataWriter is able to store the modification without exceeding the limits and all expected acknowledgements are received, the writedispose operation will fail and returns RETCODE_TIMEOUT.

Sample Validation

OpenSplice DDS offers the possibility to check the sample that is passed as instance_data for validity. Because validity checking might reduce the overall performance, it is by default disabled. This has been done by enclosing the validity checking with conditional compiler directives like this:

```
#ifdef OSPL_BOUNDS_CHECK
    // check a specific bound.
#endif
```

i By defining a macro called `OSPL_OSPL_BOUNDS_CHECK`, the validity checking will be included. On most compilers this macro can be defined by passing an additional command line parameter called `-DOSPL_BOUNDS_CHECK`.

Before the sample is accepted by the DataWriter, it is validated against the restrictions imposed by the IDL to C++ language mapping, where:

- an enum may not exceed the value of its highest label
- a string (bounded or unbounded) may not be `NULL`. (Use `""` for an empty string instead)
- the length of a bounded string may not exceed the limit specified in IDL
- the length of a bounded sequence may not exceed the limit specified in IDL

If any of these restrictions is violated when validity checking is enabled, the operation will fail and return a `RETCODE_BAD_PARAMETER`. More specific information about the context of this error will be written to the error log. When validity checking is disabled, any of these violations may result in undefined behaviour.

 Be aware that it is not possible for the middleware to determine whether a union is correctly initialized, since according to the IDL-C++ language mapping a union just returns its current contents in the format of the requested branch without performing any checks. It is therefore the responsibility of the application programmer to make sure that the requested branch actually corresponds to the currently active branch. Not doing so may result in undefined behaviour as well.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the Data Distribution Service has modified the instance and marked it for deletion.
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_BAD_PARAMETER`* - `handle` is not a valid handle or `instance_data` is not a valid sample.
- *`RETCODE_ALREADY_DELETED`* - the `FooDataWriter` has already been deleted.
- *`RETCODE_OUT_OF_RESOURCES`* - the Data Distribution Service ran out of resources to complete this operation.
- *`RETCODE_NOT_ENABLED`* - the `FooDataWriter` is not enabled.
- *`RETCODE_PRECONDITION_NOT_MET`* - the `handle` has not been registered with this `SPACE_FooDataWriter`.

- *RETCODE_TIMEOUT* - either the current action overflowed the available resources as specified by the combination of the ReliabilityQosPolicy, HistoryQosPolicy and ResourceLimitsQosPolicy, or the current action was waiting for data delivery acknowledgement by synchronous DataReaders. This caused blocking of the writedispose operation, which could not be resolved before max_blocking_time of the ReliabilityQosPolicy elapsed.

3.4.2.60 writedispose_w_timestamp

Scope

SPACE::FooDataWriter

Synopsis

```
#include <ccpp_Space.h>
       ReturnCode_t
          writedispose_w_timestamp
              (const Foo& instance_data,
               InstanceHandle_t handle,
               const Time_t& source_timestamp);
```

Description

This operation requests the Data Distribution Service to modify the instance and mark it for deletion, and provides a value for the source_timestamp explicitly.

Parameters

in const Foo& instance_data - the data to be written and disposed.

in InstanceHandle_t handle - the handle to the instance as supplied by register_instance.

in const Time_t& source_timestamp - the timestamp used.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES, RETCODE_NOT_ENABLED, RETCODE_PRECONDITION_NOT_MET or RETCODE_TIMEOUT.

Detailed Description

This operation performs the same functions as writedispose except that the application provides the value for the source_timestamp that is made available to connected DataReader objects. This timestamp is important for the interpretation of the DestinationOrderQosPolicy.

Return Code

When the operation returns:

- *RETCODE_OK* - the Data Distribution Service has modified the instance and marked it for deletion.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - `handle` is not a valid handle or `instance_data` is not a valid sample.
- *RETCODE_ALREADY_DELETED* - the `FooDataWriter` has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_NOT_ENABLED* - the `FooDataWriter` is not enabled.
- *RETCODE_PRECONDITION_NOT_MET* - the `handle` has not been registered with this `SPACE_FooDataWriter`.
- *RETCODE_TIMEOUT* - either the current action overflowed the available resources as specified by the combination of the `ReliabilityQosPolicy`, `HistoryQosPolicy` and `ResourceLimitsQosPolicy`, or the current action was waiting for data delivery acknowledgement by synchronous `DataReaders`. This caused blocking of the `writedispose_w_timestamp` operation, which could not be resolved before `max_blocking_time` of the `ReliabilityQosPolicy` elapsed.

3.4.3 PublisherListener Interface

Since a `Publisher` is an `Entity`, it has the ability to have a `Listener` associated with it. In this case, the associated `Listener` should be of type `PublisherListener`. This interface must be implemented by the application. A user-defined class must be provided by the application which must extend from the `PublisherListener` class. **All** `PublisherListener` operations **must** be implemented in the user-defined class, it is up to the application whether an operation is empty or contains some functionality.

All operations for this interface must be implemented in the user-defined class, it is up to the application whether an operation is empty or contains some functionality.

The `PublisherListener` provides a generic mechanism (actually a callback function) for the Data Distribution Service to notify the application of relevant asynchronous status change events, such as a missed deadline, violation of a `QosPolicy` setting, etc. The `PublisherListener` is related to changes in communication status.

The interface description of this class is as follows:

```
class PublisherListener {
//
// inherited from DataWriterListener
//
// void
//    on_offered_deadline_missed
//       (DataWriter_ptr writer,
//       const OfferedDeadlineMissedStatus& status) = 0;

// void
//    on_offered_incompatible_qos
//       (DataWriter_ptr writer,
//       const OfferedIncompatibleQosStatus& status) = 0;

// void
//    on_liveliness_lost
//       (DataWriter_ptr writer,
//       const LivelinessLostStatus& status) = 0;

// void
//    on_publication_matched
//       (DataWriter_ptr writer,
//       const PublicationMatchedStatus& status) = 0;
//
// implemented API operations
//       <no operations>
//
};
```

The next paragraphs list all `PublisherListener` operations. Since these operations are all inherited, they are listed but not fully described because they are not implemented in this class. The full description of these operations is given in the classes from which they are inherited.

3.4.3.1 on_liveliness_lost (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataWriterListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_liveliness_lost
      (DataWriter_ptr writer,
        const LivelinessLostStatus& status) = 0;
```

3.4.3.2 on_offered_deadline_missed (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataWriterListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_offered_deadline_missed
      (DataWriter_ptr writer,
        const OfferedDeadlineMissedStatus& status) = 0;
```

3.4.3.3 on_offered_incompatible_qos (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataWriterListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_offered_incompatible_qos
      (DataWriter_ptr writer,
        const OfferedIncompatibleQosStatus& status) = 0;
```

3.4.3.4 on_publication_matched (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataWriterListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_publication_matched
      (DataWriter_ptr writer,
        const PublicationMatchedStatus& status) = 0;
```

3.4.4 DataWriterListener Interface

Since a `DataWriter` is an `Entity`, it has the ability to have a `Listener` associated with it. In this case, the associated `Listener` should be of type `DataWriterListener`. This interface must be implemented by the application. A user-defined class must be provided by the application which must extend from the `DataWriterListener` class. **All** `DataWriterListener` operations **must** be implemented in the user-defined class, it is up to the application whether an operation is empty or contains some functionality.

All operations for this interface must be implemented in the user-defined class, it is up to the application whether an operation is empty or contains some functionality.

The DataWriterListener provides a generic mechanism (actually a callback function) for the Data Distribution Service to notify the application of relevant asynchronous status change events, such as a missed deadline, violation of a QosPolicy setting, etc. The DataWriterListener is related to changes in communication status.

The interface description of this class is as follows:

```
class DataWriterListener
{
// abstract external operations
   void
      on_offered_deadline_missed
         (DataWriter_ptr writer,
         const OfferedDeadlineMissedStatus& status) = 0;

   void
      on_offered_incompatible_qos
         (DataWriter_ptr writer,
         const OfferedIncompatibleQosStatus& status) = 0;

   void
      on_liveliness_lost
         (DataWriter_ptr writer,
         const LivelinessLostStatus& status) = 0;

   void
      on_publication_matched
         (DataWriter_ptr writer,
         const PublicationMatchedStatus& status) = 0;
// implemented API operations
//      <no operations>
   };
```

The next paragraphs describe the usage of all DataWriterListener operations. These abstract operations are fully described because they must be implemented by the application.

3.4.4.1 on_liveliness_lost (abstract)

Scope

DDS::DataWriterListener

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_liveliness_lost
      (DataWriter_ptr writer,
        const LivelinessLostStatus& status) = 0;
```

Description

This operation must be implemented by the application and is called by the Data Distribution Service when the `LivelinessLostStatus` changes.

Parameters

in DataWriter_ptr writer - contains a pointer to the `DataWriter` on which the `LivelinessLostStatus` has changed (this is an input to the application).

in const LivelinessLostStatus& status - contains the `LivelinessLostStatus` struct (this is an input to the application).

Return Value

<none>

Detailed Description

This operation is the external operation (interface, which must be implemented by the application) that is called by the Data Distribution Service when the `LivelinessLostStatus` changes. The implementation may be left empty when this functionality is not needed. This operation will only be called when the relevant `DataWriterListener` is installed and enabled for the liveliness lost status. The liveliness lost status will change when the liveliness that the `DataWriter` has committed through its `LivelinessQosPolicy` was not respected. In other words, the `DataWriter` failed to actively signal its liveliness within the offered liveliness period. As a result, the `DataReader` objects will consider the `DataWriter` as no longer "alive".

The Data Distribution Service will call the `DataWriterListener` operation with a parameter `writer`, which will contain a reference to the `DataWriter` on which the conflict occurred and a parameter `status`, which will contain the `LivelinessLostStatus` struct.

3.4.4.2 on_offered_deadline_missed (abstract)

Scope

`DDS::DataWriterListener`

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_offered_deadline_missed
      (DataWriter_ptr writer,
        const OfferedDeadlineMissedStatus& status) = 0;
```

Description

This operation must be implemented by the application and is called by the Data Distribution Service when the `OfferedDeadlineMissedStatus` changes.

Parameters

`in DataWriter_ptr writer` - contain a pointer to the `DataWriter` on which the `OfferedDeadlineMissedStatus` has changed (this is an input to the application).

`in const OfferedDeadlineMissedStatus& status` - contain the `OfferedDeadlineMissedStatus` struct (this is an input to the application).

Return Value

<none>

Detailed Description

This operation is the external operation (interface, which must be implemented by the application) that is called by the Data Distribution Service when the `OfferedDeadlineMissedStatus` changes. The implementation may be left empty when this functionality is not needed. This operation will only be called when the relevant `DataWriterListener` is installed and enabled for the offered deadline missed status. The offered deadline missed status will change when the deadline that the `DataWriter` has committed through its `DeadlineQosPolicy` was not respected for a specific instance.

The Data Distribution Service will call the `DataWriterListener` operation with a parameter `writer`, which will contain a reference to the `DataWriter` on which the conflict occurred and a parameter `status`, which will contain the `OfferedDeadlineMissedStatus` struct.

3.4.4.3 on_offered_incompatible_qos (abstract)

Scope

`DDS::DataWriterListener`

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_offered_incompatible_qos
      (DataWriter_ptr writer,
        const OfferedIncompatibleQosStatus& status) = 0;
```

Description

This operation must be implemented by the application and is called by the Data Distribution Service when the OFFERED_INCOMPATIBLE_QOS_STATUS changes.

Parameters

in DataWriter_ptr writer - contain a pointer to the DataWriter on which the OFFERED_INCOMPATIBLE_QOS_STATUS has changed (this is an input to the application).

in const OfferedIncompatibleQosStatus& status - contain the OfferedIncompatibleQosStatus struct (this is an input to the application).

Return Value

<none>

Detailed Description

This operation is the external operation (interface, which must be implemented by the application) that is called by the Data Distribution Service when the OFFERED_INCOMPATIBLE_QOS_STATUS changes. The implementation may be left empty when this functionality is not needed. This operation will only be called when the relevant DataWriterListener is installed and enabled for the OFFERED_INCOMPATIBLE_QOS_STATUS. The incompatible Qos status will change when a DataReader object has been discovered by the DataWriter with the same Topic and a requested DataReaderQos that was incompatible with the one offered by the DataWriter.

The Data Distribution Service will call the DataWriterListener operation with a parameter writer, which will contain a reference to the DataWriter on which the conflict occurred and a parameter status, which will contain the OfferedIncompatibleQosStatus struct.

3.4.4.4 on_publication_matched (abstract)

Scope

DDS::DataWriterListener

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_publication_matched
      (DataWriter_ptr writer,
        const PublicationMatchedStatus& status) = 0;
```

Description

This operation must be implemented by the application and is called by the Data Distribution Service when a new match has been discovered for the current publication, or when an existing match has ceased to exist.

Parameters

in DataWriter_ptr writer - contains a pointer to the DataWriter for which a match has been discovered (this is an input to the application provided by the Data Distribution Service).

in const PublicationMatchedStatus& status - contains the *PublicationMatchedStatus* struct (this is an input to the application provided by the Data Distribution Service).

Return Value

<none>

Detailed Description

This operation must be implemented by the application and is called by the Data Distribution Service when a new match has been discovered for the current publication, or when an existing match has ceased to exist. Usually this means that a new DataReader that matches the Topic and that has compatible Qos as the current DataWriter has either been discovered, or that a previously discovered DataReader has ceased to be matched to the current DataWriter. A DataReader may cease to match when it gets deleted, when it changes its Qos to a value that is incompatible with the current DataWriter or when either the DataWriter or the DataReader has chosen to put its matching counterpart on its ignore-list using the ignore_subcription or ignore_publication operations on the DomainParticipant.

The implementation of this Listener operation may be left empty when this functionality is not needed: it will only be called when the relevant DataWriterListener is installed and enabled for the PUBLICATION_MATCHED_STATUS.

The Data Distribution Service will provide a pointer to the DataWriter in the parameter writer and the PublicationMatchedStatus struct in the parameter status for use by the application.

3.5 Subscription Module

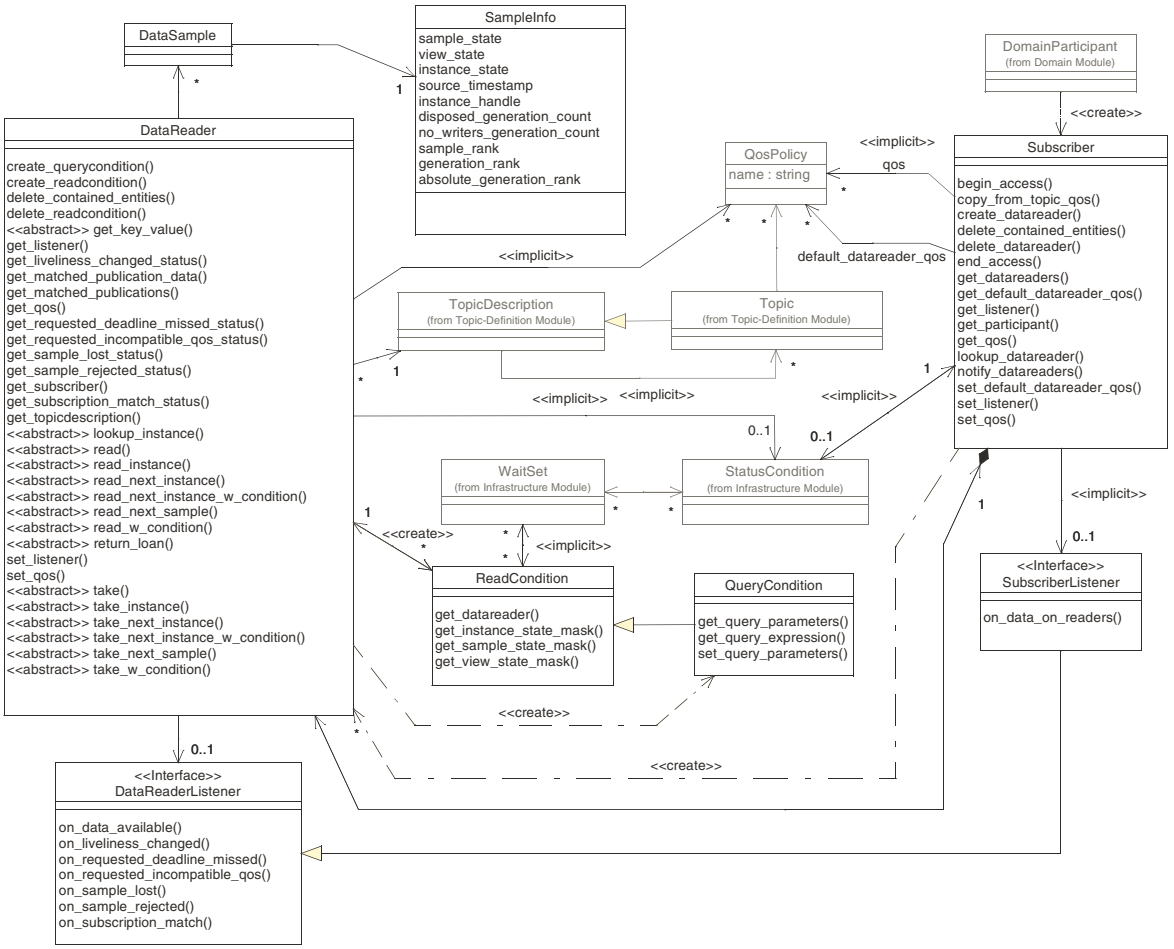

Figure 19 DCPS Subscription Module's Class Model

This module contains the following classes:

- `Subscriber`
- Subscription type specific classes
- `DataSample`
- `SampleInfo` (struct)
- `SubscriberListener` (interface)
- `DataReaderListener` (interface)
- `ReadCondition`
- `QueryCondition`.

"Subscription type specific classes" contains the generic class and the generated data type specific classes. For each data type, a data type specific class `<type>DataReader` is generated (based on IDL) by calling the pre-processor.

For instance, for the fictional data type `Foo` (this also applies to other types) "Subscription type specific classes" contains the following classes:

- `DataReader (abstract)`
- `FooDataReader`
- `DataReaderView (abstract)`
- `FooDataReaderView`

A `Subscriber` is an object responsible for receiving published data and making it available (according to the `SubscriberQos`) to the application. It may receive and dispatch `Topic` with data of different specified data types. To access the received data, the application must use a typed `DataReader` attached to the `Subscriber`. Thus, a subscription is defined by the association of a `DataReader` with a `Subscriber`. This association expresses the intent of the application to subscribe to the data described by the `DataReader` in the context provided by the `Subscriber`.

3.5.1 Class Subscriber

A `Subscriber` is the object responsible for the actual reception of the data resulting from its subscriptions.

A `Subscriber` acts on behalf of one or more `DataReader` objects that are related to it. When it receives data (from the other parts of the system), it indicates to the application that data is available through its `DataReaderListener` and by enabling related `Conditions`. The application can access the list of concerned `DataReader` objects through the operation `get_datareaders` and then access the data available through operations on the `DataReader`.

The interface description of this class is as follows:

```
class Subscriber
{
//
// inherited from class Entity
//
// StatusCondition_ptr
//    get_statuscondition
//       (void);
// StatusMask
//    get_status_changes
//       (void);
// ReturnCode_t
//    enable
//       (void);
//
```

```
// implemented API operations
//
    DataReader_ptr
       create_datareader
          (TopicDescription_ptr a_topic,
          const DataReaderQos& qos,
          DataReaderListener_ptr a_listener,
          StatusMask mask);

    ReturnCode_t
       delete_datareader
          (DataReader_ptr a_datareader);

    ReturnCode_t
       delete_contained_entities
          (void);

    DataReader_ptr
       lookup_datareader
          (const char* topic_name);

    ReturnCode_t
       get_datareaders
          (DataReaderSeq& readers,
          SampleStateMask sample_states,
          ViewStateMask view_states,
          InstanceStateMask instance_states);

    ReturnCode_t
       notify_datareaders
          (void);

    ReturnCode_t
       set_qos
          (const SubscriberQos& qos);

    ReturnCode_t
       get_qos
          (SubscriberQos& qos);
    ReturnCode_t
       set_listener
          (SubscriberListener_ptr a_listener,
            StatusMask mask);

    SubscriberListener_ptr
       get_listener
          (void);

    ReturnCode_t
       begin_access
```

```
            (void);

        ReturnCode_t
           end_access
              (void);

        DomainParticipant_ptr
           get_participant
              (void);

        ReturnCode_t
           set_default_datareader_qos
              (const DataReaderQos& qos);

        ReturnCode_t
           get_default_datareader_qos
              (DataReaderQos& qos);

        ReturnCode_t
           copy_from_topic_qos
              (DataReaderQos& a_datareader_qos,
              const TopicQos& a_topic_qos);
    };
```

The next paragraphs describe the usage of all `Subscriber` operations. The inherited operations are listed but not fully described because they are not implemented in this class. The full description of these operations is given in the classes from which they are inherited.

3.5.1.1 begin_access

Scope

`DDS::Subscriber`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   begin_access
      (void);
```

Description

This operation indicates that the application will begin accessing a coherent and/or ordered set of modifications that spans multiple DataReaders attached to this Subscriber. The access will be completed by a matching call to `end_access`.

Parameters

<none>

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR or RETCODE_ALREADY_DELETED.

Detailed Description

This operation indicates that the application is about to access a set of coherent and/or ordered samples in any of the DataReader objects attached to the Subscriber. The operation will effectively lock all of the Subscriber's DataReader objects for any incoming modifications, so that the state of their history remains consistent for the duration of the access.

The application is required to use this operation only if the PresentationQosPolicy of the Subscriber to which the DataReader belongs has the access_scope set to 'GROUP'. In the aforementioned case, the operation begin_access must be called prior to calling any of the sample-accessing operations, namely: get_datareaders on the Subscriber and read, take, and all their variants on any DataReader. Otherwise the sample-accessing operations will return the error RETCODE_PRECONDITION_NOT_MET. Once the application has finished accessing the data samples it must call end_access.

It is not required for the application to call begin_access/end_access if the PresentationQosPolicy has the access_scope set to something other than 'GROUP'. Calling begin_access/end_access in this case is not considered an error and has no effect.

The calls to begin_access/end_access may be nested. In that case, the application must call end_access as many times as it called begin_access.

Return Code

When the operation returns:

- *RETCODE_OK* - access to coherent/ordered data has successfully started.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the Subscriber has already been deleted.

3.5.1.2 copy_from_topic_qos

Scope

DDS::Subscriber

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   copy_from_topic_qos
      (DataReaderQos& a_datareader_qos,
```

```
        const TopicQos& a_topic_qos);
```

Description

This operation will copy the policies in `a_topic_qos` to the corresponding policies in `a_datareader_qos`.

Parameters

`inout DataReaderQos& a_datareader_qos` - the destination `DataReaderQos` struct to which the `QosPolicy` settings will be copied.

`in const TopicQos& a_topic_qos` - the source `TopicQos`, which will be copied.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_ALREADY_DELETED` or `RETCODE_OUT_OF_RESOURCES`.

Detailed Description

This operation will copy the `QosPolicy` settings in `a_topic_qos` to the corresponding `QosPolicy` settings in `a_datareader_qos` (replacing the values in `a_datareader_qos`, if present).

This is a "convenience" operation, useful in combination with the operations `get_default_datawriter_qos` and `Topic::get_qos`. The operation `copy_from_topic_qos` can be used to merge the `DataReader` default `QosPolicy` settings with the corresponding ones on the `Topic`. The resulting `DataReaderQos` can then be used to create a new `DataReader`, or set its `DataReaderQos`.

This operation does not check the resulting `a_datareader_qos` for self consistency. This is because the "merged" `a_datareader_qos` may not be the final one, as the application can still modify some `QosPolicy` settings prior to applying the `DataReaderQos` to the `DataReader`.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the `QosPolicy` settings have successfully been copied from the `TopicQos` to the `DataReaderQos`
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_ALREADY_DELETED`* - the `Subscriber` has already been deleted.
- *`RETCODE_OUT_OF_RESOURCES`* - the Data Distribution Service ran out of resources to complete this operation.

3.5.1.3 create_datareader

Scope

`DDS::Subscriber`

Synopsis

```
#include <ccpp_dds_dcps.h>
DataReader_ptr
   create_datareader
      (TopicDescription_ptr a_topic,
        const DataReaderQos& qos,
        DataReaderListener_ptr a_listener,
        StatusMask mask);
```

Description

This operation creates a `DataReader` with the desired `QosPolicy` settings, for the desired `TopicDescription` and attaches the optionally specified `DataWriterListener` to it.

Parameters

in `TopicDescription_ptr a_topic` - a pointer to the `TopicDescription` for which the `DataReader` is created. This may be a `Topic`, `MultiTopic` or `ContentFilteredTopic`.

in `const DataReaderQos& qos` - the struct with the `QosPolicy` settings for the new `DataReader`, when these `QosPolicy` settings are not self consistent, no `DataReader` is created.

in `DataReaderListener_ptr a_listener` - a pointer to the `DataReaderListener` instance which will be attached to the new `DataReader`. It is permitted to use `NULL` as the value of the listener: this behaves as a `DataWriterListener` whose operations perform no action.

in `StatusMask mask` - a bit-mask in which each bit enables the invocation of the `DataReaderListener` for a certain status.

Return Value

`DataReader_ptr` - a pointer to the newly created `DataReader`. In case of an error, the `NULL` pointer is returned.

Detailed Description

This operation creates a `DataReader` with the desired `QosPolicy` settings, for the desired `TopicDescription` and attaches the optionally specified `DataReaderListener` to it. The `TopicDescription` may be a `Topic`, `MultiTopic` or `ContentFilteredTopic`. The returned `DataReader` is attached

(and belongs) to the Subscriber. To delete the DataReader the operation delete_datareader or delete_contained_entities must be used. If no read rights are defined for the specific topic then the creation of the DataReader will fail.

Application Data Type

The DataReader returned by this operation is an object of a derived class, specific to the data type associated with the TopicDescription. For each application-defined data type <type> there is a class <type>DataReader generated by calling the pre-processor. This data type specific class extends DataReader and contains the operations to read data of data type <type>.

Because the DataReader may read a Topic, ContentFilteredTopic or MultiTopic, the DataReader is associated with the TopicDescription. The DataWriter can only write a Topic, **not** a ContentFilteredTopic or MultiTopic, because these two are constructed at the Subscriber side.

QosPolicy

The common application pattern to construct the QosPolicy settings for the DataReader is to:

- Retrieve the QosPolicy settings on the associated TopicDescription by means of the get_qos operation on the TopicDescription
- Retrieve the default DataReaderQos by means of the get_default_datareader_qos operation on the Subscriber
- Combine those two QosPolicy settings and selectively modify policies as desired (copy_from_topic_qos)
- Use the resulting QosPolicy settings to construct the DataReader.
- In case the specified QosPolicy settings are not self consistent, no DataReader is created and the NULL pointer is returned.

Default QoS

The constant DATAREADER_QOS_DEFAULT can be used as parameter qos to create a DataReader with the default DataReaderQos as set in the Subscriber. The effect of using DATAREADER_QOS_DEFAULT is the same as calling the operation get_default_datareader_qos and using the resulting DataReaderQos to create the DataReader.

The special DATAREADER_QOS_USE_TOPIC_QOS can be used to create a DataReader with a combination of the default DataReaderQos and the TopicQos. The effect of using DATAREADER_QOS_USE_TOPIC_QOS is the same as calling the operation get_default_datareader_qos and retrieving the TopicQos (by means of the operation Topic::get_qos) and then combining

these two QosPolicy settings using the operation copy_from_topic_qos, whereby any common policy that is set on the TopicQos "overrides" the corresponding policy on the default DataReaderQos. The resulting DataReaderQos is then applied to create the DataReader.

Communication Status

For each communication status, the StatusChangedFlag flag is initially set to FALSE. It becomes TRUE whenever that communication status changes. For each communication status activated in the mask, the associated DataReaderListener operation is invoked and the communication status is reset to FALSE, as the listener implicitly accesses the status which is passed as a parameter to that operation. The fact that the status is reset prior to calling the listener means that if the application calls the get_<status_name>_status from inside the listener it will see the status already reset.

The following statuses are applicable to the DataReaderListener:

- REQUESTED_DEADLINE_MISSED_STATUS
- REQUESTED_INCOMPATIBLE_QOS_STATUS
- SAMPLE_LOST_STATUS
- SAMPLE_REJECTED_STATUS
- DATA_AVAILABLE_STATUS
- LIVELINESS_CHANGED_STATUS
- SUBSCRIPTION_MATCHED_STATUS.

Be aware that the SUBSCRIPTION_MATCHED_STATUS is not applicable when the infrastructure does not have the information available to determine connectivity. This is the case when OpenSplice is configured not to maintain discovery information in the Networking Service. (See the description for the NetworkingService/Discovery/enabled property in the Deployment Manual for more information about this subject.) In this case the operation will return NULL.

Status bits are declared as a constant and can be used by the application in an OR operation to create a tailored mask. The special constant STATUS_MASK_NONE can be used to indicate that the created entity should not respond to any of its available statuses. The DDS will therefore attempt to propagate these statuses to its factory. The special constant STATUS_MASK_ANY_V1_2 can be used to select all applicable statuses specified in the "Data Distribution Service for Real-time Systems Version 1.2" specification which are applicable to the PublisherListener.

Status Propagation

In case a communication status is not activated in the `mask` of the `DataReaderListener`, the `SubscriberListener` of the containing `Subscriber` is invoked (if attached and activated for the status that occurred). This allows the application to set a default behaviour in the `SubscriberListener` of the containing `Subscriber` and a `DataReader` specific behaviour when needed. In case the communication status is not activated in the `mask` of the `SubscriberListener` as well, the communication status will be propagated to the `DomainParticipantListener` of the containing `DomainParticipant`. In case the `DomainParticipantListener` is also not attached or the communication status is not activated in its `mask`, the application is not notified of the change.

3.5.1.4 delete_contained_entities

Scope

`DDS::Subscriber`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   delete_contained_entities
      (void);
```

Description

This operation deletes all the `DataReader` objects that were created by means of the `create_datareader` operation on the `Subscriber`.

Parameters

<none>

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_ALREADY_DELETED`, `RETCODE_OUT_OF_RESOURCES` or `RETCODE_PRECONDITION_NOT_MET`.

Detailed Description

This operation deletes all the `DataReader` objects that were created by means of the `create_datareader` operation on the `Subscriber`. In other words, it deletes all contained `DataReader` objects. Prior to deleting each `DataReader`, this operation recursively calls the corresponding `delete_contained_entities`

operation on each DataReader. In other words, all DataReader objects in the Subscriber are deleted, including the QueryCondition and ReadCondition objects contained by the DataReader.

NOTE: The operation will return PRECONDITION_NOT_MET if the any of the contained entities is in a state where it cannot be deleted. This will occur, for example, if a contained DataReader cannot be deleted because the application has called a read or take operation and has not called the corresponding return_loan operation to return the loaned samples. In such cases, the operation does not roll back any entity deletions performed prior to the detection of the problem.

Return Code

When the operation returns:

- *RETCODE_OK* - the contained Entity objects are deleted and the application may delete the Subscriber;
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the Subscriber has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_PRECONDITION_NOT_MET* - one or more of the contained entities are in a state where they cannot be deleted.

3.5.1.5 delete_datareader

Scope

DDS::Subscriber

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   delete_datareader
      (DataReader_ptr a_datareader);
```

Description

This operation deletes a DataReader that belongs to the Subscriber.

Parameters

in DataReader_ptr a_datareader - a pointer to the DataReader, which is to be deleted.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES or RETCODE_PRECONDITION_NOT_MET.

Detailed Description

This operation deletes a DataReader that belongs to the Subscriber. When the operation is called on a different Subscriber as used when the DataReader was created, the operation has no effect and returns RETCODE_PRECONDITION_NOT_MET. The deletion of the DataReader is not allowed if there are any ReadCondition or QueryCondition objects that are attached to the DataReader, or when the DataReader still contains unreturned loans. In those cases the operation also returns RETCODE_PRECONDITION_NOT_MET.

Return Code

When the operation returns:

- *RETCODE_OK* - the DataReader is deleted
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - the parameter a_datareader is not a valid DataReader_ptr
- *RETCODE_ALREADY_DELETED* - the Subscriber has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_PRECONDITION_NOT_MET* - the operation is called on a different Subscriber as used when the DataReader was created, the DataReader contains one or more ReadCondition or QueryCondition objects or the DataReader still contains unreturned loans.

3.5.1.6 enable (inherited)

This operation is inherited and therefore not described here. See the class Entity for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   enable
      (void);
```

3.5.1.7 end_access

Scope

`DDS::Subscriber`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   end_access
      (void);
```

Description

This operation indicates that the application will stop accessing a coherent and/or ordered set of modifications that spans multiple DataReaders attached to this `Subscriber`. This access must have been started by a matching call to `begin_access`.

Parameters

<none>

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_ALREADY_DELETED` or `RETCODE_PRECONDITION_NOT_MET`.

Detailed Description

Indicates that the application has finished accessing the data samples in DataReader objects managed by the Subscriber. This operation must be used to 'close' a corresponding `begin_access`. The operation will effectively unlock all of the Subscriber's DataReader objects for incoming modifications, so it is important to invoke it as quickly as possible to avoid an ever increasing backlog of modifications. After calling `end_access` the application should no longer access any of the Data or SampleInfo elements returned from the sample-accessing operations.

This call must close a previous call to `begin_access` otherwise the operation will return the error `PRECONDITION_NOT_MET`.

Return Code

When the operation returns:

- *`RETCODE_OK`* - access to coherent/ordered data has successfully started.
- *`RETCODE_ERROR`* - an internal error has occurred.

- *RETCODE_ALREADY_DELETED* - the Subscriber has already been deleted.
- *RETCODE_PRECONDITION_NOT_MET* - no matching call to begin_access has been detected.

3.5.1.8 get_datareaders

Scope

DDS::Subscriber

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_datareaders
      (DataReaderSeq& readers,
        SampleStateMask sample_states,
        ViewStateMask view_states,
        InstanceStateMask instance_states);
```

Description

This operation allows the application to access the DataReader objects that contain samples with the specified sample_states, view_states, and instance_states.

Parameters

inout DataReaderSeq &readers - a sequence which is used to pass the list of all DataReaders that contain samples of the specified sample_states, view_states, and instance_states.

in SampleStateMask sample_states - a mask, which selects only those readers that have samples with the desired sample states.

in ViewStateMask view_states - a mask, which selects only those readers that have samples with the desired view states.

in InstanceStateMask instance_states - a mask, which selects only those readers that have samples with the desired instance states.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES, RETCODE_NOT_ENABLED or RETCODE_PRECONDITION_NOT_MET.

Detailed Description

This operation allows the application to access the DataReader objects that contain samples with the specified sample_states, view_states, and instance_states.

If the PresentationQosPolicy of the Subscriber to which the DataReader belongs has the access_scope set to 'GROUP', this operation should only be invoked inside a begin_access/end_access block. Otherwise it will return the error RETCODE_PRECONDITION_NOT_MET.

Depending on the setting of the PresentationQoSPolicy (see Section *3.1.3.14* on page 64), the returned collection of DataReader objects may be:

- a 'set' containing each DataReader at most once in no specified order,
- a 'list' containing each DataReader one or more times in a specific order.

This difference is due to the fact that, in the second situation it is required to access samples belonging to different DataReader objects in a particular order. In this case, the application should process each DataReader in the same order it appears in the 'list' and read or take exactly one sample from each DataReader. The patterns that an application should use to access data is fully described in Section 3.1.3.14, *PresentationQosPolicy*, on page 64.

It is allowed to pre-allocate the DataReader sequence prior to invoking this function:

- if the PresentationQosPolicy has access_scope set to 'GROUP' and ordered_access set to TRUE, the ReaderList will never contain more than the pre-allocated number of elements. Pre-allocating 'n' Reader elements this way is convenient in scenario's where the application only intends to access the first 'n' ordered samples. Otherwise the middleware would waste precious CPU cycles composing a list that will only partially be accessed.
- In all other cases, the ReaderList will re-allocated when it is not big enough to accommodate a list describing all DataReaders that have matching samples.

Return Code

When the operation returns:

- *RETCODE_OK* - a list of DataReaders matching your description has successfully been composed.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the Subscriber has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_NOT_ENABLED* - the Subscriber is not enabled.

- *RETCODE_PRECONDITION_NOT_MET* - the operation is not invoked inside a begin_access/end_access block as required by its QosPolicy settings.

3.5.1.9 get_default_datareader_qos

Scope

DDS::Subscriber

Synopsis

```
#include <ccpp_dds_dcps.h>
       ReturnCode_t
          get_default_datareader_qos
             (DataReaderQos& qos);
```

Description

This operation gets the default QosPolicy settings of the DataReader.

Parameters

inout DataReaderQos& qos - a reference to the DataReaderQos struct (provided by the application) in which the default QosPolicy settings for the DataReader are written.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ALREADY_DELETED or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation gets the default QosPolicy settings of the DataReader (that is the DataReaderQos) which is used for newly created DataReader objects, in case the constant DATAREADER_QOS_DEFAULT is used. The default DataReaderQos is only used when the constant is supplied as parameter qos to specify the DataReaderQos in the create_datareader operation. The application must provide the DataReaderQos struct in which the QosPolicy settings can be stored and pass the qos reference to the operation. The operation writes the default QosPolicy settings to the struct referenced to by qos. Any settings in the struct are overwritten.

The values retrieved by this operation match the values specified on the last successful call to set_default_datareader_qos, or, if the call was never made, the default values as specified for each QosPolicy setting as defined in Table 2 on page 38.

Return Code

When the operation returns:

- *RETCODE_OK* - the default DataReader QosPolicy settings of this Subscriber have successfully been copied into the specified DataReaderQos parameter.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the Subscriber has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.5.1.10 get_listener

Scope

DDS::Subscriber

Synopsis

```
#include <ccpp_dds_dcps.h>
SubscriberListener_ptr
   get_listener
      (void);
```

Description

This operation allows access to a SubscriberListener.

Parameters

<none>

Return Value

SubscriberListener_ptr - result is a pointer to the SubscriberListener attached to the Subscriber.

Detailed Description

This operation allows access to a SubscriberListener attached to the Subscriber. When no SubscriberListener was attached to the Subscriber, the NULL pointer is returned.

3.5.1.11 get_participant

Scope

DDS::Subscriber

Synopsis

```
#include <ccpp_dds_dcps.h>
DomainParticipant_ptr
   get_participant
     (void);
```

Description

This operation returns the `DomainParticipant` associated with the `Subscriber` or the `NULL` pointer.

Parameters

<none>

Return Value

`DomainParticipant_ptr` - a pointer to the `DomainParticipant` associated with the `Subscriber` or the `NULL` pointer.

Detailed Description

This operation returns the `DomainParticipant` associated with the `Subscriber`. Note that there is exactly one `DomainParticipant` associated with each `Subscriber`. When the `Subscriber` was already deleted (there is no associated `DomainParticipant` any more), the `NULL` pointer is returned.

3.5.1.12 get_qos

Scope

`DDS::Subscriber`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_qos
      (SubscriberQos& qos);
```

Description

This operation allows access to the existing set of QoS policies for a `Subscriber`.

Parameters

`inout SubscriberQos& qos` - a reference to the destination `SubscriberQos` struct in which the `QosPolicy` settings will be copied.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ALREADY_DELETED or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation allows access to the existing set of QoS policies of a Subscriber on which this operation is used. This SubscriberQos is stored at the location pointed to by the qos parameter.

Return Code

When the operation returns:

- *RETCODE_OK* - the existing set of QoS policy values applied to this Subscriber has successfully been copied into the specified SubscriberQos parameter.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the Subscriber has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.5.1.13 get_status_changes (inherited)

This operation is inherited and therefore not described here. See the class Entity for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
StatusMask
   get_status_changes
      (void);
```

3.5.1.14 get_statuscondition (inherited)

This operation is inherited and therefore not described here. See the class Entity for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
StatusCondition_ptr
   get_statuscondition
      (void);
```

3.5.1.15 lookup_datareader

Scope

`DDS::Subscriber`

Synopsis

```
#include <ccpp_dds_dcps.h>
DataReader_ptr
   lookup_datareader
         (const char* topic_name);
```

Description

This operation returns a previously created `DataReader` belonging to the `Subscriber` which is attached to a `Topic` with the matching `topic_name`.

Parameters

`in const char* topic_name` - the name of the `Topic`, which is attached to the `DataReader` to look for.

Return Value

`DataReader_ptr` - Return value is a reference to the `DataReader` found. When no such `DataReader` is found, the `NULL` pointer is returned.

Detailed Description

This operation returns a previously created `DataReader` belonging to the `Subscriber` which is attached to a `Topic` with the matching `topic_name`. When multiple `DataReader` objects (which satisfy the same condition) exist, this operation will return one of them. It is not specified which one.

This operation may be used on the built-in `Subscriber`, which returns the built-in `DataReader` objects for the built-in `Topics`.

3.5.1.16 notify_datareaders

Scope

`DDS::Subscriber`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   notify_datareaders
      (void);
```

Description

This operation invokes the `on_data_available` operation on `DataReaderListener` objects which are attached to the contained `DataReader` entities having new, available data.

Parameters

<none>

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_ALREADY_DELETED` or `RETCODE_OUT_OF_RESOURCES`.

Detailed Description

This operation invokes the `on_data_available` operation on the `DataReaderListener` objects attached to contained `DataReader` entities that have received information, but which have not yet been processed by those `DataReaders`.

The `notify_datareaders` operation ignores the bit mask value of individual `DataReaderListener` objects, even when the `DATA_AVAILABLE_STATUS` bit has not been set on a `DataReader` that has new, available data. The `on_data_available` operation will still be invoked, when the `DATA_AVAILABLE_STATUS` bit has not been set on a `DataReader`, but will not propagate to the `DomainParticipantListener`.

When the `DataReader` has attached a `NULL` listener, the event will be consumed and will not propagate to the `DomainParticipantListener`. (Remember that a `NULL` listener is regarded as a listener that handles all its events as a `NOOP`).

Return Code

When the operation returns:

- *`RETCODE_OK`* - all appropriate listeners have been invoked
- *`RETCODE_ERROR`* - an internal error has occurred
- *`RETCODE_ALREADY_DELETED`* - the `Subscriber` has already been deleted
- *`RETCODE_OUT_OF_RESOURCES`* - there are insufficient Data Distribution Service resources to complete this operation

3.5.1.17 set_default_datareader_qos

Scope

`DDS::Subscriber`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   set_default_datareader_qos
      (const DataReaderQos& qos);
```

Description

This operation sets the default DataReaderQos of the DataReader.

Parameters

in const DataReaderQos& qos - the DataReaderQos struct, which contains the new default QosPolicy settings for the newly created DataReaders.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_UNSUPPORTED, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES or RETCODE_INCONSISTENT_POLICY.

Detailed Description

This operation sets the default DataReaderQos of the DataReader (that is the struct with the QosPolicy settings). This QosPolicy is used for newly created DataReader objects in case the constant DATAREADER_QOS_DEFAULT is used as parameter qos to specify the DataReaderQos in the create_datareader operation. This operation checks if the DataReaderQos is self consistent. If it is not, the operation has no effect and returns RETCODE_INCONSISTENT_POLICY.

The values set by this operation are returned by get_default_datareader_qos.

Return Code

When the operation returns:

- *RETCODE_OK* - the new default DataReaderQos is set
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - the parameter qos is not a valid DataReaderQos. It contains a QosPolicy setting with an invalid Duration_t value or an enum value that is outside its legal boundaries.
- *RETCODE_UNSUPPORTED* - one or more of the selected QosPolicy values are currently not supported by OpenSplice.
- *RETCODE_ALREADY_DELETED* - the Subscriber has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

- *RETCODE_INCONSISTENT_POLICY* - the parameter `qos` contains conflicting `QosPolicy` settings, e.g. a history depth that is higher than the specified resource limits.

3.5.1.18 set_listener

Scope

`DDS::Subscriber`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   set_listener
      (SubscriberListener_ptr a_listener,
        StatusMask mask);
```

Description

This operation attaches a `SubscriberListener` to the `Subscriber`.

Parameters

in SubscriberListener_ptr a_listener - a pointer to the `SubscriberListener` instance, which will be attached to the `Subscriber`.

in StatusMask mask - a bit mask in which each bit enables the invocation of the `SubscriberListener` for a certain status.

Return Value

ReturnCode_t - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_UNSUPPORTED`, `RETCODE_ALREADY_DELETED` or `RETCODE_OUT_OF_RESOURCES`.

Detailed Description

This operation attaches a `SubscriberListener` to the `Subscriber`. Only one `SubscriberListener` can be attached to each `Subscriber`. If a `SubscriberListener` was already attached, the operation will replace it with the new one. When `a_listener` is the `NULL` pointer, it represents a listener that is treated as a NOOP[1] for all statuses activated in the bit mask.

Communication Status

For each communication status, the `StatusChangedFlag` flag is initially set to `FALSE`. It becomes `TRUE` whenever that communication status changes. For each communication status activated in the `mask`, the associated `SubscriberListener`

1. Short for **No-Op**eration, an instruction that does nothing.

operation is invoked and the communication status is reset to FALSE, as the listener implicitly accesses the status which is passed as a parameter to that operation. The status is reset prior to calling the listener, so if the application calls the get_<status_name>_status from inside the listener it will see the status already reset. An exception to this rule is the NULL listener, which does not reset the communication statuses for which it is invoked.

The following statuses are applicable to the SubscriberListener:

- REQUESTED_DEADLINE_MISSED_STATUS *(propagated)*
- REQUESTED_INCOMPATIBLE_QOS_STATUS *(propagated)*
- SAMPLE_LOST_STATUS *(propagated)*
- SAMPLE_REJECTED_STATUS *(propagated)*
- DATA_AVAILABLE_STATUS *(propagated)*
- LIVELINESS_CHANGED_STATUS *(propagated)*
- SUBSCRIPTION_MATCHED_STATUS *(propagated)*.
- DATA_ON_READERS_STATUS.

Be aware that the SUBSCRIPTION_MATCHED_STATUS is not applicable when the infrastructure does not have the information available to determine connectivity. This is the case when OpenSplice is configured not to maintain discovery information in the Networking Service. (See the description for the NetworkingService/Discovery/enabled property in the Deployment Manual for more information about this subject.) In this case the operation will return RETCODE_UNSUPPORTED.

Status bits are declared as a constant and can be used by the application in an OR operation to create a tailored mask. The special constant STATUS_MASK_NONE can be used to indicate that the created entity should not respond to any of its available statuses. The DDS will therefore attempt to propagate these statuses to its factory. The special constant STATUS_MASK_ANY_V1_2 can be used to select all applicable statuses specified in the “Data Distribution Service for Real-time Systems Version 1.2” specification which are applicable to the PublisherListener.

Status Propagation

The Data Distribution Service will trigger the most specific and relevant Listener. In other words, in case a communication status is also activated on the DataReaderListener of a contained DataReader, the DataReaderListener on that contained DataReader is invoked instead of the SubscriberListener. This means that a status change on a contained DataReader only invokes the SubscriberListener if the contained DataReader itself does not handle the trigger event generated by the status change.

In case a communication status is not activated in the mask of the SubscriberListener, the DomainParticipantListener of the containing DomainParticipant is invoked (if attached and activated for the status that occurred). This allows the application to set a default behaviour in the DomainParticipantListener of the containing DomainParticipant and a Subscriber specific behaviour when needed. In case the DomainParticipantListener is also not attached or the communication status is not activated in its mask, the application is not notified of the change.

The statuses DATA_ON_READERS_STATUS and DATA_ AVAILABLE_STATUS are "Read Communication Statuses" and are an exception to all other plain communication statuses: they have no corresponding status structure that can be obtained with a get_<status_name>_status operation and they are mutually exclusive. When new information becomes available to a DataReader, the Data Distribution Service will first look in an attached and activated SubscriberListener or DomainParticipantListener (in that order) for the DATA_ON_READERS_STATUS. In case the DATA_ON_READERS_STATUS can not be handled, the Data Distribution Service will look in an attached and activated DataReaderListener, SubscriberListener or DomainParticipant Listener for the DATA_AVAILABLE_STATUS (in that order).

Return Code

When the operation returns:

- *RETCODE_OK* - the SubscriberListener is attached
- *RETCODE_ERROR* - an internal error has occurred
- *RETCODE_UNSUPPORTED* - a status was selected that cannot be supported because the infrastructure does not maintain the required connectivity information.
- *RETCODE_ALREADY_DELETED* - the Subscriber has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.5.1.19 set_qos

Scope

DDS::Subscriber

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   set_qos
      (const SubscriberQos& qos);
```

Description

This operation replaces the existing set of QosPolicy settings for a Subscriber.

Parameters

in const SubscriberQos& qos - new set of QosPolicy settings for the Subscriber.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_UNSUPPORTED, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES, RETCODE_IMMUTABLE_POLICY or RETCODE_PRECONDITION_NOT_MET.

Detailed Description

This operation replaces the existing set of QosPolicy settings for a Subscriber. The parameter qos contains the QosPolicy settings which is checked for self-consistency and mutability. When the application tries to change a QosPolicy setting for an enabled Subscriber, which can only be set before the Subscriber is enabled, the operation will fail and a RETCODE_IMMUTABLE_POLICY is returned. In other words, the application must provide the presently set QosPolicy settings in case of the immutable QosPolicy settings. Only the mutable QosPolicy settings can be changed. When qos contains conflicting QosPolicy settings (not self-consistent), the operation will fail and a RETCODE_INCONSISTENT_POLICY is returned.

The set of QosPolicy settings specified by the qos parameter are applied on top of the existing QoS, replacing the values of any policies previously set (provided, the operation returned RETCODE_OK). If one or more of the partitions in the QoS structure have insufficient access rights configured then the set_qos function will fail with a RETCODE_PRECONDITION_NOT_MET error code.

Return Code

When the operation returns:

- *RETCODE_OK* - the new SubscriberQos is set
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - the parameter qos is not a valid SubscriberQos. It contains a QosPolicy setting with an enum value that is outside its legal boundaries.
- *RETCODE_UNSUPPORTED* - one or more of the selected QosPolicy values are currently not supported by OpenSplice.

- *RETCODE_ALREADY_DELETED* - the Subscriber has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_IMMUTABLE_POLICY* - the parameter qos contains an immutable QosPolicy setting with a different value than set during enabling of the Subscriber.
- *RETCODE_PRECONDITION_NOT_MET* - returned when insufficient access rights exist for the partition(s) listed in the QoS structure.

3.5.2 Subscription Type Specific Classes

"Subscription type specific classes" contains the generic class and the generated data type specific classes. For each data type, a data type specific class <type>DataReader is generated (based on IDL) by calling the pre-processor. In case of data type Foo (this also applies to other types); "Subscription type specific classes" contains the following classes:

This paragraph describes the generic DataReader class and the derived application type specific <type>DataReader classes which together implement the application subscription interface. For each application type, used as Topic data type, the pre-processor generates a <type>DataReader class from an IDL type description. The FooDataReader class that would be generated by the pre-processor for a fictional type Foo describes the <type>DataReader classes.

3.5.2.1 Class DataReader (abstract)

A DataReader allows the application:

- to declare data it wishes to receive (i.e., make a subscription)
- to access data received by the associated Subscriber.

A DataReader refers to exactly one TopicDescription (either a Topic, a ContentFilteredTopic or a MultiTopic) that identifies the samples to be read. The DataReader may give access to several instances of the data type, which are distinguished from each other by their key.

DataReader is an abstract class. It is specialized for each particular application data type. For a fictional application data type "Foo" (defined in the module SPACE) the specialized class would be SPACE::FooDataReader.

The interface description of this class is as follows:

```
class DataReader
{
//
// inherited from class Entity
//
// StatusCondition_ptr
```

```
//    get_statuscondition
//       (void);
// StatusMask
//    get_status_changes
//       (void);
// ReturnCode_t
//    enable
//       (void);
//
// abstract operations (implemented in the data type
// specific DataReader)
//
// ReturnCode_t
//    read
//       (<data>Seq& data_values,
//         SampleInfoSeq& info_seq,
//         Long max_samples,
//         SampleStateMask sample_states,
//         ViewStateMask view_states,
//         InstanceStateMask instance_states);
// ReturnCode_t
//    take
//       (<data>Seq& data_values,
//         SampleInfoSeq& info_seq,
//         Long max_samples,
//         SampleStateMask sample_states,
//         ViewStateMask view_states,
//         InstanceStateMask instance_states);
// ReturnCode_t
//    read_w_condition
//       (<data>Seq& data_values,
//         SampleInfoSeq& info_seq,
//         Long max_samples,
//         ReadCondition a_condition);
// ReturnCode_t
//    take_w_condition
//       (<data>Seq& data_values,
//         SampleInfoSeq& info_seq,
//         Long max_samples,
//         ReadCondition a_condition);
// ReturnCode_t
//    read_next_sample
//       (<data>& data_values,
//         SampleInfo sample_info);
// ReturnCode_t
//    take_next_sample
//       (<data>& data_values,
//         SampleInfo sample_info);
// ReturnCode_t
//    read_instance
```

```
//        (<data>Seq& data_values,
//          SampleInfoSeq& info_seq,
//          Long max_samples,
//          InstanceHandle_t a_handle,
//          SampleStateMask sample_states,
//          ViewStateMask view_states,
//          InstanceStateMask instance_states);
// ReturnCode_t
//    take_instance
//        (<data>Seq& data_values,
//          SampleInfoSeq& info_seq,
//          Long max_samples,
//          InstanceHandle_t a_handle,
//          SampleStateMask sample_states,
//          ViewStateMask view_states,
//          InstanceStateMask instance_states);
// ReturnCode_t
//    read_next_instance
//        (<data>Seq& data_values,
//          SampleInfoSeq& info_seq,
//          Long max_samples,
//          InstanceHandle_t a_handle,
//          SampleStateMask sample_states,
//          ViewStateMask view_states,
//          InstanceStateMask instance_states);
// ReturnCode_t
//    take_next_instance
//        (<data>Seq& data_values,
//          SampleInfoSeq& info_seq,
//          Long max_samples,
//          InstanceHandle_t a_handle,
//          SampleStateMask sample_states,
//          ViewStateMask view_states,
//          InstanceStateMask instance_states);
// ReturnCode_t
//    read_next_instance_w_condition
//        (<data>Seq& data_values,
//          SampleInfoSeq& info_seq,
//          Long max_samples,
//          InstanceHandle_t a_handle,
//          ReadCondition a_condition);
// ReturnCode_t
//    take_next_instance_w_condition
//        (<data>Seq& data_values,
//          SampleInfoSeq& info_seq,
//          Long max_samples,
//          InstanceHandle_t a_handle,
//          ReadCondition a_condition);
// ReturnCode_t
//    return_loan
```

```
//        (<data>Seq& data_values,
//          SampleInfoSeq& info_seq);
// ReturnCode_t
//    get_key_value
//        (<data>& key_holder,
//          InstanceHandle_t handle);
// InstanceHandle_t
//    lookup_instance
//        (const <data>& instance_data);
//
// implemented API operations
//
    ReadCondition_ptr
       create_readcondition
          (SampleStateMask sample_states,
          ViewStateMask view_states,
          InstanceStateMask instance_states);

    QueryCondition_ptr
       create_querycondition
          (SampleStateMask sample_states,
          ViewStateMask view_states,
          InstanceStateMask instance_states,
          const char* query_expression,
          const StringSeq& query_parameters);

    ReturnCode_t
       delete_readcondition
          (ReadCondition_ptr a_condition);

    ReturnCode_t
       delete_contained_entities
          (void);

    ReturnCode_t
       set_qos
          (const DataReaderQos& qos);

    ReturnCode_t
       get_qos
          (DataReaderQos& qos);

    ReturnCode_t
       set_listener
          (DataReaderListener_ptr a_listener,
            StatusMask mask);

    DataReaderListener_ptr
       get_listener
          (void);
```

```
TopicDescription_ptr
   get_topicdescription
      (void);

Subscriber_ptr
   get_subscriber
      (void);

ReturnCode_t
   get_sample_rejected_status
      (SampleRejectedStatus& status);

ReturnCode_t
   get_liveliness_changed_status
      (LivelinessChangedStatus& status);

ReturnCode_t
   get_requested_deadline_missed_status
      (RequestedDeadlineMissedStatus& status);

ReturnCode_t
   get_requested_incompatible_qos_status
      (RequestedIncompatibleQosStatus& status);

ReturnCode_t
   get_subscription_matched_status
      (SubscriptionMatchedStatus& status);

ReturnCode_t
   get_sample_lost_status
      (SampleLostStatus& status);

ReturnCode_t
   wait_for_historical_data
      (const Duration_t& max_wait);

ReturnCode_t
   get_matched_publications
      (InstanceHandleSeq& publication_handles);

ReturnCode_t
   get_matched_publication_data
      (PublicationBuiltinTopicData& publication_data,
      InstanceHandle_t publication_handle);

DataReaderView_ptr
 create_view
   (DataReaderViewQos& qos);
```

```
        ReturnCode_t
         delete_view
           (DataReaderView_ptr a_view);

        ReturnCode_t
         get_default_datareaderview_qos
           (DataReaderViewQos& qos);

        ReturnCode_t
         set_default_datareaderview_qos
           (DataReaderViewQos& qos);
    };
```

The following paragraphs describe the usage of all `DataReader` operations. The inherited operations are listed but not fully described because they are not implemented in this class. The full description of these operations is given in the classes from which they are inherited. The abstract operations are listed but not fully described because they are not implemented in this specific class. The full description of these operations is located in the subclasses that contain the data type specific implementation of these operations.

3.5.2.2 create_querycondition

Scope

`DDS::DataReader`

Synopsis

```
#include <ccpp_dds_dcps.h>
QueryCondition_ptr
   create_querycondition
      (SampleStateMask sample_states,
        ViewStateMask view_states,
        InstanceStateMask instance_states,
        const char* query_expression,
        const StringSeq& query_parameters);
```

Description

This operation creates a new `QueryCondition` for the `DataReader`.

Parameters

in SampleStateMask sample_states - a mask, which selects only those samples with the desired sample states.

in ViewStateMask view_states - a mask, which selects only those samples with the desired view states.

in InstanceStateMask instance_states - a mask, which selects only those samples with the desired instance states.

in const char query_expression* - the query string, which must be a subset of the SQL query language.

in const StringSeq& query_parameters - a sequence of strings which are the parameter values used in the SQL query string (i.e., the "%n" tokens in the expression). The number of values in `query_parameters` must be equal or greater than the highest referenced `%n` token in the `query_expression` (e.g. if `%1` and `%8` are used as parameters in the `query_expression`, the `query_parameters` should at least contain `n+1 = 9` values).

Return Value

QueryCondition_ptr - Result value is a pointer to the `QueryCondition`. When the operation fails, the `NULL` pointer is returned.

Detailed Description

This operation creates a new `QueryCondition` for the `DataReader`. The returned `QueryCondition` is attached (and belongs) to the `DataReader`. When the operation fails, the `NULL` pointer is returned. To delete the `QueryCondition` the operation `delete_readcondition` or `delete_contained_entities` must be used.

State Masks

The result of the `QueryCondition` also depends on the selection of samples determined by three masks:

- `sample_states` is the mask, which selects only those samples with the desired sample states `READ_SAMPLE_STATE`, `NOT_READ_SAMPLE_STATE` or both
- `view_states` is the mask, which selects only those samples with the desired view states `NEW_VIEW_STATE`, `NOT_NEW_VIEW_STATE` or both
- `instance_states` is the mask, which selects only those samples with the desired instance states `ALIVE_INSTANCE_STATE`, `NOT_ALIVE_DISPOSED_INSTANCE_STATE`, `NOT_ALIVE_NO_WRITERS_INSTANCE_STATE` or a combination of these.

SQL Expression

The SQL query string is set by `query_expression` which must be a subset of the SQL query language. In this query expression, parameters may be used, which must be set in the sequence of strings defined by the parameter `query_parameters`. A parameter is a string which can define an integer, float, string or enumeration. The number of values in `query_parameters` must be equal or greater than the highest

referenced %n token in the query_expression (e.g. if %1 and %8 are used as parameters in the query_expression, the query_parameters should at least contain n+1 = 9 values).

3.5.2.3 create_readcondition

Scope

DDS::DataReader

Synopsis

```
#include <ccpp_dds_dcps.h>
ReadCondition_ptr
   create_readcondition
      (SampleStateMask sample_states,
        ViewStateMask view_states,
        InstanceStateMask instance_states);
```

Description

This operation creates a new ReadCondition for the DataReader.

Parameters

in SampleStateMask sample_states - a mask, which selects only those samples with the desired sample states.

in ViewStateMask view_states - a mask, which selects only those samples with the desired view states.

in InstanceStateMask instance_states - a mask, which selects only those samples with the desired instance states.

Return Value

ReadCondition_ptr - Result value is a pointer to the ReadCondition. When the operation fails, the NULL pointer is returned.

Detailed Description

This operation creates a new ReadCondition for the DataReader. The returned ReadCondition is attached (and belongs) to the DataReader. When the operation fails, the NULL pointer is returned. To delete the ReadCondition the operation delete_readcondition or delete_contained_entities must be used.

State Masks

The result of the ReadCondition depends on the selection of samples determined by three masks:

- `sample_states` is the mask, which selects only those samples with the desired sample states `READ_SAMPLE_STATE`, `NOT_READ_SAMPLE_STATE` or both
- `view_states` is the mask, which selects only those samples with the desired view states `NEW_VIEW_STATE`, `NOT_NEW_VIEW_STATE` or both
- `instance_states` is the mask, which selects only those samples with the desired instance states `ALIVE_INSTANCE_STATE`, `NOT_ALIVE_DISPOSED_INSTANCE_STATE`, `NOT_ALIVE_NO_WRITERS_INSTANCE_STATE` or a combination of these.

3.5.2.4 create_view

Scope

`DDS::DataReader`

Synopsis

```
#include <ccpp_dds_dcps.h>
 DataReaderView_ptr
   create_view
     (DataReaderViewQos& qos);
```

Description

This operation creates a DataReaderView with the desired QosPolicy settings.

Parameters

`in const DataReaderViewQos&` - the QosPolicy settings for the DataReaderView.

Return Value

`DataReaderView_ptr` - Pointer to the newly created DataReaderView. In case of error, the `NULL` pointer is returned.

Detailed Description

This operation creates a DataReaderView with the desired QosPolicy settings. In case the QosPolicy is invalid, a `NULL` pointer is returned. The convenience macro `DATAREADERVIEW_QOS_DEFAULT` can be used as parameter `qos`, to create a DataReaderView with the default DataReaderViewQos as set in the DataReader.

Application Data Type

The DataReaderView returned by this operation is an object of a derived class, specific to the data type associated with the Topic. For each application-defined data type `<type>` there is a class `<type>DataReaderView` generated by calling the pre-processor. This data type specific class extends DataReaderView and contains the operations to read and take data of data type `<type>`.

The typed operations of a DataReaderView exactly mimic those of the DataReader from which it is created.

3.5.2.5 delete_contained_entities

Scope

`DDS::DataReader`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   delete_contained_entities
      (void);
```

Description

This operation deletes all the `Entity` objects that were created by means of one of the "`create_`" operations on the `DataReader`.

Parameters

<none>

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_ALREADY_DELETED`, `RETCODE_OUT_OF_RESOURCES` or `RETCODE_PRECONDITION_NOT_MET`.

Detailed Description

This operation deletes all the `Entity` objects that were created by means of one of the "`create_`" operations on the `DataReader`. In other words, it deletes all `QueryCondition` and `ReadCondition` objects contained by the `DataReader`.

NOTE: The operation will return `PRECONDITION_NOT_MET` if the any of the contained entities is in a state where it cannot be deleted. In such cases, the operation does not roll back any entity deletions performed prior to the detection of the problem.

Return Code

When the operation returns:

- *RETCODE_OK* - the contained Entity objects are deleted and the application may delete the DataReader
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the DataReader has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_PRECONDITION_NOT_MET* - one or more of the contained entities are in a state where they cannot be deleted.

3.5.2.6 delete_readcondition

Scope

DDS::DataReader

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   delete_readcondition
      (ReadCondition_ptr a_condition);
```

Description

This operation deletes a ReadCondition or QueryCondition which is attached to the DataReader.

Parameters

in ReadCondition_ptr a_condition - a pointer to the ReadCondition or QueryCondition which is to be deleted.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES or RETCODE_PRECONDITION_NOT_MET.

Detailed Description

This operation deletes a ReadCondition or QueryCondition which is attached to the DataReader. Since a QueryCondition is a specialized ReadCondition, the operation can also be used to delete a QueryCondition. A ReadCondition or QueryCondition cannot be deleted when it is not attached to this DataReader.

When the operation is called on a ReadCondition or QueryCondition which was not attached to this DataReader, the operation returns RETCODE_PRECONDITION_NOT_MET.

Return Code

When the operation returns:

- *RETCODE_OK* - the ReadCondition or QueryCondition is deleted
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - the parameter a_condition is not a valid ReadCondition_ptr
- *RETCODE_ALREADY_DELETED* - the DataReader has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_PRECONDITION_NOT_MET* - the operation is called on a different DataReader, as used when the ReadCondition or QueryCondition was created.

3.5.2.7 delete_view

Scope

DDS::DataReader

Synopsis

```
#include <ccpp_dds_dcps.h>
 ReturnCode_t
   delete_view
     (DataReaderView_ptr a_view);
```

Description

This operation deletes a DataReaderView that belongs to the DataReader.

Parameters

in DataReaderView_ptr a_view - a pointer to the DataReaderView which is to be deleted.

Return Value

ReturnCode_t - Possible return codes of the operation are:
RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES, RETCODE_PRECONDITION_NOT_MET.

Detailed Description

This operation deletes the DataReaderView from the DataReader.

Return Code

When the operation returns:

- *RETCODE_OK* - the DataReaderView is deleted.
- *RETCODE_ERROR* - an internal error occurred.
- *RETCODE_BAD_PARAMETER* - the DataReaderView_ptr parameter is invalid.
- *RETCODE_ALREADY_DELETED* - the DataReader has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the data distribution service ran out of resources to complete this operation.
- *RETCODE_PRECONDITION_NOT_MET* - the DataReaderView is not associated with this DataReader, or the DataReaderView still contains one or more ReadCondition or QueryCondition objects or an unreturned loan.

3.5.2.8 enable (inherited)

This operation is inherited and therefore not described here. See the class `Entity` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
   ReturnCode_t
      enable
         (void);
```

3.5.2.9 get_default_datareaderview_qos

Scope

```
DDS::DataReader
```

Synopsis

```
#include <ccpp_dds_dcps.h>
 ReturnCode_t
   get_default_datareaderview_qos
     (DataReaderViewQos& qos);
```

Description

This operation gets the default QosPolicy settings of the DataReaderView.

Parameters

inout DataReaderViewQos qos - a reference to the DataReaderViewQos struct in which the default QosPolicy settings will be stored.

Return Value

ReturnCode_t - Possible return codes of the operation are:
RETCODE_OK, RETCODE_ERROR, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation gets the default QosPolicy settings of the DataReaderView, which are used for newly-created DataReaderView objects in case the constant DATAREADERVIEW_QOS_DEFAULT is used.

The values retrieved by this call match the values specified on the last successful call to set_default_datareaderview_qos, or, if this call was never made, the default values as specified in *Table 2* on page 38.

Return Code

When the operation returns:

- *RETCODE_OK* - the default DataReaderView QosPolicy settings of this DataReader have successfully been copied into the provided DataReaderViewQos parameter.
- *RETCODE_ERROR* - an internal error has occurred
- *RETCODE_ALREADY_DELETED* - the DataReader has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the data distribution service ran out of resources to complete this operation

3.5.2.10 get_key_value (abstract)

This abstract operation is defined as a generic operation, which is implemented by the <type>DataReader class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type Foo derived FooDataReader class.

Synopsis

```
#include <ccpp_dds_dcps.h>
       ReturnCode_t
          get_key_value
             (<data>& key_holder,
               InstanceHandle_t handle);
```

3.5.2.11 get_listener

Scope

`DDS::DataReader`

Synopsis

```
#include <ccpp_dds_dcps.h>
DataReaderListener_ptr
   get_listener
      (void);
```

Description

This operation allows access to a `DataReaderListener`.

Parameters

<none>

Return Value

`datareaderlistener_ptr` - result is a pointer to the `DataReaderListener` attached to the `DataReader`.

Detailed Description

This operation allows access to a `DataReaderListener` attached to the `DataReader`. When no `DataReaderListener` was attached to the `DataReader`, the `NULL` pointer is returned.

3.5.2.12 get_liveliness_changed_status

Scope

`DDS::DataReader`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_liveliness_changed_status
      (LivelinessChangedStatus& status);
```

Description

This operation obtains the `LivelinessChangedStatus` struct of the `DataReader`.

Parameters

inout LivelinessChangedStatus& status - the contents of the LivelinessChangedStatus struct of the DataReader will be copied into the location specified by status.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ALREADY_DELETED or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This obtains returns the LivelinessChangedStatus struct of the DataReader. This struct contains the information whether the liveliness of one or more DataWriter objects that were writing instances read by the DataReader has changed. In other words, some DataWriter have become "alive" or "not alive".

The LivelinessChangedStatus can also be monitored using a DataReaderListener or by using the associated StatusCondition.

Return Code

When the operation returns:

- *RETCODE_OK* - the current LivelinessChangedStatus of this DataReader has successfully been copied into the specified status parameter.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the DataReader has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.5.2.13 get_matched_publication_data

Scope

DDS::DataReader

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_matched_publication_data
      (PublicationBuiltinTopicData& publication_data,
        InstanceHandle_t publication_handle);
```

Description

This operation retrieves information on the specified publication that is currently "associated" with the DataReader.

Parameters

inout PublicationBuiltinTopicData& publication_data - a reference to the sample in which the information about the specified publication is to be stored.

in InstanceHandle_t publication_handle - a handle to the publication whose information needs to be retrieved.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_UNSUPPORTED, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES or RETCODE_NOT_ENABLED.

Detailed Description

This operation retrieves information on the specified publication that is currently "associated" with the DataReader. That is, a publication with a matching Topic and compatible QoS that the application has not indicated should be "ignored" by means of the ignore_publication operation on the DomainParticipant.

The publication_handle must correspond to a publication currently associated with the DataReader, otherwise the operation will fail and return RETCODE_BAD_PARAMETER. The operation get_matched_publications can be used to find the publications that are currently matched with the DataReader.

The operation may also fail if the infrastructure does not hold the information necessary to fill in the publication_data. This is the case when OpenSplice is configured not to maintain discovery information in the Networking Service. (See the description for the NetworkingService/Discovery/enabled property in the Deployment Manual for more information about this subject.) In this case the operation will return RETCODE_UNSUPPORTED.

Return Code

When the operation returns:

- *RETCODE_OK* - the information on the specified publication has successfully been retrieved.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_UNSUPPORTED* - OpenSplice is configured not to maintain the information about "associated" publications.

- *RETCODE_ALREADY_DELETED* - the DataReader has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_NOT_ENABLED* - the DataReader is not enabled.

3.5.2.14 get_matched_publications

Scope

DDS::DataReader

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_matched_publications
      (InstanceHandleSeq& publication_handles);
```

Description

This operation retrieves the list of publications currently "associated" with the DataReader.

Parameters

inout InstanceHandleSeq& publication_handles - a sequence which is used to pass the list of all associated publications.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_UNSUPPORTED, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES or RETCODE_NOT_ENABLED.

Detailed Description

This operation retrieves the list of publications currently "associated" with the DataReader. That is, subscriptions that have a matching Topic and compatible QoS that the application has not indicated should be “ignored” by means of the ignore_publication operation on the DomainParticipant.

The publication_handles sequence and its buffer may be pre-allocated by the application and therefore must either be re-used in a subsequent invocation of the get_matched_publications operation or be released by invoking its destructor either implicitly or explicitly. If the pre-allocated sequence is not big enough to hold the number of associated publications, the sequence will automatically be (re-)allocated to fit the required size.

The handles returned in the publication_handles sequence are the ones that are used by the DDS implementation to locally identify the corresponding matched DataWriter entities. You can access more detailed information about a particular publication by passing its publication_handle to either the get_matched_publication_data operation or to the read_instance operation on the built-in reader for the “DCPSPublication” topic.

Be aware that since InstanceHandle_t is an opaque datatype, it does not necessarily mean that the handles obtained from the get_matched_publications operation have the same value as the ones that appear in the instance_handle field of the SampleInfo when retrieving the publication info through corresponding "DCPSPublications" built-in reader. You can’t just compare two handles to determine whether they represent the same publication. If you want to know whether two handles actually do represent the same publication, use both handles to retrieve their corresponding PublicationBuiltinTopicData samples and then compare the key field of both samples.

The operation may fail if the infrastructure does not locally maintain the connectivity information. This is the case when OpenSplice is configured not to maintain discovery information in the Networking Service. (See the description for the NetworkingService/Discovery/enabled property in the Deployment Manual for more information about this subject.) In this case the operation will return RETCODE_UNSUPPORTED.

Return Code

When the operation returns:

- *RETCODE_OK* - the list of associated publications has successfully been obtained.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_UNSUPPORTED* - OpenSplice is configured not to maintain the information about “associated” publications.
- *RETCODE_ALREADY_DELETED* - the DataReader has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_NOT_ENABLED* - the DataReader is not enabled.

3.5.2.15 get_property

Scope

```
DDS::DataReader
```

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  get_property
    (Property& a_property);
```

Description

This function queries the value of a property set on a `DataReader`.

Parameters

`inout Property& a_property` - on entry, `a_property.name` determines which property to query the value of; on successful return, `a_property.value` is set to the current value of that property in the DataReader.

Return Value

`int` - Possible return codes of the operation are:
`RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_ALREADY_DELETED`, `RETCODE_OUT_OF_RESOURCES`, `RETCODE_UNSUPPORTED`

Detailed Description

This operation looks up the property specified by `a_property.name` in the DataReader, setting `a_property.value` to the current value of the property. If the property has not been set using `set_property`, the default value is returned.

Return Code

When the operation returns:

- *`RETCODE_OK`* - `a_property.value` has been set to the current value of the property.
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_ALREADY_DELETED`* - the DataReader has already been deleted.
- *`RETCODE_OUT_OF_RESOURCES`* - the Data Distribution Service ran out of resources to complete this operation.
- *`RETCODE_UNSUPPORTED`* - `a_property.name` specifies an undefined property or the operation is not supported in this version.

3.5.2.16 get_qos

Scope

`DDS::DataReader`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_qos
      (DataReaderQos& qos);
```

Description

This operation allows access to the existing set of QoS policies for a `DataReader`.

Parameters

`inout DataReaderQos& qos` - a reference to the destination `DataReaderQos` struct in which the `QosPolicy` settings will be copied.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_ALREADY_DELETED` or `RETCODE_OUT_OF_RESOURCES`.

Detailed Description

This operation allows access to the existing set of QoS policies of a `DataReader` on which this operation is used. This `DataReaderQos` is stored at the location pointed to by the `qos` parameter.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the existing set of `QoSPolicy` values applied to this `DataReader` has successfully been copied into the specified `DataReaderQos` parameter.
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_ALREADY_DELETED`* - the `DataReader` has already been deleted.
- *`RETCODE_OUT_OF_RESOURCES`* - the Data Distribution Service ran out of resources to complete this operation.

3.5.2.17 get_requested_deadline_missed_status

Scope

`DDS::DataReader`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_requested_deadline_missed_status
      (RequestedDeadlineMissedStatus& status);
```

Description

This operation obtains the RequestedDeadlineMissedStatus struct of the DataReader.

Parameters

inout RequestedDeadlineMissedStatus& status - the contents of the RequestedDeadlineMissedStatus struct of the DataReader will be copied into the location specified by status.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ALREADY_DELETED or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation obtains the RequestedDeadlineMissedStatus struct of the DataReader. This struct contains the information whether the deadline that the DataReader was expecting through its DeadlineQosPolicy was not respected for a specific instance.

The RequestedDeadlineMissedStatus can also be monitored using a DataReaderListener or by using the associated StatusCondition.

Return Code

When the operation returns:

- *RETCODE_OK* - the current RequestedDeadlineMissedStatus of this DataReader has successfully been copied into the specified status parameter.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the DataReader has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.5.2.18 get_requested_incompatible_qos_status

Scope

DDS::DataReader

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_requested_incompatible_qos_status
      (RequestedIncompatibleQosStatus& status);
```

Description

This operation obtains the `RequestedIncompatibleQosStatus` struct of the `DataReader`.

Parameters

`inout RequestedIncompatibleQosStatus& status` - the contents of the `RequestedIncompatibleQosStatus` struct of the `DataReader` will be copied into the location specified by `status`.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_ALREADY_DELETED` or `RETCODE_OUT_OF_RESOURCES`.

Detailed Description

This operation obtains the `RequestedIncompatibleQosStatus` struct of the `DataReader`. This struct contains the information whether a `QosPolicy` setting was incompatible with the offered `QosPolicy` setting.

The Request/Offering mechanism is applicable between the `DataWriter` and the `DataReader`. If the `QosPolicy` settings between `DataWriter` and `DataReader` are inconsistent, no communication between them is established. In addition the `DataWriter` will be informed via a `REQUESTED_INCOMPATIBLE_QOS` status change and the `DataReader` will be informed via an `OFFERED_INCOMPATIBLE_QOS` status change.

The `RequestedIncompatibleQosStatus` can also be monitored using a `DataReaderListener` or by using the associated `StatusCondition`.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the current `RequestedIncompatibleQosStatus` of this `DataReader` has successfully been copied into the specified `status` parameter.
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_ALREADY_DELETED`* - the `DataReader` has already been deleted.
- *`RETCODE_OUT_OF_RESOURCES`* - the Data Distribution Service ran out of resources to complete this operation.

3.5.2.19 get_sample_lost_status

Scope

`DDS::DataReader`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_sample_lost_status
      (SampleLostStatus& status);
```

Description

This operation obtains the SampleLostStatus struct of the DataReader.

Parameters

inout SampleLostStatus& status - the contents of the SampleLostStatus struct of the DataReader will be copied into the location specified by status.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ALREADY_DELETED or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation obtains the SampleLostStatus struct of the DataReader. This struct contains information whether samples have been lost. This only applies when the ReliabilityQosPolicy is set to RELIABLE. If the ReliabilityQosPolicy is set to BEST_EFFORT the Data Distribution Service will not report the loss of samples.

The SampleLostStatus can also be monitored using a DataReaderListener or by using the associated StatusCondition.

Return Code

When the operation returns:

- *RETCODE_OK* - the current SampleLostStatus of this DataReader has successfully been copied into the specified status parameter.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the DataReader has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.5.2.20 get_sample_rejected_status

Scope

DDS::DataReader

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_sample_rejected_status
      (SampleRejectedStatus& status);
```

Detailed Description

This operation obtains the SampleRejectedStatus struct of the DataReader.

Parameters

inout SampleRejectedStatus& status - the contents of the SampleRejectedStatus struct of the DataReader will be copied into the location specified by status.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ALREADY_DELETED or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation obtains the SampleRejectedStatus struct of the DataReader. This struct contains the information whether a received sample has been rejected. Samples may be rejected by the DataReader when it runs out of resource_limits to store incoming samples. Ususally this means that old samples need to be 'consumed' (for example by 'taking' them instead of 'reading' them) to make room for newly incoming samples.

The SampleRejectedStatus can also be monitored using a DataReaderListener or by using the associated StatusCondition.

Return Code

When the operation returns:

- *RETCODE_OK* - the current SampleRejectedStatus of this DataReader has successfully been copied into the specified status parameter.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the DataReader has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.5.2.21 get_status_changes (inherited)

This operation is inherited and therefore not described here. See the class `Entity` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
StatusMask
   get_status_changes
      (void);
```

3.5.2.22 get_statuscondition (inherited)

This operation is inherited and therefore not described here. See the class `Entity` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
StatusCondition_ptr
   get_statuscondition
      (void);
```

3.5.2.23 get_subscriber

Scope

```
DDS::DataReader
```

Synopsis

```
#include <ccpp_dds_dcps.h>
Subscriber_ptr
   get_subscriber
      (void);
```

Description

This operation returns the `Subscriber` to which the `DataReader` belongs.

Parameters

<none>

Return Value

`Subscriber_ptr` - Return value is a pointer to the `Subscriber` to which the `DataReader` belongs.

Detailed Description

This operation returns the Subscriber to which the DataReader belongs, thus the Subscriber that has created the DataReader. If the DataReader is already deleted, the NULL pointer is returned.

3.5.2.24 get_subscription_matched_status

Scope

DDS::DataReader

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_subscription_matched_status
      (SubscriptionMatchedStatus& status);
```

Description

This operation obtains the SubscriptionMatchedStatus struct of the DataReader.

Parameters

inout SubscriptionMatchedStatus& status - the contents of the SubscriptionMatchedStatus struct of the DataReader will be copied into the location specified by status.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_UNSUPPORTED, RETCODE_ALREADY_DELETED or RETCODE_OUT_OF_RESOURCES.

Detailed Description

This operation obtains the SubscriptionMatchedStatus struct of the DataReader. This struct contains the information whether a new match has been discovered for the current subscription, or whether an existing match has ceased to exist.

This means that the status represents that either a DataWriter object has been discovered by the DataReader with the same Topic and a compatible Qos, or that a previously discovered DataWriter has ceased to be matched to the current DataReader. A DataWriter may cease to match when it gets deleted, when it changes its Qos to a value that is incompatible with the current DataReader or

when either the DataReader or the DataWriter has chosen to put its matching counterpart on its ignore-list using the ignore_publication or ignore_subcription operations on the DomainParticipant.

The operation may fail if the infrastructure does not hold the information necessary to fill in the SubscriptionMatchedStatus. This is the case when OpenSplice is configured not to maintain discovery information in the Networking Service. (See the description for the NetworkingService/Discovery/enabled property in the Deployment Manual for more information about this subject.) In this case the operation will return RETCODE_UNSUPPORTED.

The SubscriptionMatchedStatus can also be monitored using a DataReaderListener or by using the associated StatusCondition.

Return Code

When the operation returns:

- *RETCODE_OK* - the current SubscriptionMatchedStatus of this DataReader has successfully been copied into the specified status parameter.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_UNSUPPORTED* - OpenSplice is configured not to maintain the information about "associated" publications.
- *RETCODE_ALREADY_DELETED* - the DataReader has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.5.2.25 get_topicdescription

Scope

DDS::DataReader

Synopsis

```
#include <ccpp_dds_dcps.h>
TopicDescription_ptr
   get_topicdescription
      (void);
```

Description

This operation returns the TopicDescription which is associated with the DataReader.

Parameters

<none>

Return Value

TopicDescription_ptr - Return value is a pointer to the TopicDescription which is associated with the DataReader.

Detailed Description

This operation returns the TopicDescription which is associated with the DataReader, thus the TopicDescription with which the DataReader is created. If the DataReader is already deleted, the NULL pointer is returned.

3.5.2.26 lookup_instance (abstract)

This abstract operation is defined as a generic operation, which is implemented by the <type>DataReader class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type Foo derived FooDataReader class.

Synopsis

```
#include <ccpp_dds_dcps.h>
InstanceHandle_t
   lookup_instance
      (const <data>& instance_data);
```

3.5.2.27 read (abstract)

This abstract operation is defined as a generic operation, which is implemented by the <type>DataReader class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type Foo derived FooDataReader class.

Synopsis

```
#include <ccpp_dds_dcps.h>
       ReturnCode_t
          read
             (<data>& data_values,
               SampleInfoSeq& info_seq,
               Long max_samples,
               SampleStateMask sample_states,
               ViewStateMask view_states,
               InstanceStateMask instance_states);
```

3.5.2.28 read_instance (abstract)

This abstract operation is defined as a generic operation, which is implemented by the <type>DataReader class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type Foo derived FooDataReader class.

Synopsis

```
#include <ccpp_dds_dcps.h>
       ReturnCode_t
          read_instance
             (<data>& data_values,
               SampleInfoSeq& info_seq,
               Long max_samples,
               InstanceHandle_t a_handle,
               SampleStateMask sample_states,
               ViewStateMask view_states,
               InstanceStateMask instance_states);
```

3.5.2.29 read_next_instance (abstract)

This abstract operation is defined as a generic operation, which is implemented by the <type>DataReader class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type Foo derived FooDataReader class.

Synopsis

```
#include <ccpp_dds_dcps.h>
       ReturnCode_t
          read_next_instance
             (<data>& data_values,
               SampleInfoSeq& info_seq,
               Long max_samples,
               InstanceHandle_t a_handle,
               SampleStateMask sample_states,
               ViewStateMask view_states,
               InstanceStateMask instance_states);
```

3.5.2.30 read_next_instance_w_condition (abstract)

This abstract operation is defined as a generic operation, which is implemented by the <type>DataReader class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type Foo derived FooDataReader class.

Synopsis

```
#include <ccpp_dds_dcps.h>
       ReturnCode_t
          read_next_instance_w_condition
             (<data>& data_values,
               SampleInfoSeq& info_seq,
               Long max_samples,
               InstanceHandle_t a_handle,
               ReadCondition a_condition);
```

3.5.2.31 read_next_sample (abstract)

This abstract operation is defined as a generic operation, which is implemented by the `<type>DataReader` class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type `Foo` derived `FooDataReader` class.

Synopsis

```
#include <ccpp_dds_dcps.h>
       ReturnCode_t
          read_next_sample
             (<data>& data_value,
               SampleInfo sample_info);
```

NOTE: This operation is not yet implemented. It is scheduled for a future release.

3.5.2.32 read_w_condition (abstract)

This abstract operation is defined as a generic operation, which is implemented by the `<type>DataReader` class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type `Foo` derived `FooDataReader` class.

Synopsis

```
#include <ccpp_dds_dcps.h>
       ReturnCode_t
          read_w_condition
             (<data>& data_values,
               SampleInfoSeq& info_seq,
               Long max_samples,
               ReadCondition a_condition);
```

3.5.2.33 return_loan (abstract)

This abstract operation is defined as a generic operation, which is implemented by the <type>DataReader class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type Foo derived FooDataReader class.

Synopsis

```
#include <ccpp_dds_dcps.h>
       ReturnCode_t
          return_loan
             (<data>& data_values,
               SampleInfoSeq& info_seq);
```

3.5.2.34 set_default_datareaderview_qos

Synopsis

```
#include <ccpp_dds_dcps.h>
    DDS::DataReader
        set_default_datareaderview_qos
            (DataReaderViewQos& qos);
```

Description

This operation sets the default DataReaderViewQos of the DataReader.

Parameters

in const DataReaderViewQos& qos - the DataReaderQos struct which contains the default QosPolicy settings for newly-created DataReaderView objects.

Return Value

ReturnCode_t - Possible return codes of the operation are:
RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_OUT_OF_RESOURCES.

Detailed Description

Return Code

When the operation returns:

- *RETCODE_OK* - the new default DataReaderQos is set.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - the DataReaderViewQos parameter is invalid.

- *RETCODE_OUT_OF_RESOURCES* - the data distribution service ran out of resources to complete this operation.

3.5.2.35 set_listener

Scope

`DDS::DataReader`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   set_listener
      (DataReaderListener_ptr a_listener,
        StatusMask mask);
```

Description

This operation attaches a `DataReaderListener` to the `DataReader`.

Parameters

in DataReaderListener_ptr a_listener - a pointer to the `DataReaderListener` instance, which will be attached to the `DataReader`.

in StatusMask mask - a bit mask in which each bit enables the invocation of the `DataReaderListener` for a certain status.

Return Value

ReturnCode_t - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_UNSUPPORTED`, `RETCODE_ALREADY_DELETED` or `RETCODE_OUT_OF_RESOURCES`.

Detailed Description

This operation attaches a `DataReaderListener` to the `DataReader`. Only one `DataReaderListener` can be attached to each `DataReader`. If a `DataReaderListener` was already attached, the operation will replace it with the new one. When `a_listener` is the `NULL` pointer, it represents a listener that is treated as a NOOP[1] for all statuses activated in the bit mask.

Communication Status

For each communication status, the `StatusChangedFlag` flag is initially set to `FALSE`. It becomes `TRUE` whenever that communication status changes. For each communication status activated in the `mask`, the associated `DataReaderListener` operation is invoked and the communication status is reset to `FALSE`, as the listener

1. Short for **No-Op**eration, an instruction that does nothing.

implicitly accesses the status which is passed as a parameter to that operation. The status is reset prior to calling the listener, so if the application calls the `get_<status_name>_status` from inside the listener it will see the status already reset. An exception to this rule is the `NULL` listener, which does not reset the communication statuses for which it is invoked.

The following statuses are applicable to the `DataReaderListener`:

- `REQUESTED_DEADLINE_MISSED_STATUS`
- `REQUESTED_INCOMPATIBLE_QOS_STATUS`
- `SAMPLE_LOST_STATUS`
- `SAMPLE_REJECTED_STATUS`
- `DATA_AVAILABLE_STATUS`
- `LIVELINESS_CHANGED_STATUS`
- `SUBSCRIPTION_MATCHED_STATUS`.

Be aware that the `SUBSCRIPTION_MATCHED_STATUS` is not applicable when the infrastructure does not have the information available to determine connectivity. This is the case when OpenSplice is configured not to maintain discovery information in the Networking Service. (See the description for the `NetworkingService/Discovery/enabled` property in the Deployment Manual for more information about this subject.) In this case the operation will return `RETCODE_UNSUPPORTED`.

Status bits are declared as a constant and can be used by the application in an OR operation to create a tailored mask. The special constant `STATUS_MASK_NONE` can be used to indicate that the created entity should not respond to any of its available statuses. The DDS will therefore attempt to propagate these statuses to its factory. The special constant `STATUS_MASK_ANY_V1_2` can be used to select all applicable statuses specified in the “Data Distribution Service for Real-time Systems Version 1.2” specification which are applicable to the `PublisherListener`.

Status Propagation

In case a communication status is not activated in the `mask`, the `SubscriberListener` of the `DataReaderListener` is invoked (if attached and activated for the status that occurred). This allows the application to set a default behaviour in the `SubscriberListener` of the containing `Subscriber` and a `DataReader` specific behaviour when needed. In case the communication status is not activated in the `mask` of the `SubscriberListener` as well, the communication status will be propagated to the `DomainParticipantListener` of the containing `DomainParticipant`. In case the `DomainParticipantListener` is also not attached or the communication status is not activated in its `mask`, the application is not notified of the change.

The statuses DATA_ON_READERS_STATUS and DATA_AVAILABLE_STATUS are "Read Communication Statuses" and are an exception to all other plain communication statuses: they have no corresponding status structure that can be obtained with a get_<status_name>_status operation and they are mutually exclusive. When new information becomes available to a DataReader, the Data Distribution Service will first look in an attached and activated SubscriberListener or DomainParticipantListener (in that order) for the DATA_ON_READERS_STATUS. In case the DATA_ON_READERS_STATUS can not be handled, the Data Distribution Service will look in an attached and activated DataReaderListener, SubscriberListener or DomainParticipant Listener for the DATA_AVAILABLE_STATUS (in that order).

Return Code

When the operation returns:

- *RETCODE_OK* - the DataReaderListener is attached
- *RETCODE_ERROR* - an internal error has occurred
- *RETCODE_UNSUPPORTED* - a status was selected that cannot be supported because the infrastructure does not maintain the required connectivity information.
- *RETCODE_ALREADY_DELETED* - the DataReader has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.5.2.36 set_property

Scope

```
DDS::DataReader
```

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  set_property
    (const Property& a_property);
```

Description

This function sets a property on a DataReader.

Parameters

in Property a_property - specifies the property (in a_property.name) and its new value (in a_property.value).

Return Value

int - Possible return codes of the operation are:
`RETCODE_OK`, `RETCODE_BAD_PARAMETER`, `RETCODE_ERROR`, `RETCODE_ALREADY_DELETED`, `RETCODE_OUT_OF_RESOURCES`, `RETCODE_UNSUPPORTED`

Detailed Description

This operation sets the property specified by `a_property.name` to the value given by `a_property.value`.

Currently, the following properties are defined:

parallelReadThreadCount

By default, the demarshalling of data into objects by a single read or take operation happens only in the calling thread. The `parallelReadThreadCount` property can be used to control the number of parallel threads to be used for this demarshalling. When reading multiple samples takes a significant amount of time, increasing the number of threads on a multi-core machine can provide a significant benefit.

The value is interpreted as the number of parallel threads to use (*i.e.*, the value is a string representing a natural integer in decimal notation, so for example the string '`4`' will cause 4 threads to be used). The value '`0`' is allowed and selects the default behaviour.

If the call was successful, successive read/take operations on that DataReader will use the specified number of threads for the demarshalling step of the respective operations until the value of this property is changed again.

ignoreLoansOnDeletion

By default, the DataReader keeps history about open loans.

'Open loans' is memory given to the user by a take or a read action on a DataReader which is not returned with a call to `return_loan`.

A DataReader can by default not be deleted if there are open loans; such an attempt will result in a `RETCODE_PRECONDITION_NOT_MET` returncode.

To ignore open loans when it is necessary to delete the DataReader, set the property `ignoreLoansOnDeletion` on the DataReader to `true`. If this property is set the DataReader will ignore its open loans in the case of a delete action.

The value is interpreted as a boolean (*i.e.*, it must be either '`true`' or '`false`').

false (default): The DataReader will check for open loans in case of a delete action and will return RETCODE_PRECONDITION_NOT_MET if there are open loans.

true: The DataReader will ignore open loans and can be deleted.

Return Code

When the operation returns:

- *RETCODE_OK* - the property has been set.
- *RETCODE_BAD_PARAMETER* - an invalid value has been specified.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the DataReader has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_UNSUPPORTED* - a_property.name specifies an undefined property or the operation is not supported in this version.

3.5.2.37 set_qos

Scope

DDS::DataReader

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   set_qos
      (const DataReaderQos& qos);
```

Description

This operation replaces the existing set of QosPolicy settings for a DataReader.

Parameters

in const DataReaderQos& qos - qos contains the new set of QosPolicy settings for the DataReader.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_UNSUPPORTED, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES, RETCODE_IMMUTABLE_POLICY or RETCODE_INCONSISTENT_POLICY.

Detailed Description

This operation replaces the existing set of QosPolicy settings for a DataReader. The parameter qos contains the QosPolicy settings which is checked for self-consistency and mutability. When the application tries to change a QosPolicy setting for an enabled DataReader, which can only be set before the DataReader is enabled, the operation will fail and a RETCODE_IMMUTABLE_POLICY is returned. In other words, the application must provide the presently set QosPolicy settings in case of the immutable QosPolicy settings. Only the mutable QosPolicy settings can be changed. When qos contains conflicting QosPolicy settings (not self-consistent), the operation will fail and a RETCODE_INCONSISTENT_POLICY is returned.

The set of QosPolicy settings specified by the qos parameter are applied on top of the existing QoS, replacing the values of any policies previously set (provided, the operation returned RETCODE_OK).

Return Code

When the operation returns:

- *RETCODE_OK* - the new DataReaderQos is set
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - the parameter qos is not a valid DataReaderQos. It contains a QosPolicy setting with an invalid Duration_t value or an enum value that is outside its legal boundaries
- *RETCODE_UNSUPPORTED* - one or more of the selected QosPolicy values are currently not supported by OpenSplice.
- *RETCODE_ALREADY_DELETED* - the DataReader has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_IMMUTABLE_POLICY* - the parameter qos contains an immutable QosPolicy setting with a different value than set during enabling of the DataReader
- *RETCODE_INCONSISTENT_POLICY* - the parameter qos contains conflicting QosPolicy settings, e.g. a history depth that is higher than the specified resource limits.

3.5.2.38 take (abstract)

This abstract operation is defined as a generic operation, which is implemented by the `<type>DataReader` class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type `Foo` derived `FooDataReader` class.

Synopsis

```
#include <ccpp_dds_dcps.h>
       ReturnCode_t
          take
             (<data>& data_values,
               SampleInfoSeq& info_seq,
               Long max_samples,
               SampleStateMask sample_states,
               ViewStateMask view_states,
               InstanceStateMask instance_states)
```

3.5.2.39 take_instance (abstract)

This abstract operation is defined as a generic operation, which is implemented by the `<type>DataReader` class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type `Foo` derived `FooDataReader` class.

Synopsis

```
#include <ccpp_dds_dcps.h>
       ReturnCode_t
          take_instance
             (<data>& data_values,
               SampleInfoSeq& info_seq,
               Long max_samples,
               InstanceHandle_t a_handle,
               SampleStateMask sample_states,
               ViewStateMask view_states,
               InstanceStateMask instance_states);
```

3.5.2.40 take_next_instance (abstract)

This abstract operation is defined as a generic operation, which is implemented by the `<type>DataReader` class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type `Foo` derived `FooDataReader` class.

Synopsis

```
#include <ccpp_dds_dcps.h>
       ReturnCode_t
          take_next_instance
             (<data>& data_values,
               SampleInfoSeq& info_seq,
               Long max_samples,
               InstanceHandle_t a_handle,
               SampleStateMask sample_states,
               ViewStateMask view_states,
               InstanceStateMask instance_states);
```

3.5.2.41 take_next_instance_w_condition (abstract)

This abstract operation is defined as a generic operation, which is implemented by the `<type>DataReader` class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type `Foo` derived `FooDataReader` class.

Synopsis

```
#include <ccpp_dds_dcps.h>
       ReturnCode_t
          take_next_instance_w_condition
             (<data>& data_values,
               SampleInfoSeq& info_seq,
               Long max_samples,
               InstanceHandle_t a_handle,
               ReadCondition a_condition);
```

3.5.2.42 take_next_sample (abstract)

This abstract operation is defined as a generic operation, which is implemented by the `<type>DataReader` class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type `Foo` derived `FooDataReader` class.

Synopsis

```
#include <ccpp_dds_dcps.h>
       ReturnCode_t
          take_next_sample
             (<data>& data_value,
               SampleInfo sample_info);
```

NOTE: This operation is not yet implemented. It is scheduled for a future release.

3.5.2.43 take_w_condition (abstract)

This abstract operation is defined as a generic operation, which is implemented by the `<type>DataReader` class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type `Foo` derived `FooDataReader` class.

Synopsis

```
#include <ccpp_dds_dcps.h>
       ReturnCode_t
          take_w_condition
             (<data>& data_values,
               SampleInfoSeq& info_seq,
               Long max_samples,
               ReadCondition a_condition);
```

3.5.2.44 wait_for_historical_data

Scope

```
DDS::DataReader
```

Synopsis

```
#include <ccpp_dds_dcps.h>
       ReturnCode_t
          wait_for_historical_data
             (const Duration_t& max_wait);
```

Description

This operation will block the application thread until all “historical” data is received.

Parameters

`in const Duration_t& max_wait` - the maximum duration to block for the `wait_for_historical_data`, after which the application thread is unblocked. The special constant `DURATION_INFINITE` can be used when the maximum waiting time does not need to be bounded.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_ALREADY_DELETED`, `RETCODE_OUT_OF_RESOURCES`, `RETCODE_NOT_ENABLED` or `RETCODE_TIMEOUT`.

Detailed Description

This operation behaves differently for DataReader objects which have a non-VOLATILE_DURABILITY_QOS DurabilityQosPolicy and for DataReader objects which have a VOLATILE_DURABILITY_QOS DurabilityQosPolicy.

As soon as an application enables a non-VOLATILE_DURABILITY_QOS DataReader it will start receiving both "historical" data, i.e. the data that was written prior to the time the DataReader joined the domain, as well as any new data written by the DataWriter objects. There are situations where the application logic may require the application to wait until all "historical" data is received. This is the purpose of the wait_for_historical_data operation.

As soon as an application enables a VOLATILE_DURABILITY_QOS DataReader it will not start receiving "historical" data but only new data written by the DataWriter objects. By calling wait_for_historical_data the DataReader explicitly requests the Data Distribution Service to start receiving also the "historical" data and to wait until either all "historical" data is received, or the duration specified by the max_wait parameter has elapsed, whichever happens first.

Thread Blocking

The operation wait_for_historical_data blocks the calling thread until either all "historical" data is received, or the duration specified by the max_wait parameter elapses, whichever happens first. A return value of RETCODE_OK indicates that all the "historical" data was received a return value of RETCODE_TIMEOUT indicates that max_wait elapsed before all the data was received.

Return Code

When the operation returns:

- *RETCODE_OK* - the "historical" data is received
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the DataReader has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_NOT_ENABLED* - the DataReader is not enabled.
- *RETCODE_TIMEOUT* - not all data is received before max_wait elapsed.

3.5.2.45 wait_for_historical_data_w_condition

Scope

`DDS::DataReader`

Synopsis

```
#include <ccpp_dds_dcps.h>
   ReturnCode_t
     wait_for_historical_data_w_condition
      (const char* filter_expression,
       const StringSeq& filter_parameters,
       const Time_t& min_source_timestamp,
       const Time_t& max_source_timestamp
       const ResourceLimitsQosPolicy &resource_limits,
       const Duration_t &max_wait)
```

Description

This operation will block the application thread until all historical data that matches the supplied conditions is received.

NOTE: This operation only makes sense when the receiving node has configured its durability service as an On_Request alignee. (See also the description of the `OpenSplice/DurabilityService/NameSpaces/Policy[@alignee]` attribute in the *Deployment Guide*.) Otherwise the Durability Service will not distinguish between separate reader requests and still inject the full historical data set in each reader.

Additionally, when creating the DataReader, the DurabilityQos.kind of the DataReaderQos needs to be set to VOLATILE, to ensure that historical data that potentially is available already at creation time is not immediately delivered to the DataReader at that time.

Parameters

in const char filter_expression* – the SQL expression (subset of SQL), which defines the filtering criteria (NULL when no SQL filtering is needed).

in const StringSeq& filter_parameters – sequence of strings with the parameter values used in the SQL expression (*i.e.*, the number of `%n` tokens in the expression). The number of values in `expression_parameters` must be equal to or greater than the highest referenced `%n` token in the `filter_expression` (*e.g.* if `%1` and `%8` are used as parameters in the `filter_expression`, the `expression_parameters` should contain at least $n + 1 = 9$ values).

in const Time_t& min_source_timestamp – Filter out all data published before this time. The special constant TIMESTAMP_INVALID can be used when no minimum filter is needed. The value of min_source_timestamp.sec must be less than 0x7fffffff otherwise it will be recognized as TIMESTAMP_INVALID_SEC.

in const Time_t& max_source_timestamp – Filter out all data published after this time. The special constant TIMESTAMP_INVALID can be used when no maximum filter is needed. The value of max_source_timestamp.sec must be less than 0x7fffffff otherwise it will be recognized as TIMESTAMP_INVALID_SEC.

in const ResourceLimitsQosPolicy& resource_limits – Specifies limits on the maximum amount of historical data that may be received.

in const Duration_t& max_wait – The maximum duration the application thread is blocked during this operation.

Return Value

ReturnCode_t – Possible return codes of the operation are:
RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_PRECONDITION_NOT_MET, RETCODE_ALREADY_DELETED, RETCODE_NOT_ENABLED, RETCODE_TIMEOUT.

Detailed Description

This operation is similar to the *wait_for_historical_data* operation, but instead of inserting all historical data into the DataReader, only data that matches the conditions expressed by the parameters to this opération is inserted. For more information about historical data please refer to section *3.5.2.44* on page 400.

By using filter_expression and filter_parameters, data can be selected or discarded based on content. The filter_expression must adhere to SQL syntax of the *WHERE* clause as described in Appendix H, *DCPS Queries and Filters*. Constraints on the age of data can be set by using the min_source_timestamp and max_source_timestamp parameters. Only data published within this timeframe will be selected. Note that TIMESTAMP_INVALID is also accepted as a lower or upper timeframe limit. The amount of selected data can be further reduced by the resource_limits parameter. This QosPolicy allows to set a limit on the number of samples, instances and samples per instance that are to be received.

Return Code

When the operation returns:

- *RETCODE_OK* - the historical data is received.
- *RETCODE_ERROR* - an internal error occurred.

- *RETCODE_BAD_PARAMETER* - any of the parameters is invalid, including resource_limits that do not meet constraints set on the DataReader.
- *RETCODE_PRECONDITION_NOT_MET* - No Durability service is available or a different request for historical data is already being processed.
- *RETCODE_ALREADY_DELETED* - the DataReader is already deleted.
- *RETCODE_NOT_ENABLED* - the DataReader is not enabled.
- *RETCODE_TIMEOUT* - not all data is received before max_wait elapsed.

3.5.2.46 Class FooDataReader

The pre-processor generates from IDL type descriptions the application <type>DataReader classes. For each application data type that is used as Topic data type, a typed class <type>DataReader is derived from the DataReader class. In this paragraph, the class FooDataReader in the namespace SPACE describes the operations of these derived <type>DataReader classes as an example for the fictional application type Foo (defined in the module SPACE).

For instance, for an application, the definitions are located in the Space.idl file. The pre-processor will generate a ccpp_Space.h include file.

i **General note**: The name ccpp_Space.h is derived from the IDL file Space.idl, that defines Foo, for all relevant FooDataWriter operations.

State Masks

A FooDataReader refers to exactly one TopicDescription (either a Topic, a ContentFilteredTopic or a MultiTopic) that identifies the data to be read. Therefore it refers to exactly one data type. The Topic must exist prior to the FooDataReader creation. The FooDataReader may give access to several instances of the data type, which are distinguished from each other by their key. The FooDataReader is attached to exactly one Subscriber which acts as a factory for it.

The interface description of this class is as follows:

```
class FooDataReader
{
//
// inherited from class Entity
//
// StatusCondition_ptr
//    get_statuscondition
//       (void);
// StatusMask
//    get_status_changes
//       (void);
// ReturnCode_t
```

```
//    enable
//       (void);
//
// inherited from class DataReader
//
// ReadCondition_ptr
//    create_readcondition
//       (SampleStateMask sample_states,
//       ViewStateMask view_states,
//       InstanceStateMask instance_states);

// QueryCondition_ptr
//    create_querycondition
//       (SampleStateMask sample_states,
//       ViewStateMask view_states,
//       InstanceStateMask instance_states,
//       const char* query_expression,
//       const StringSeq& query_parameters);

// ReturnCode_t
//    delete_readcondition
//       (ReadCondition_ptr a_condition);

// ReturnCode_t
//    delete_contained_entities
//       (void);

// ReturnCode_t
//    set_qos
//       (const DataReaderQos& qos);

// ReturnCode_t
//    get_qos
//       (DataReaderQos& qos);

// ReturnCode_t
//    set_listener
//       (DataReaderListener_ptr a_listener,
//         StatusMask mask);

// DataReaderListener_ptr
//    get_listener
//       (void);

// TopicDescription_ptr
//    get_topicdescription
//       (void);

// Subscriber_ptr
//    get_subscriber
```

```
//        (void);

// ReturnCode_t
//    get_sample_rejected_status
//        (SampleRejectedStatus& status);

// ReturnCode_t
//    get_liveliness_changed_status
//        (LivelinessChangedStatus& status);

// ReturnCode_t
//    get_requested_deadline_missed_status
//        (RequestedDeadlineMissedStatus& status);

// ReturnCode_t
//    get_requested_incompatible_qos_status
//        (RequestedIncompatibleQosStatus& status);

// ReturnCode_t
//    get_subscription_matched_status
//        (SubscriptionMatchedStatus& status);

// ReturnCode_t
//    get_sample_lost_status
//        (SampleLostStatus& status);

// ReturnCode_t
//    wait_for_historical_data
//        (const Duration_t& max_wait);

// ReturnCode_t
//    get_matched_publications
//        (InstanceHandleSeq& publication_handles);

// ReturnCode_t
//    get_matched_publication_data
//        (PublicationBuiltinTopicData& publication_data,
//        InstanceHandle_t publication_handle);
//
// implemented API operations
//
   ReturnCode_t
      read
         (FooSeq& data_values,
           SampleInfoSeq& info_seq,
           Long max_samples,
           SampleStateMask sample_states,
           ViewStateMask view_states,
           InstanceStateMask instance_states);
   ReturnCode_t
```

```
   take
      (FooSeq& data_values,
        SampleInfoSeq& info_seq,
        Long max_samples,
        SampleStateMask sample_states,
        ViewStateMask view_states,
        InstanceStateMask instance_states);
ReturnCode_t
   read_w_condition
      (FooSeq& data_values,
        SampleInfoSeq& info_seq,
        Long max_samples,
        ReadCondition_ptr a_condition);
ReturnCode_t
   take_w_condition
      (FooSeq& data_values,
        SampleInfoSeq& info_seq,
        Long max_samples,
        ReadCondition_ptr a_condition);
ReturnCode_t
   data_value
      (Foo& received_data,
        SampleInfo sample_info);
ReturnCode_t
   take_next_sample
      (Foo& data_value,
        SampleInfo sample_info);
ReturnCode_t
   read_instance
      (FooSeq& data_values,
        SampleInfoSeq& info_seq,
        Long max_samples,
        InstanceHandle_t a_handle,
        SampleStateMask sample_states,
        ViewStateMask view_states,
        InstanceStateMask instance_states);
ReturnCode_t
   take_instance
      (FooSeq& data_values,
        SampleInfoSeq& info_seq,
        Long max_samples,
        InstanceHandle_t a_handle,
        SampleStateMask sample_states,
        ViewStateMask view_states,
        InstanceStateMask instance_states);
ReturnCode_t
   read_next_instance
      (FooSeq& data_values,
        SampleInfoSeq& info_seq,
        Long max_samples,
```

```
                InstanceHandle_t a_handle,
                SampleStateMask sample_states,
                ViewStateMask view_states,
                InstanceStateMask instance_states);
        ReturnCode_t
           take_next_instance
              (FooSeq& data_values,
                SampleInfoSeq& info_seq,
                Long max_samples,
                InstanceHandle_t a_handle,
                SampleStateMask sample_states,
                ViewStateMask view_states,
                InstanceStateMask instance_states);
        ReturnCode_t
           read_next_instance_w_condition
              (FooSeq& data_values,
                SampleInfoSeq& info_seq,
                Long max_samples,
                InstanceHandle_t a_handle,
                ReadCondition_ptr a_condition);
        ReturnCode_t
           take_next_instance_w_condition
              (FooSeq& data_values,
                SampleInfoSeq& info_seq,
                Long max_samples,
                InstanceHandle_t a_handle,
                ReadCondition_ptr a_condition);
        ReturnCode_t
           return_loan
              (FooSeq& data_values,
                SampleInfoSeq& info_seq);
        ReturnCode_t
           get_key_value
              (Foo& key_holder,
                InstanceHandle_t handle);
        InstanceHandle_t
           lookup_instance
              (const Foo& instance_data);
    };
```

The next paragraphs describe the usage of all `FooDataReader` operations. The inherited operations are listed but not fully described because they are not implemented in this class. The full description of these operations is given in the classes from which they are inherited.

3.5.2.47 create_querycondition (inherited)

This operation is inherited and therefore not described here. See the class `DataReader` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
QueryCondition_ptr
   create_querycondition
      (SampleStateMask sample_states,
        ViewStateMask view_states,
        InstanceStateMask instance_states,
        const char* query_expression,
        const StringSeq& query_parameters);
```

3.5.2.48 create_readcondition (inherited)

This operation is inherited and therefore not described here. See the class `DataReader` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
ReadCondition_ptr
   create_readcondition
      (SampleStateMask sample_states,
        ViewStateMask view_states,
        InstanceStateMask instance_states);
```

3.5.2.49 delete_contained_entities (inherited)

This operation is inherited and therefore not described here. See the class `DataReader` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
ReturnCode_t
   delete_contained_entities
      (void);
```

3.5.2.50 delete_readcondition (inherited)

This operation is inherited and therefore not described here. See the class `DataReader` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
ReturnCode_t
   delete_readcondition
      (ReadCondition_ptr a_condition);
```

3.5.2.51 enable (inherited)

This operation is inherited and therefore not described here. See the class `Entity` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
ReturnCode_t
   enable
      (void);
```

3.5.2.52 get_key_value

Scope

```
SPACE::FooDataReader
```

Synopsis

```
#include <ccpp_Space.h>
       ReturnCode_t
          get_key_value
             (Foo& key_holder,
               InstanceHandle_t handle);
```

Description

This operation retrieves the key value of a specific instance.

Parameters

inout Foo& key_holder - a reference to the sample in which the key values are stored.

in InstanceHandle_t handle - the handle to the instance from which to get the key value.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES, RETCODE_NOT_ENABLED or RETCODE_PRECONDITION_NOT_MET.

Detailed Description

This operation retrieves the key value of the instance referenced to by instance_handle. When the operation is called with a HANDLE_NIL handle value as an instance_handle, the operation will return RETCODE_BAD_PARAMETER. The operation will only fill the fields that form the key inside the key_holder instance. This means that the non-key fields are not applicable and may contain garbage.

The operation must only be called on registered instances. Otherwise the operation returns the error RETCODE_PRECONDITION_NOT_MET.

Return Code

When the operation returns:

- *RETCODE_OK* - the `key_holder` instance contains the key values of the instance;
- *RETCODE_ERROR* - an internal error has occurred
- *RETCODE_BAD_PARAMETER* - `handle` is not a valid handle
- *RETCODE_ALREADY_DELETED* - the `FooDataReader` has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_NOT_ENABLED* - the `FooDataReader` is not enabled.
- *RETCODE_PRECONDITION_NOT_MET* - this instance is not registered.

3.5.2.53 get_listener (inherited)

This operation is inherited and therefore not described here. See the class `DataReader` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
DataReaderListener_ptr
   get_listener
      (void);
```

3.5.2.54 get_liveliness_changed_status (inherited)

This operation is inherited and therefore not described here. See the class `DataReader` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
ReturnCode_t
   get_liveliness_changed_status
      (LivelinessChangedStatus& status);
```

3.5.2.55 get_matched_publication_data (inherited)

This operation is inherited and therefore not described here. See the class `DataReader` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
ReturnCode_t
   get_matched_publication_data
      (PublicationBuiltinTopicData& publication_data,
        InstanceHandle_t publication_handle);
```

3.5.2.56 get_matched_publications (inherited)

This operation is inherited and therefore not described here. See the class `DataReader` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
ReturnCode_t
   get_matched_publications
      (InstanceHandleSeq& publication_handles);
```

3.5.2.57 get_qos (inherited)

This operation is inherited and therefore not described here. See the class `DataReader` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
ReturnCode_t
   get_qos
      (DataReaderQos& qos);
```

3.5.2.58 get_requested_deadline_missed_status (inherited)

This operation is inherited and therefore not described here. See the class `DataReader` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
ReturnCode_t
   get_requested_deadline_missed_status
      (RequestedDeadlineMissedStatus& status);
```

3.5.2.59 get_requested_incompatible_qos_status (inherited)

This operation is inherited and therefore not described here. See the class `DataReader` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
ReturnCode_t
   get_requested_incompatible_qos_status
      (RequestedIncompatibleQosStatus& status);
```

3.5.2.60 get_sample_lost_status (inherited)

This operation is inherited and therefore not described here. See the class `DataReader` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
ReturnCode_t
   get_sample_lost_status
      (SampleLostStatus& status);
```

3.5.2.61 get_sample_rejected_status (inherited)

This operation is inherited and therefore not described here. See the class `DataReader` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
ReturnCode_t
   get_sample_rejected_status
      (SampleRejectedStatus& status);
```

3.5.2.62 get_status_changes (inherited)

This operation is inherited and therefore not described here. See the class `Entity` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
StatusMask
   get_status_changes
      (void);
```

3.5.2.63 get_statuscondition (inherited)

This operation is inherited and therefore not described here. See the class `Entity` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
StatusCondition_ptr
   get_statuscondition
      (void);
```

3.5.2.64 get_subscriber (inherited)

This operation is inherited and therefore not described here. See the class `DataReader` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
Subscriber_ptr
   get_subscriber
```

```
   (void);
```

3.5.2.65 get_subscription_matched_status (inherited)

This operation is inherited and therefore not described here. See the class `DataReader` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
ReturnCode_t
   get_subscription_matched_status
      (SubscriptionMatchedStatus& status);
```

3.5.2.66 get_topicdescription (inherited)

This operation is inherited and therefore not described here. See the class `DataReader` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
TopicDescription_ptr
   get_topicdescription
      (void);
```

3.5.2.67 lookup_instance

Scope

```
SPACE::FooDataReader
```

Synopsis

```
#include <ccpp_Space.h>
InstanceHandle_t
   lookup_instance
      (const Foo& instance_data);
```

Description

This operation returns the value of the instance handle which corresponds to the `instance_data`.

Parameters

`in const Foo& instance_data` - the instance for which the corresponding instance handle needs to be looked up.

Return Value

`InstanceHandle_t` - Result value is the instance handle which corresponds to the `instance_data`.

Detailed Description

This operation returns the value of the instance handle which corresponds to the `instance_data`. The instance handle can be used in read operations that operate on a specific instance. Note that `DataReader` instance handles are local, and are not interchangeable with `DataWriter` instance handles nor with instance handles of an other `DataReader`. If the `DataReader` is already deleted, the handle value `HANDLE_NIL` is returned.

3.5.2.68 read

Scope

`SPACE::FooDataReader`

Synopsis

```
#include <ccpp_Space.h>
       ReturnCode_t
          read
             (FooSeq& data_values,
               SampleInfoSeq& info_seq,
               Long max_samples,
               SampleStateMask sample_states,
               ViewStateMask view_states,
               InstanceStateMask instance_states);
```

Description

This operation reads a sequence of `Foo` samples from the `FooDataReader`.

Parameters

inout FooSeq& data_values - the returned sample data sequence. *data_values* is also used as an input to control the behaviour of this operation.

inout SampleInfoSeq& info_seq - the returned `SampleInfo` structure sequence. `info_seq` is also used as an input to control the behaviour of this operation.

in long max_samples - the maximum number of samples that is returned.

in SampleStateMask sample_states - a mask, which selects only those samples with the desired sample states.

in ViewStateMask view_states - a mask, which selects only those samples with the desired view states.

in InstanceStateMask instance_states - a mask, which selects only those samples with the desired instance states.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES, RETCODE_NOT_ENABLED, RETCODE_PRECONDITION_NOT_MET or RETCODE_NO_DATA.

Detailed Description

This operation reads a sequence of Foo samples from the FooDataReader. The data is returned by the parameters data_values and info_seq. The number of samples that is returned is limited by the parameter max_samples. This operation is part of the specialized class which is generated for the particular application data type (in this case type Foo) that is being read. If the FooDataReader has no samples that meet the constraints, the return value is RETCODE_NO_DATA.

State Masks

The read operation depends on a selection of the samples by using three masks:

- sample_states is the mask, which selects only those samples with the desired sample states READ_SAMPLE_STATE, NOT_READ_SAMPLE_STATE or both
- view_states is the mask, which selects only those samples with the desired view states NEW_VIEW_STATE, NOT_NEW_VIEW_STATE or both
- instance_states is the mask, which selects only those samples with the desired instance states ALIVE_INSTANCE_STATE, NOT_ALIVE_DISPOSED_INSTANCE_STATE, NOT_ALIVE_NO_WRITERS_INSTANCE_STATE or a combination of these.

Destination Order

In any case, the relative order between the samples of one instance is consistent with the DestinationOrderQosPolicy of the Subscriber.

- When the DestinationOrderQosPolicy kind is BY_RECEPTION_timestamp_DESTINATIONORDER_QOS, the samples belonging to the same instances will appear in the relative order in which they were received (FIFO)
- When the DestinationOrderQosPolicy kind is BY_SOURCE_timestamp_DESTINATIONORDER_QOS, the samples belonging to the same instances will appear in the relative order implied by the source_timestamp.

Data Sample

In addition to the sample sequence (`data_values`), the operation also returns a sequence of `SampleInfo` structures with the parameter `info_seq`. The `info_seq` structures and `data_values` also determine the behaviour of this operation.

Resource Control

The initial (input) properties of the `data_values` and `info_seq` sequences determine the precise behaviour of the `read` operation. The sequences are modelled as having three properties: the current-length (`length`), the maximum length (`maximum`), and whether or not the sequence container owns the memory of the elements within (`release`).

The initial (input) values of the `length`, `maximum`, and `release` properties for the `data_values` and `info_seq` sequences govern the behaviour of the `read` operation as specified by the following rules:

- The values of `length`, `maximum`, and `release` for the two sequences must be identical. Otherwise `read` returns `RETCODE_PRECONDITION_NOT_MET`
- On successful output, the values of `length`, `maximum`, and `release` are the same for both sequences
- If the input `maximum == 0`, the `received_data` and `info_seq` sequences are filled with elements that are "loaned" by the `FooDataReader`. On output, `release` is `FALSE`, `length` is set to the number of values returned, and `maximum` is set to a value verifying `maximum >= length`. In this case the application will need to "return the loan" to the Data Distribution Service using the `return_loan` operation
- If the input `maximum>0` and the input `release == FALSE`, the `read` operation will fail and returns `RETCODE_PRECONDITION_NOT_MET`. This avoids the potential hard-to-detect memory leaks caused by an application forgetting to "return the loan"
- If input `maximum>0` and the input `release==TRUE`, the `read` operation will copy the `Foo` samples and `info_seq` values into the elements already inside the sequences. On output, `release` is `TRUE`, `length` is set to the number of values copied, and `maximum` will remain unchanged. The application can control where the copy is placed and the application does not need to "return the loan". The number of samples copied depends on the relative values of `maximum` and `max_samples`:
  - If `max_samples==LENGTH_UNLIMITED`, at most `maximum` values are copied. The use of this variant lets the application limit the number of samples returned to what the sequence can accommodate

- If max_samples<=maximum, at most max_samples values are copied. The use of this variant lets the application limit the number of samples returned to fewer than what the sequence can accommodate
- If max_samples>maximum, the read operation will fail and returns RETCODE_PRECONDITION_NOT_MET. This avoids the potential confusion where the application expects to be able to access up to max_samples, but that number can never be returned, even if they are available in the FooDataReader, because the output sequence cannot accommodate them.

Buffer Loan

As described above, upon return the data_values and info_seq sequences may contain elements "loaned" from the Data Distribution Service. If this is the case, the application will need to use the return_loan operation to return the "loan" once it is no longer using the data in the sequence. Upon return from return_loan, the sequence has maximum==0 and release==FALSE.

The application can determine whether it is necessary to "return the loan" or not, based on the state of the sequences, when the read operation was called, or by accessing the "release" property. However, in many cases it may be simpler to always call return_loan, as this operation is harmless (i.e. leaves all elements unchanged) if the sequence does not have a loan.

To avoid potential memory leaks, it is not allowed to change the length of the data_values and info_seq structures for which release==FALSE. Furthermore, deleting a sequence for which release==FALSE is considered to be an error except when the sequence is empty.

Data Sequence

On output, the sequence of data values and the sequence of SampleInfo structures are of the same length and are in an one-to-one correspondence. Each SampleInfo structures provides information, such as the source_timestamp, the sample_state, view_state, and instance_state, etc., about the matching sample.

Some elements in the returned sequence may not have valid data: the valid_data field in the SampleInfo indicates whether the corresponding data value contains any meaningful data. If not, the data value is just a 'dummy' sample for which only the keyfields have been assigned. It is used to accompany the SampleInfo that communicates a change in the instance_state of an instance for which there is no 'real' sample available.

For example, when an application always 'takes' all available samples of a particular instance, there is no sample available to report the disposal of that instance. In such a case the DataReader will insert a dummy sample into the data_values sequence to accompany the SampleInfo element in the info_seq sequence that communicates the disposal of the instance.

The act of reading a sample sets its sample_state to READ_SAMPLE_STATE. If the sample belongs to the most recent generation of the instance, it also sets the view_state of the instance to NOT_NEW_VIEW_STATE. It does not affect the instance_state of the instance.

Return Code

When the operation returns:

- *RETCODE_OK* - a sequence of data values is available
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the FooDataReader has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_NOT_ENABLED* - the FooDataReader is not enabled.
- *RETCODE_PRECONDITION_NOT_MET* - one of the following is true:
  - the max_samples>maximum and max_samples is not LENGTH_UNLIMITED
  - one or more values of length, maximum, and release for the two sequences are not identical
  - the maximum>0 and the release==FALSE.
- *RETCODE_NO_DATA* - no samples that meet the constraints are available.

3.5.2.69 read_instance

Scope

```
SPACE::FooDataReader
```

Synopsis

```
#include <ccpp_Space.h>
       ReturnCode_t
          read_instance
             (FooSeq& data_values,
               SampleInfoSeq& info_seq,
               Long max_samples,
               InstanceHandle_t a_handle,
               SampleStateMask sample_states,
               ViewStateMask view_states,
```

```
InstanceStateMask instance_states);
```

Description

This operation reads a sequence of `Foo` samples of a single instance from the `FooDataReader`.

Parameters

`inout FooSeq& data_values` - the returned sample data sequence. `data_values` is also used as an input to control the behaviour of this operation.

`inout SampleInfoSeq& info_seq` - the returned `SampleInfo` structure sequence. `info_seq` is also used as an input to control the behaviour of this operation.

`in long max_samples` - the maximum number of samples that is returned.

`in InstanceHandle_t a_handle` - the single instance, the samples belong to.

`in SampleStateMask sample_states` - a mask, which selects only those samples with the desired sample states.

`in ViewStateMask view_states` - a mask, which selects only those samples with the desired view states.

`in InstanceStateMask instance_states` - a mask, which selects only those samples with the desired instance states.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_BAD_PARAMETER`, `RETCODE_ALREADY_DELETED`, `RETCODE_OUT_OF_RESOURCES`, `RETCODE_NOT_ENABLED`, `RETCODE_PRECONDITION_NOT_MET` or `RETCODE_NO_DATA`.

Detailed Description

This operation reads a sequence of `Foo` samples of a single instance from the `FooDataReader`. The behaviour is identical to `read` except for that all samples returned belong to the single specified instance whose handle is `a_handle`. Upon successful return, the data collection will contain samples all belonging to the same instance. The data is returned by the parameters `data_values` and `info_seq`. The corresponding `SampleInfo.instance_handle` in `info_seq` will have the value of `a_handle`. The `DataReader` will check that each sample belongs to the specified instance (indicated by `a_handle`) otherwise it will not place the sample in the returned collection.

Return Code

When the operation returns:

- *RETCODE_OK* - a sequence of data values is available
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - the parameter `a_handle` is not a valid handle
- *RETCODE_ALREADY_DELETED* - the `FooDataReader` has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_NOT_ENABLED* - the `FooDataReader` is not enabled.
- *RETCODE_PRECONDITION_NOT_MET* - one of the following is true:
  - the `max_samples>maximum` and `max_samples` is not `LENGTH_UNLIMITED`.
  - one or more values of `length`, `maximum`, and `release` for the two sequences are not identical.
  - the `maximum>0` and the `release==FALSE`.
  - the handle `==HANDLE_NIL`.
  - the handle has not been registered with this DataReader.
- `RETCODE_NO_DATA` - no samples that meet the constraints are available.

3.5.2.70 read_next_instance

Scope

`SPACE::FooDataReader`

Synopsis

```
#include <ccpp_Space.h>
       ReturnCode_t
          read_next_instance
             (FooSeq& data_values,
               SampleInfoSeq& info_seq,
               Long max_samples,
               InstanceHandle_t a_handle,
               SampleStateMask sample_states,
               ViewStateMask view_states,
               InstanceStateMask instance_states);
```

Description

This operation reads a sequence of `Foo` samples of the next single instance from the `FooDataReader`.

Parameters

inout FooSeq& data_values - the returned sample data sequence. data_values is also used as an input to control the behaviour of this operation.

inout SampleInfoSeq& info_seq - the returned SampleInfo structure sequence. info_seq is also used as an input to control the behaviour of this operation.

in long max_samples - the maximum number of samples that is returned.

in InstanceHandle_t a_handle - the current single instance, the returned samples belong to the next single instance.

in SampleStateMask sample_states - a mask, which selects only those samples with the desired sample states.

in ViewStateMask view_states - a mask, which selects only those samples with the desired view states.

in InstanceStateMask instance_states - a mask, which selects only those samples with the desired instance states.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES, RETCODE_NOT_ENABLED, RETCODE_PRECONDITION_NOT_MET or RETCODE_NO_DATA.

Detailed Description

This operation reads a sequence of Foo samples of a single instance from the FooDataReader. The behaviour is similar to read_instance (all samples returned belong to a single instance) except that the actual instance is not directly specified. Rather the samples will all belong to the 'next' instance with instance_handle 'greater' (according to some internal-defined order) than a_handle, that has available samples. The data is returned by the parameters data_values and info_seq. The corresponding SampleInfo.instance_handle in info_seq will has the value of the next instance with respect to a_handle.

Instance Order

The internal-defined order is not important and is implementation specific. The important thing is that, according to the Data Distribution Service, all instances are ordered relative to each other. This ordering is between the instances, that is, it does not depend on the actual samples received. For the purposes of this explanation it is *'as if'* each instance handle was represented as a unique integer.

The behaviour of read_next_instance is *'as if'* the DataReader invoked read_instance passing the smallest instance_handle among all the ones that:

- are greater than a_handle
- have available samples (i.e. samples that meet the constraints imposed by the specified states).
- The special value HANDLE_NIL is guaranteed to be 'less than' any valid instance_handle. So the use of the parameter value a_handle==HANDLE_NIL will return the samples for the instance which has the smallest instance_handle among all the instances that contains available samples.

Typical Use

The operation read_next_instance is intended to be used in an application-driven iteration where the application starts by passing a_handle==HANDLE_NIL, examines the samples returned, and then uses the instance_handle returned in the SampleInfo as the value of a_handle argument to the next call to read_next_instance. The iteration continues until read_next_instance returns the return value RETCODE_NO_DATA.

Return Code

When the operation returns:

- *RETCODE_OK* - a sequence of data values is available
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - the parameter a_handle is not a valid handle
- *RETCODE_ALREADY_DELETED* - the FooDataReader has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_NOT_ENABLED* - the FooDataReader is not enabled.
- *RETCODE_PRECONDITION_NOT_MET* - one of the following is true:
  - the max_samples>maximum and max_samples is not LENGTH_UNLIMITED
  - one or more values of length, maximum, and release for the two sequences are not identical
  - the maximum>0 and the release==FALSE.
  - the handle has not been registered with this DataReader.
- *RETCODE_NO_DATA* - no samples that meet the constraints are available.

3.5.2.71 read_next_instance_w_condition

Scope

SPACE::FooDataReader

Synopsis

```
#include <ccpp_Space.h>
       ReturnCode_t
          read_next_instance_w_condition
             (FooSeq& data_values,
               SampleInfoSeq& info_seq,
               Long max_samples,
               InstanceHandle_t a_handle,
               ReadCondition_ptr a_condition);
```

Description

This operation reads a sequence of Foo samples of the next single instance from the FooDataReader, filtered by a ReadCondition or QueryCondition.

Parameters

inout FooSeq& data_values - the returned sample data sequence. data_values is also used as an input to control the behaviour of this operation.

inout SampleInfoSeq& info_seq - the returned SampleInfo structure sequence. info_seq is also used as an input to control the behaviour of this operation.

in long max_samples - the maximum number of samples that is returned.

in InstanceHandle_t a_handle - the current single instance, the returned samples belong to the next single instance.

in ReadCondition_ptr a_condition - a pointer to a ReadCondition or QueryCondition which filters the data before it is returned by the read operation.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES, RETCODE_NOT_ENABLED, RETCODE_PRECONDITION_NOT_MET or RETCODE_NO_DATA.

Detailed Description

This operation reads a sequence of `Foo` samples of a single instance from the `FooDataReader, filtered by a ReadCondition or QueryCondition`. The behaviour is identical to `read_next_instance` except for that the `samples` are filtered by a `ReadCondition or QueryCondition`. When using a `ReadCondition`, the result is the same as the `read_next_instance` operation with the same state parameters filled in as for the `create_readcondition`. In this way, the application can avoid repeating the same parameters, specified when creating the `ReadCondition`. When using a `QueryCondition`, a content based filtering can be done. When either using a `ReadCondition` or `QueryCondition`, the condition must be created by this `FooDataReader`. Otherwise the operation will fail and returns `RETCODE_PRECONDITION_NOT_MET`.

Return Code

When the operation returns:

- *`RETCODE_OK`* - a sequence of data values is available
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_BAD_PARAMETER`* - the parameter `a_condition` is not a valid `ReadCondition_ptr` or `a_handle` is not a valid handle.
- *`RETCODE_ALREADY_DELETED`* - the `FooDataReader` has already been deleted
- *`RETCODE_OUT_OF_RESOURCES`* - the Data Distribution Service ran out of resources to complete this operation.
- *`RETCODE_NOT_ENABLED`* - the `FooDataReader` is not enabled.
- *`RETCODE_PRECONDITION_NOT_MET`* - one of the following is true:
  - the `max_samples>maximum` and `max_samples` is not `LENGTH_UNLIMITED`
  - one or more values of `length`, `maximum`, and `release` for the two sequences are not identical
  - the `maximum>0` and the `release==FALSE`.
  - the handle has not been registered with this DataReader.
- *`RETCODE_NO_DATA`* - no samples that meet the constraints are available.

3.5.2.72 read_next_sample

Scope

`SPACE::FooDataReader`

Synopsis

```
#include <ccpp_Space.h>
```

```
ReturnCode_t
   read_next_sample
      (Foo& data_value,
        SampleInfo sample_info);
```

NOTE: This operation is not yet implemented. It is scheduled for a future release.

3.5.2.73 read_w_condition

Scope

`SPACE::FooDataReader`

Synopsis

```
#include <ccpp_Space.h>
       ReturnCode_t
          read_w_condition
             (FooSeq& data_values,
               SampleInfoSeq& info_seq,
               Long max_samples,
               ReadCondition_ptr a_condition);
```

Description

This operation reads a sequence of `Foo` samples from the `FooDataReader`, filtered by a `ReadCondition` or `QueryCondition`.

Parameters

`inout FooSeq& data_values` - the returned sample data sequence. `data_values` is also used as an input to control the behaviour of this operation.

`inout SampleInfoSeq& info_seq` - the returned `SampleInfo` structure sequence. `info_seq` is also used as an input to control the behaviour of this operation.

`in long max_samples` - the maximum number of samples that is returned.

`in ReadCondition_ptr a_condition` - a pointer to a `ReadCondition` or `QueryCondition` which filters the data before it is returned by the `read` operation.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_BAD_PARAMETER`, `RETCODE_ALREADY_DELETED`, `RETCODE_OUT_OF_RESOURCES`, `RETCODE_NOT_ENABLED`, `RETCODE_PRECONDITION_NOT_MET` or `RETCODE_NO_DATA`.

Detailed Description

This operation reads a sequence of `Foo` samples from the `FooDataReader`, filtered by a `ReadCondition` or `QueryCondition`. The condition reference from both `create_readcondition` or `create_querycondition` may be used. The behaviour is identical to `read` except for that the samples are filtered by a `ReadCondition` or `QueryCondition`. When using a `ReadCondition`, the result is the same as the `read` operation with the same state parameters filled in as for the `create_readcondition`. In this way, the application can avoid repeating the same parameters, specified when creating the `ReadCondition`. When using a `QueryCondition`, a content based filtering can be done. When either using a `ReadCondition` or `QueryCondition`, the condition must be created by this `FooDataReader`. Otherwise the operation will fail and returns `RETCODE_PRECONDITION_NOT_MET`.

Return Code

When the operation returns:

- *`RETCODE_OK`* - a sequence of data values is available
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_BAD_PARAMETER`* - the parameter `a_condition` is not a valid `ReadCondition_ptr`
- *`RETCODE_ALREADY_DELETED`* - the `FooDataReader` has already been deleted
- *`RETCODE_OUT_OF_RESOURCES`* - the Data Distribution Service ran out of resources to complete this operation.
- *`RETCODE_NOT_ENABLED`* - the `FooDataReader` is not enabled.
- *`RETCODE_PRECONDITION_NOT_MET`* - one of the following is true:
  - the `ReadCondition` or `QueryCondition` is not attached to this `FooDataReader`
  - the `max_samples>maximum` and `max_samples` is not `LENGTH_UNLIMITED`
  - one or more values of `length`, `maximum`, and `release` for the two sequences are not identical
  - the `maximum>0` and the `release==FALSE`.
- *`RETCODE_NO_DATA`* - no samples that meet the constraints are available.

3.5.2.74 return_loan

Scope

`SPACE::FooDataReader`

Synopsis

```
#include <ccpp_Space.h>
       ReturnCode_t
          return_loan
             (FooSeq& data_values,
               SampleInfoSeq& info_seq);
```

Description

This operation indicates to the DataReader that the application is done accessing the sequence of data_values and info_seq.

Parameters

inout FooSeq& data_values - the sample data sequence which was loaned from the DataReader.

inout SampleInfoSeq& info_seq - the SampleInfo structure sequence which was loaned from the DataReader.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES, RETCODE_NOT_ENABLED or RETCODE_PRECONDITION_NOT_MET.

Detailed Description

This operation indicates to the DataReader that the application is done accessing the sequence of data_values and info_seq obtained by some earlier invocation of the operation read or take (or any of the similar operations) on the DataReader.

The data_values and info_seq must belong to a single related pair that is, they should correspond to a pair returned from a single call to the operation read or take. The data_values and info_seq must also have been obtained from the same DataReader to which they are returned. If either of these conditions is not met the operation will fail and returns RETCODE_PRECONDITION_NOT_MET.

Buffer Loan

The operation return_loan allows implementations of the read and take operations to "loan" buffers from the Data Distribution Service to the application and in this manner provide "zero-copy" access to the data. During the loan, the Data Distribution Service will guarantee that the data_values and info_seq are not modified.

It is not necessary for an application to return the loans immediately after calling the operation `read` or `take`. However, as these buffers correspond to internal resources inside the `DataReader`, the application should not retain them indefinitely.

Calling return_loan

The use of the `return_loan` operation is only necessary if the call to the operation `read` or `take` "loaned" buffers to the application. This only occurs if the `data_values` and `info_seq` sequences had `maximum=0` at the time the operation `read` or `take` was called. The application may also examine the '`release`' property of the collection to determine where there is an outstanding loan. However, calling the operation `return_loan` on a pair of sequences that does not have a loan is safe and has no side effects.

If the pair of sequences had a loan, upon return from the operation `return_loan` the pair of sequences has `maximum=0`.

Return Code

When the operation returns:

- *RETCODE_OK* - the `DataReader` is informed that the sequences will not be used any more
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the `FooDataReader` has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_NOT_ENABLED* - the `FooDataReader` is not enabled.
- *RETCODE_PRECONDITION_NOT_MET* - one of the following is true:
  - the `data_values` and `info_seq` do not belong to a single related pair
  - the `data_values` and `info_seq` were not obtained from this `FooDataReader`.

3.5.2.75 set_listener (inherited)

This operation is inherited and therefore not described here. See the class `DataReader` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
ReturnCode_t
   set_listener
      (DataReaderListener_ptr a_listener,
        StatusMask mask);
```

3.5.2.76 set_qos (inherited)

This operation is inherited and therefore not described here. See the class `DataReader` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
ReturnCode_t
   set_qos
      (const DataReaderQos& qos);
```

3.5.2.77 take

Scope

```
SPACE::FooDataReader
```

Synopsis

```
#include <ccpp_Space.h>
       ReturnCode_t
          take
             (FooSeq& data_values,
               SampleInfoSeq& info_seq,
               Long max_samples,
               SampleStateMask sample_states,
               ViewStateMask view_states,
               InstanceStateMask instance_states);
```

Description

This operation reads a sequence of `Foo` samples from the `FooDataReader` and by doing so, removes the data from the `FooDataReader`.

Parameters

`inout FooSeq& data_values` - the returned sample data sequence. `data_values` is also used as an input to control the behaviour of this operation.

`inout SampleInfoSeq& info_seq` - the returned `SampleInfo` structure sequence. `info_seq` is also used as an input to control the behaviour of this operation.

`in long max_samples` - the maximum number of samples that is returned.

`in SampleStateMask sample_states` - a mask, which selects only those samples with the desired sample states.

`in ViewStateMask view_states` - a mask, which selects only those samples with the desired view states.

in InstanceStateMask instance_states - a mask, which selects only those samples with the desired instance states.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES, RETCODE_NOT_ENABLED, RETCODE_PRECONDITION_NOT_MET or RETCODE_NO_DATA.

Detailed Description

This operation reads a sequence of Foo samples from the FooDataReader and by doing so, removes the data from the FooDataReader, so it can not be read or taken again. The behaviour is identical to read except for that the samples are removed from the FooDataReader.

Return Code

When the operation returns:

- *RETCODE_OK* - a sequence of data values is available and removed from the FooDataReader
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_ALREADY_DELETED* - the FooDataReader has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_NOT_ENABLED* - the FooDataReader is not enabled.
- *RETCODE_PRECONDITION_NOT_MET* - one of the following is true:
  - the max_samples>maximum and max_samples is not LENGTH_UNLIMITED
  - one or more values of length, maximum, and release for the two sequences are not identical
  - the maximum>0 and the release==FALSE.
- *RETCODE_NO_DATA* - no samples that meet the constraints are available.

3.5.2.78 take_instance

Scope

SPACE::FooDataReader

Synopsis

```
#include <ccpp_Space.h>
       ReturnCode_t
```

```
take_instance
   (FooSeq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     InstanceHandle_t a_handle,
     SampleStateMask sample_states,
     ViewStateMask view_states,
     InstanceStateMask instance_states);
```

Description

This operation reads a sequence of `Foo` samples of a single instance from the `FooDataReader` and by doing so, removes the data from the `FooDataReader`.

Parameters

`inout FooSeq& data_values` - the returned sample data sequence. `data_values` is also used as an input to control the behaviour of this operation.

`inout SampleInfoSeq& info_seq` - the returned `SampleInfo` structure sequence. `info_seq` is also used as an input to control the behaviour of this operation.

`in long max_samples` - the maximum number of samples that is returned.

`in InstanceHandle_t a_handle` - the single instance, the samples belong to.

`in SampleStateMask sample_states` - a mask, which selects only those samples with the desired sample states.

`in ViewStateMask view_states` - a mask, which selects only those samples with the desired view states.

`in InstanceStateMask instance_states` - a mask, which selects only those samples with the desired instance states.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_BAD_PARAMETER`, `RETCODE_ALREADY_DELETED`, `RETCODE_OUT_OF_RESOURCES`, `RETCODE_NOT_ENABLED`, `RETCODE_PRECONDITION_NOT_MET` or `RETCODE_NO_DATA`.

Detailed Description

This operation reads a sequence of `Foo` samples of a single instance from the `FooDataReader` and by doing so, removes the data from the `FooDataReader`, so it can not be read or taken again. The behaviour is identical to `read_instance` except for that the samples are removed from the `FooDataReader`.

Return Code

When the operation returns:

- *RETCODE_OK* - a sequence of data values is available and removed from the FooDataReader
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - the parameter a_handle is not a valid handle
- *RETCODE_ALREADY_DELETED* - the FooDataReader has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_NOT_ENABLED* - the FooDataReader is not enabled.
- *RETCODE_PRECONDITION_NOT_MET* - one of the following is true:
  - the max_samples>maximum and max_samples is not LENGTH_UNLIMITED
  - one or more values of length, maximum, and release for the two sequences are not identical
  - the maximum>0 and the release==FALSE.
  - the handle ==HANDLE_NIL.
  - the handle has not been registered with this DataReader.
- *RETCODE_NO_DATA* - no samples that meet the constraints are available.

3.5.2.79 take_next_instance

Scope

```
SPACE::FooDataReader
```

Synopsis

```
#include <ccpp_Space.h>
       ReturnCode_t
          take_next_instance
             (FooSeq& data_values,
               SampleInfoSeq& info_seq,
               Long max_samples,
               InstanceHandle_t a_handle,
               SampleStateMask sample_states,
               ViewStateMask view_states,
               InstanceStateMask instance_states);
```

Description

This operation reads a sequence of Foo samples of the next single instance from the FooDataReader and by doing so, removes the data from the FooDataReader.

Parameters

inout FooSeq& data_values - the returned sample data sequence. data_values is also used as an input to control the behaviour of this operation.

inout SampleInfoSeq& info_seq - the returned SampleInfo structure sequence. info_seq is also used as an input to control the behaviour of this operation.

in long max_samples - the maximum number of samples that is returned.

in InstanceHandle_t a_handle - the current single instance, the returned samples belong to the next single instance.

in SampleStateMask sample_states - a mask, which selects only those samples with the desired sample states.

in ViewStateMask view_states - a mask, which selects only those samples with the desired view states.

in InstanceStateMask instance_states - a mask, which selects only those samples with the desired instance states.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES, RETCODE_NOT_ENABLED, RETCODE_PRECONDITION_NOT_MET or RETCODE_NO_DATA.

Detailed Description

This operation reads a sequence of Foo samples of a single instance from the FooDataReader and by doing so, removes the data from the FooDataReader, so it can not be read or taken again. The behaviour is identical to read_next_instance except for that the samples are removed from the FooDataReader.

Return Code

When the operation returns:

- *RETCODE_OK* - a sequence of data values is available and removed from the FooDataReader
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - the parameter a_handle is not a valid handle
- *RETCODE_ALREADY_DELETED* - the FooDataReader has already been deleted

- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_NOT_ENABLED* - the FooDataReader is not enabled.
- *RETCODE_PRECONDITION_NOT_MET* - one of the following is true:
  - the max_samples>maximum and max_samples is not LENGTH_UNLIMITED
  - one or more values of length, maximum, and release for the two sequences are not identical
  - the maximum>0 and the release==FALSE.
  - the handle has not been registered with this DataReader.
- *RETCODE_NO_DATA* - no samples that meet the constraints are available.

3.5.2.80 take_next_instance_w_condition

Scope

SPACE::FooDataReader

Synopsis

```
#include <ccpp_Space.h>
       ReturnCode_t
          take_next_instance_w_condition
             (FooSeq& data_values,
               SampleInfoSeq& info_seq,
               Long max_samples,
               InstanceHandle_t a_handle,
               ReadCondition_ptr a_condition);
```

Description

This operation reads a sequence of Foo samples of the next single instance from the FooDataReader, filtered by a ReadCondition or QueryCondition and by doing so, removes the data from the FooDataReader.

Parameters

inout FooSeq& data_values - the returned sample data sequence. data_values is also used as an input to control the behaviour of this operation.

inout SampleInfoSeq& info_seq - the returned SampleInfo structure sequence. info_seq is also used as an input to control the behaviour of this operation.

in long max_samples - the maximum number of samples that is returned.

in InstanceHandle_t a_handle - the current single instance, the returned samples belong to the next single instance.

in ReadCondition_ptr a_condition - a pointer to a ReadCondition or QueryCondition which filters the data before it is returned by the read operation.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES, RETCODE_NOT_ENABLED, RETCODE_PRECONDITION_NOT_MET or RETCODE_NO_DATA.

Detailed Description

This operation reads a sequence of Foo samples of a single instance from the FooDataReader, filtered by a ReadCondition or QueryCondition and by doing so, removes the data from the FooDataReader, so it can not be read or taken again. The behaviour is identical to read_next_instance_w_condition except for that the samples are removed from the FooDataReader.

Return Code

When the operation returns:

- *RETCODE_OK* - a sequence of data values is available and removed from the FooDataReader
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - the parameter a_condition is not a valid ReadCondition_ptr or a_handle is not a valid handle
- *RETCODE_ALREADY_DELETED* - the FooDataReader has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_NOT_ENABLED* - the FooDataReader is not enabled.
- *RETCODE_PRECONDITION_NOT_MET* - one of the following is true:
  - the ReadCondition or QueryCondition is not attached to this FooDataReader.
  - the max_samples>maximum and max_samples is not LENGTH_UNLIMITED
  - one or more values of length, maximum, and release for the two sequences are not identical
  - the maximum>0 and the release==FALSE.

- the handle has not been registered with this DataReader.

- *RETCODE_NO_DATA* - no samples that meet the constraints are available.

3.5.2.81 take_next_sample

Scope

`SPACE::FooDataReader`

Synopsis

```
#include <ccpp_Space.h>
       ReturnCode_t
          take_next_sample
             (Foo& data_value,
               SampleInfo sample_info);
```

NOTE: This operation is not yet implemented. It is scheduled for a future release.

3.5.2.82 take_w_condition

Scope

`SPACE::FooDataReader`

Synopsis

```
#include <ccpp_Space.h>
       ReturnCode_t
          take_w_condition
             (FooSeq& data_values,
               SampleInfoSeq& info_seq,
               Long max_samples,
               ReadCondition_ptr a_condition);
```

Description

This operation reads a sequence of `Foo` samples from the `FooDataReader`, filtered by a `ReadCondition` or `QueryCondition` and by doing so, removes the data from the `FooDataReader`.

Parameters

inout FooSeq& data_values - the returned sample data sequence. `data_values` is also used as an input to control the behaviour of this operation.

inout SampleInfoSeq& info_seq - the returned `SampleInfo` structure sequence. `info_seq` is also used as an input to control the behaviour of this operation.

in long max_samples - the maximum number of samples that is returned.

in ReadCondition_ptr a_condition - a pointer to a ReadCondition or QueryCondition which filters the data before it is returned by the read operation.

Return Value

ReturnCode_t - Possible return codes of the operation are: RETCODE_OK, RETCODE_ERROR, RETCODE_BAD_PARAMETER, RETCODE_ALREADY_DELETED, RETCODE_OUT_OF_RESOURCES, RETCODE_NOT_ENABLED, RETCODE_PRECONDITION_NOT_MET or RETCODE_NO_DATA.

Detailed Description

This operation reads a sequence of Foo samples from the FooDataReader, filtered by a ReadCondition or QueryCondition and by doing so, removes the data from the FooDataReader, so it can not be read or taken again. The behaviour is identical to read_w_condition except for that the samples are removed from the FooDataReader.

Return Code

When the operation returns:

- *RETCODE_OK* - a sequence of data values is available and removed from the FooDataReader
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - the parameter a_condition is not a valid ReadCondition_ptr
- *RETCODE_ALREADY_DELETED* - the FooDataReader has already been deleted
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_NOT_ENABLED* - the FooDataReader is not enabled.
- *RETCODE_PRECONDITION_NOT_MET* - one of the following is true:
  - the ReadCondition or QueryCondition is not attached to this FooDataReader
  - the max_samples>maximum and max_samples is not LENGTH_UNLIMITED
  - one or more values of length, maximum, and release for the two sequences are not identical
  - the maximum>0 and the release==FALSE.
- *RETCODE_NO_DATA* - no samples that meet the constraints are available.

3.5.2.83 wait_for_historical_data (inherited)

This operation is inherited and therefore not described here. See the class `DataReader` for further explanation.

Synopsis

```
#include <ccpp_Space.h>
       ReturnCode_t
          wait_for_historical_data
             (const Duration_t& max_wait);
```

3.5.2.84 wait_for_historical_data_w_condition (inherited)

This operation is inherited and therefore not described here. See the class DataReader for further explanation.

Synopsis

```
#include <ccpp_Space.h>
  ReturnCode_t
    wait_for_historical_data_w_condition
      (const char* filter_expression,
       const StringSeq& filter_parameters,
       const Time_t& min_source_timestamp,
       const Time_t& max_source_timestamp
       const ResourceLimitsQosPolicy &resource_limits,
       const Duration_t &max_wait)
```

3.5.3 Class DataSample

A `DataSample` represents an atom of data information (*i.e.* one value for an instance) as returned by the `DataReader`'s `read`/`take` operations. It consists of two parts: A `SampleInfo` and the `Data` itself. The `Data` part is the data as produced by a `Publisher`. The `SampleInfo` part contains additional information related to the data provided by the Data Distribution Service.

3.5.4 Struct SampleInfo

The struct `SampleInfo` represents the additional information that accompanies the data in each sample that is read or taken.

The interface description of this struct is as follows:

```
struct SampleInfo
{
    SampleStateKind sample_state;
    ViewStateKind view_state;
    InstanceStateKind instance_state;
    Time_t source_timestamp;
    InstanceHandle_t instance_handle;
```

```
    InstanceHandle_t publication_handle;
    Long disposed_generation_count;
    Long no_writers_generation_count;
    Long sample_rank;
    Long generation_rank;
    Long absolute_generation_rank;
    Boolean valid_data;
    Time_t reception_timestamp;
};
```

The next paragraph describes the usage of the `SampleInfo` struct.

3.5.4.1 SampleInfo

Scope

`DDS`

Synopsis

```
#include <ccpp_dds_dcps.h>
struct SampleInfo
   {
     SampleStateKind sample_state;
     ViewStateKind view_state;
     InstanceStateKind instance_state;
     Time_t source_timestamp;
     InstanceHandle_t instance_handle;
     InstanceHandle_t publication_handle;
     Long disposed_generation_count;
     Long no_writers_generation_count;
     Long sample_rank;
     Long generation_rank;
     Long absolute_generation_rank;
     Boolean valid_data;
     Time_t reception_timestamp;
   };
```

Description

The struct `SampleInfo` represents the additional information that accompanies the data in each sample that is read or taken.

Attributes

`SampleStateKind sample_state` - whether or not the corresponding data sample has already been read.

`ViewStateKind view_state` - whether the `DataReader` has already seen samples of the most-current generation of the related instance.

InstanceStateKind instance_state - whether the instance is alive, has no writers or is disposed of.

Time_t source_timestamp - the time provided by the DataWriter when the sample was written.

InstanceHandle_t instance_handle - the handle that identifies locally the corresponding instance.

InstanceHandle_t publication_handle - the handle that identifies locally the DataWriter that modified the instance. In fact it is an instance_handle of the built-in DCPSPublication sample that describes this DataWriter. It can be used as a parameter to the DataReader operation get_matched_publication_data to obtain this built-in DCPSPublication sample.

Long disposed_generation_count - the number of times the instance has become alive after it was disposed of explicitly by a DataWriter.

Long no_writers_generation_count - the number of times the instance has become alive after it was disposed of because there were no DataWriter objects.

Long sample_rank - the number of samples related to the same instance that are found in the collection returned by a read or take operation.

Long generation_rank - the generation difference between the time the sample was received and the time the most recent sample in the collection was received.

Long absolute_generation_rank - the generation difference between the time the sample was received and the time the most recent sample was received.

Boolean valid_data - whether the DataSample contains any meaningful data. If not, the sample is only used to communicate a change in the instance_state of the instance.

Time_t reception_timestamp - the time provided by the DataReader when the sample was received.

Detailed Description

The struct SampleInfo represents the additional information that accompanies the data in each sample that is read or taken.

Generations

A generation is defined as: 'the number of times an instance has become alive (with instance_state==ALIVE_INSTANCE_STATE) at the time the sample was received'. Note that the generation counters are initialized to zero when a DataReader first detects a never-seen-before instance.

Two types of generations are distinguished: disposed_generation_count and no_writers_generation_count.

After a DataWriter disposes an instance, the disposed_generation_count for all DataReaders that already knew that instance will be incremented the next time the instance is written again.

If the DataReader detects that there are no live DataWriter entities, the instance_state of the sample_info will change from ALIVE_INSTANCE_STATE to NOT_ALIVE_NO_WRITERS_INSTANCE_STATE. The next time the instance is written, no_writers_generation_count will be incremented.

Sample Information

SampleInfo is the additional information that accompanies the data in each sample that is read or taken. It contains the following information:

- sample_state (READ_SAMPLE_STATE or NOT_READ_SAMPLE_STATE) indicates whether or not the corresponding data sample has already been read
- view_state (NEW_VIEW_STATE, or NOT_NEW_VIEW_STATE) indicates whether the DataReader has already seen samples of the most-current generation of the related instance
- instance_state (ALIVE_INSTANCE_STATE, NOT_ALIVE_DISPOSED_INSTANCE_STATE, or NOT_ALIVE_NO_WRITERS_INSTANCE_STATE) indicates whether the instance is alive, has no writers or if it has been disposed of:
  - ALIVE_INSTANCE_STATE if this instance is currently in existence
  - NOT_ALIVE_DISPOSED_INSTANCE_STATE if this instance was disposed of by a DataWriter
  - NOT_ALIVE_NO_WRITERS_INSTANCE_STATE none of the DataWriter objects currently "alive" (according to the LivelinessQosPolicy) are writing the instance.
- source_timestamp indicates the time provided by the DataWriter when the sample was written
- instance_handle indicates locally the corresponding instance
- publication_handle is used by the DDS implementation to locally identify the corresponding source DataWriter. You can access more detailed information about this particular publication by passing its publication_handle to either the get_matched_publication_data operation on the DataReader or to the read_instance operation on the built-in reader for the "DCPSPublication" topic.

Be aware that since `InstanceHandle_t` is an opaque datatype, it does not necessarily mean that the handle obtained from the `publication_handle` has the same value as the one that appears in the `instance_handle` field of the `SampleInfo` when retrieving the publication info through corresponding "DCPSPublication" built-in reader. You can't just compare two handles to determine whether they represent the same publication. If you want to know whether two handles actually do represent the same publication, use both handles to retrieve their corresponding `PublicationBuiltinTopicData` samples and then compare the `key` field of both samples.

- `disposed_generation_count` indicates the number of times the instance has become alive after it was disposed of explicitly by a `DataWriter`, at the time the sample was received
- `no_writers_generation_count` indicates the number of times the instance has become alive after its `instance_state` has been `NOT_ALIVE_NO_WRITERS_INSTANCE_STATE`, at the time the sample was received
- `sample_rank` indicates the number of samples related to the same instance that follow in the collection returned by a `read` or `take` operation
- `generation_rank` indicates the generation difference (number of times the instance was disposed of and become alive again) between the time the sample was received and the time the most recent sample in the collection (related to the same instance) was received
- `absolute_generation_rank` indicates the generation difference (number of times the instance was disposed of and become alive again) between the time the sample was received and the time the most recent sample (which may not be in the returned collection), related to the same instance, was received.
- `valid_data` indicates whether the corresponding data value contains any meaningful data. If not, the data value is just a 'dummy' sample for which only the keyfields have been assigned. It is used to accompany the `SampleInfo` that communicates a change in the `instance_state` of an instance for which there is no 'real' sample available.
- `reception_timestamp` indicates the time provided by the DataReader when the sample was inserted.

NOTE: This is an OpenSplice-specific extension to the `SampleInfo` struct and is *not* part of the DDS Specification.

3.5.5 SubscriberListener Interface

Since a `Subscriber` is an `Entity`, it has the ability to have a `Listener` associated with it. In this case, the associated `Listener` should be of type `SubscriberListener`. This interface must be implemented by the application. A

user-defined class must be provided by the application which must extend from the `SubscriberListener` class. All `SubscriberListener` operations must be implemented in the user-defined class, it is up to the application whether an operation is empty or contains some functionality.

All operations for this interface must be implemented in the user-defined class, it is up to the application whether an operation is empty or contains some functionality.

The `SubscriberListener` provides a generic mechanism (actually a callback function) for the Data Distribution Service to notify the application of relevant asynchronous status change events, such as a missed deadline, violation of a `QosPolicy` setting, etc. The `SubscriberListener` is related to changes in communication status.

The interface description of this class is as follows:

```
 class SubscriberListener
{
//
// inherited from class DataReaderListener
//
// void
//    on_requested_deadline_missed
//       (DataReader_ptr reader,
//       const RequestedDeadlineMissedStatus& status) = 0;

// void
//    on_requested_incompatible_qos
//       (DataReader_ptr reader,
//       const RequestedIncompatibleQosStatus& status) = 0;

// void
//    on_sample_rejected
//       (DataReader_ptr reader,
//       const SampleRejectedStatus& status) = 0;

// void
//    on_liveliness_changed
//       (DataReader_ptr reader,
//       const LivelinessChangedStatus& status) = 0;

// void
//    on_data_available
//       (DataReader_ptr reader) = 0;

// void
//    on_subscription_matched
//       (DataReader_ptr reader,
//       const SubscriptionMatchedStatus& status) = 0;
```

```
// void
//    on_sample_lost
//       (DataReader_ptr reader,
//       const SampleLostStatus& status) = 0;
//
// abstract external operations
//
   void
      on_data_on_readers
         (Subscriber_ptr subs) = 0;
//
// implemented API operations
//      <no operations>
//
};
```

The next paragraphs list all `SubscriberListener` operations. The inherited operations are listed but not fully described because they are not implemented in this class. The full description of these operations is given in the classes from which they are inherited. The abstract operation is fully described since it must be implemented by the application.

3.5.5.1 on_data_available (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataReaderListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_data_available
      (DataReader_ptr reader) = 0;
```

3.5.5.2 on_data_on_readers (abstract)

Scope

```
DDS::SubscriberListener
```

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_data_on_readers
      (Subscriber_ptr subs) = 0;
```

Description

This operation must be implemented by the application and is called by the Data Distribution Service when new data is available.

Parameters

in Subscriber_ptr subs - contain a pointer to the Subscriber for which data is available (this is an input to the application provided by the Data Distribution Service).

Return Value

<none>

Detailed Description

This operation is the external operation (interface, which must be implemented by the application) that is called by the Data Distribution Service when new data is available for this Subscriber. The implementation may be left empty when this functionality is not needed. This operation will only be called when the relevant SubscriberListener is installed and enabled for the DATA_ON_READERS_STATUS.

The Data Distribution Service will provide a reference to the Subscriber in the parameter subs for use by the application.

The statuses DATA_ON_READERS_STATUS and DATA_AVAILABLE_STATUS will occur together. In case these status changes occur, the Data Distribution Service will look for an attached and activated SubscriberListener or DomainParticipantListener (in that order) for the DATA_ON_READERS_STATUS. In case the DATA_ON_READERS_STATUS can not be handled, the Data Distribution Service will look for an attached and activated DataReaderListener, SubscriberListener or DomainParticipantListener for the DATA_AVAILABLE_STATUS (in that order).

Note that if on_data_on_readers is called, then the Data Distribution Service will not try to call on_data_available, however, the application can force a call to the callback function on_data_available of DataReaderListener objects that have data by means of the notify_datareaders operation.

3.5.5.3 on_liveliness_changed (inherited, abstract)

This operation is inherited and therefore not described here. See the class DataReaderListener for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_liveliness_changed
      (DataReader_ptr reader,
        const LivelinessChangedStatus& status) = 0;
```

3.5.5.4 on_requested_deadline_missed (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataReaderListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_requested_deadline_missed
      (DataReader_ptr reader,
        const RequestedDeadlineMissedStatus& status) = 0;
```

3.5.5.5 on_requested_incompatible_qos (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataReaderListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_requested_incompatible_qos
      (DataReader_ptr reader,
        const RequestedIncompatibleQosStatus& status) = 0;
```

3.5.5.6 on_sample_lost (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataReaderListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_sample_lost
      (DataReader_ptr reader,
        const SampleLostStatus& status) = 0;
```

NOTE: This operation is not yet implemented. It is scheduled for a future release.

3.5.5.7 on_sample_rejected (inherited, abstract)

This operation is inherited and therefore not described here. See the class `DataReaderListener` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_sample_rejected
      (DataReader_ptr reader,
        const SampleRejectedStatus& status) = 0;
```

3.5.5.8 on_subscription_matched (inherited, abstract)

This operation is inherited and therefore not described here. See the class DataReaderListener for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_subscription_matched
      (DataReader_ptr reader,
        const SubscriptionMatchedStatus& status) = 0;
```

3.5.6 DataReaderListener Interface

Since a DataReader is an Entity, it has the ability to have a Listener associated with it. In this case, the associated Listener should be of type DataReaderListener. This interface must be implemented by the application. A user-defined class must be provided by the application which must extend from the DataReaderListener class. **All** DataReaderListener operations **must** be implemented in the user-defined class, it is up to the application whether an operation is empty or contains some functionality.

All operations for this interface must be implemented in the user-defined class, it is up to the application whether an operation is empty or contains some functionality.

The DataReaderListener provides a generic mechanism (actually a callback function) for the Data Distribution Service to notify the application of relevant asynchronous status change events, such as a missed deadline, violation of a QosPolicy setting, etc. The DataReaderListener is related to changes in communication status.

The interface description of this class is as follows:

```
 class DataReaderListener
{
//
// abstract external operations
//
    void
       on_requested_deadline_missed
          (DataReader_ptr reader,
          const RequestedDeadlineMissedStatus& status) = 0;
    void
       on_requested_incompatible_qos
          (DataReader_ptr reader,
          const RequestedIncompatibleQosStatus& status) = 0;

    void
       on_sample_rejected
```

```
            (DataReader_ptr reader,
            const SampleRejectedStatus& status) = 0;

        void
            on_liveliness_changed
            (DataReader_ptr reader,
            const LivelinessChangedStatus& status) = 0;

        void
            on_data_available
            (DataReader_ptr reader) = 0;

        void
            on_subscription_matched
            (DataReader_ptr reader,
            const SubscriptionMatchedStatus& status) = 0;

        void
            on_sample_lost
            (DataReader_ptr reader,
            const SampleLostStatus& status) = 0;
    //
    // implemented API operations
    //      <no operations>
    //
    };
```

The next paragraphs describe the usage of all `DataReaderListener` operations. These abstract operations are fully described because they must be implemented by the application.

3.5.6.1 on_data_available (abstract)

Scope

`DDS::DataReaderListener`

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_data_available
      (DataReader_ptr reader) = 0;
```

Description

This operation must be implemented by the application and is called by the Data Distribution Service when new data is available.

Parameters

in DataReader_ptr reader - contain a pointer to the DataReader for which data is available (this is an input to the application provided by the Data Distribution Service).

Return Value

<none>

Detailed Description

This operation is the external operation (interface, which must be implemented by the application) that is called by the Data Distribution Service when new data is available for this DataReader. The implementation may be left empty when this functionality is not needed. This operation will only be called when the relevant DataReaderListener is installed and enabled for the DATA_AVAILABLE_STATUS.

The Data Distribution Service will provide a reference to the DataReader in the parameter reader for use by the application.

The statuses DATA_ON_READERS_STATUS and DATA_AVAILABLE_STATUS will occur together. In case these status changes occur, the Data Distribution Service will look for an attached and activated SubscriberListener or DomainParticipantListener (in that order) for the DATA_ON_READERS_STATUS. In case the DATA_ON_READERS_STATUS can not be handled, the Data Distribution Service will look for an attached and activated DataReaderListener, SubscriberListener or DomainParticipantListener for the DATA_AVAILABLE_STATUS (in that order).

Note that if on_data_on_readers is called, then the Data Distribution Service will not try to call on_data_available, however, the application can force a call to the DataReader objects that have data by means of the notify_datareaders operation.

3.5.6.2 on_liveliness_changed (abstract)

Scope

DDS::DataReaderListener

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_liveliness_changed
      (DataReader_ptr reader,
        const LivelinessChangedStatus& status) = 0;
```

Description

This operation must be implemented by the application and is called by the Data Distribution Service when the liveliness of one or more `DataWriter` objects that were writing instances read through this `DataReader` has changed.

Parameters

`in DataReader_ptr reader` - contain a pointer to the `DataReader` for which the liveliness of one or more `DataWriter` objects has changed (this is an input to the application provided by the Data Distribution Service).

`in const LivelinessChangedStatus& status` - contain the `LivelinessChangedStatus` struct (this is an input to the application provided by the Data Distribution Service).

Return Value

<none>

Detailed Description

This operation is the external operation (interface, which must be implemented by the application) that is called by the Data Distribution Service when the liveliness of one or more `DataWriter` objects that were writing instances read through this `DataReader` has changed. In other words, some `DataWriter` have become "alive" or "not alive". The implementation may be left empty when this functionality is not needed. This operation will only be called when the relevant `DataReaderListener` is installed and enabled for the `LIVELINESS_CHANGED_STATUS`.

The Data Distribution Service will provide a reference to the `DataReader` in the parameter `reader` and the `LivelinessChangedStatus` struct for use by the application.

3.5.6.3 on_requested_deadline_missed (abstract)

Scope

`DDS::DataReaderListener`

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_requested_deadline_missed
      (DataReader_ptr reader,
        const RequestedDeadlineMissedStatus& status) = 0;
```

Description

This operation must be implemented by the application and is called by the Data Distribution Service when the deadline that the `DataReader` was expecting through its `DeadlineQosPolicy` was not respected.

Parameters

in `DataReader_ptr reader` - contain a pointer to the `DataReader` for which the deadline was missed (this is an input to the application provided by the Data Distribution Service).

in `const RequestedDeadlineMissedStatus& status` - contain the `RequestedDeadlineMissedStatus` struct (this is an input to the application provided by the Data Distribution Service).

Return Value

<none>

Detailed Description

This operation is the external operation (interface, which must be implemented by the application) that is called by the Data Distribution Service when the deadline that the `DataReader` was expecting through its `DeadlineQosPolicy` was not respected for a specific instance. The implementation may be left empty when this functionality is not needed. This operation will only be called when the relevant `DataReaderListener` is installed and enabled for the `REQUESTED_DEADLINE_MISSED_STATUS`.

The Data Distribution Service will provide a reference to the `DataReader` in the parameter `reader` and the `RequestedDeadlineMissedStatus` struct in the parameter `status` for use by the application.

3.5.6.4 on_requested_incompatible_qos (abstract)

Scope

`DDS::DataReaderListener`

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_requested_incompatible_qos
      (DataReader_ptr reader,
        const RequestedIncompatibleQosStatus& status) = 0;
```

Description

This operation must be implemented by the application and is called by the Data Distribution Service when the REQUESTED_INCOMPATIBLE_QOS_STATUS changes.

Parameters

in DataReader_ptr reader - a pointer to the DataReader provided by the Data Distribution Service.

in const RequestedIncompatibleQosStatus& status - the RequestedIncompatibleQosStatus struct provided by the Data Distribution Service.

Return Value

<none>

Detailed Description

This operation is the external operation (interface, which must be implemented by the application) that is called by the Data Distribution Service when the REQUESTED_INCOMPATIBLE_QOS_STATUS changes. The implementation may be left empty when this functionality is not needed. This operation will only be called when the relevant DataReaderListener is installed and enabled for the REQUESTED_INCOMPATIBLE_QOS_STATUS.

The Data Distribution Service will provide a reference to the DataReader in the parameter reader and the RequestedIncompatibleQosStatus struct in the parameter status, for use by the application.

The application can use this operation as a callback function implementing a proper response to the status change. This operation is enabled by setting the REQUESTED_INCOMPATIBLE_QOS_STATUS in the mask in the call to DataReader::set_listener. When the DataReaderListener on the DataReader is not enabled for the REQUESTED_INCOMPATIBLE_QOS_STATUS, the status change will propagate to the SubscriberListener of the Subscriber (if enabled) or to the DomainParticipantListener of the DomainParticipant (if enabled).

3.5.6.5 on_sample_lost (abstract)

Scope

DDS::DataReaderListener

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_sample_lost
      (DataReader_ptr reader,
        const SampleLostStatus& status) = 0;
```

NOTE: This operation is not yet implemented. It is scheduled for a future release.

3.5.6.6 on_sample_rejected (abstract)

Scope

```
DDS::DataReaderListener
```

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_sample_rejected
      (DataReader_ptr reader,
        const SampleRejectedStatus& status) = 0;
```

Description

This operation must be implemented by the application and is called by the Data Distribution Service when a sample has been rejected.

Parameters

in DataReader_ptr reader - contains a pointer to the `DataReader` for which a sample has been rejected (this is an input to the application provided by the Data Distribution Service).

in const SampleRejectedStatus& status - contains the `SampleRejectedStatus` struct (this is an input to the application provided by the Data Distribution Service).

Return Value

<none>

Detailed Description

This operation is the external operation (interface, which must be implemented by the application) that is called by the Data Distribution Service when a (received) sample has been rejected. Samples may be rejected by the `DataReader` when it runs out of `resource_limits` to store incoming samples. Ususally this means that old samples need to be 'consumed' (for example by 'taking' them instead of 'reading' them) to make room for newly incoming samples.

The implementation may be left empty when this functionality is not needed. This operation will only be called when the relevant DataReaderListener is installed and enabled for the SAMPLE_REJECTED_STATUS.

The Data Distribution Service will provide a reference to the DataReader in the parameter reader and the SampleRejectedStatus struct in the parameter status for use by the application.

3.5.6.7 on_subscription_matched (abstract)

Scope

DDS::DataReaderListener

Synopsis

```
#include <ccpp_dds_dcps.h>
void
   on_subscription_matched
      (DataReader_ptr reader,
        const SubscriptionMatchedStatus& status) = 0;
```

Description

This operation must be implemented by the application and is called by the Data Distribution Service when a new match has been discovered for the current subscription, or when an existing match has ceased to exist.

Parameters

in DataReader_ptr reader - contains a pointer to the DataReader for which a match has been discovered (this is an input to the application provided by the Data Distribution Service).

in const SubscriptionMatchedStatus& status - contains the *SubscriptionMatchedStatus* struct (this is an input to the application provided by the Data Distribution Service).

Return Value

<none>

Detailed Description

This operation must be implemented by the application and is called by the Data Distribution Service when a new match has been discovered for the current subscription, or when an existing match has ceased to exist. Usually this means that a new DataWriter that matches the Topic and that has compatible Qos as the current DataReader has either been discovered, or that a previously discovered DataWriter has ceased to be matched to the current DataReader. A DataWriter may cease to

match when it gets deleted, when it changes its Qos to a value that is incompatible with the current DataReader or when either the DataReader or the DataWriter has chosen to put its matching counterpart on its ignore-list using the ignore_publication or ignore_subcription operations on the DomainParticipant.

The implementation of this Listener operation may be left empty when this functionality is not needed: it will only be called when the relevant DataReaderListener is installed and enabled for the SUBSCRIPTION_MATCHED_STATUS.

The Data Distribution Service will provide a pointer to the DataReader in the parameter reader and the SubscriptionMatchedStatus struct in the parameter status for use by the application.

3.5.7 Class ReadCondition

The DataReader objects can create a set of ReadCondition (and StatusCondition) objects which provide support (in conjunction with WaitSet objects) for an alternative communication style between the Data Distribution Service and the application (i.e., state-based rather than event-based).

ReadCondition objects allow an DataReader to specify the data samples it is interested in (by specifying the desired sample-states, view-states, and instance-states); see the parameter definitions for DataReader's create_readcondition operation. This allows the Data Distribution Service to trigger the condition only when suitable information is available. ReadCondition objects are to be used in conjunction with a WaitSet. More than one ReadCondition may be attached to the same DataReader.

The interface description of this class is as follows:

```
class ReadCondition
{
//
// inherited from Condition
//
// Boolean
//    get_trigger_value
//       (void);
//
// implemented API operations
//
   SampleStateMask
      get_sample_state_mask
         (void);

   ViewStateMask
      get_view_state_mask
```

```
            (void);

        InstanceStateMask
           get_instance_state_mask
              (void);

        DataReader_ptr
           get_datareader
              (void);
    };
```

The next paragraphs describe the usage of all `ReadCondition` operations. The inherited operations are listed but not fully described because they are not implemented in this class. The full description of these operations is given in the classes from which they are inherited.

3.5.7.1 get_datareader

Scope

`DDS::ReadCondition`

Synopsis

```
#include <ccpp_dds_dcps.h>
DataReader_ptr
   get_datareader
      (void);
```

Description

This operation returns the `DataReader` associated with the `ReadCondition`.

Parameters

<none>

Return Value

`DataReader_ptr` - Result value is a pointer to the `DataReader`.

Detailed Description

This operation returns the `DataReader` associated with the `ReadCondition`. Note that there is exactly one `DataReader` associated with each `ReadCondition` (i.e. the `DataReader` that created the `ReadCondition` object).

3.5.7.2 get_instance_state_mask

Scope

`DDS::ReadCondition`

Synopsis

```
#include <ccpp_dds_dcps.h>
InstanceStateMask
   get_instance_state_mask
      (void);
```

Description

This operation returns the set of `instance_states` that are taken into account to determine the `trigger_value` of the `ReadCondition`.

Parameters

<none>

Return Value

`InstanceStateMask` - Result value are the `instance_states` specified when the `ReadCondition` was created.

Detailed Description

This operation returns the set of `instance_states` that are taken into account to determine the `trigger_value` of the `ReadCondition`.

The `instance_states` returned are the `instance_states` specified when the `ReadCondition` was created. `instance_states` can be `ALIVE_INSTANCE_STATE`, `NOT_ALIVE_DISPOSED_INSTANCE_STATE`, `NOT_ALIVE_NO_WRITERS_INSTANCE_STATE` or a combination of these.

3.5.7.3 get_sample_state_mask

Scope

`DDS::ReadCondition`

Synopsis

```
#include <ccpp_dds_dcps.h>
SampleStateMask
   get_sample_state_mask
      (void);
```

Description

This operation returns the set of `sample_states` that are taken into account to determine the `trigger_value` of the `ReadCondition`.

Parameters

<none>

Return Value

SampleStateMask - Result value are the sample_states specified when the ReadCondition was created.

Detailed Description

This operation returns the set of sample_states that are taken into account to determine the trigger_value of the ReadCondition.

The sample_states returned are the sample_states specified when the ReadCondition was created. sample_states can be READ_SAMPLE_STATE, NOT_READ_SAMPLE_STATE or both.

3.5.7.4 get_trigger_value (inherited)

This operation is inherited and therefore not described here. See the class Condition for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
Boolean
   get_trigger_value
      (void);
```

3.5.7.5 get_view_state_mask

Scope

```
DDS::ReadCondition
```

Synopsis

```
#include <ccpp_dds_dcps.h>
ViewStateMask
   get_view_state_mask
      (void);
```

Description

This operation returns the set of view_states that are taken into account to determine the trigger_value of the ReadCondition.

Parameters

<none>

Return Value

ViewStateMask - Result value are the view_states specified when the ReadCondition was created.

Detailed Description

This operation returns the set of `view_states` that are taken into account to determine the `trigger_value` of the `ReadCondition`.

The `view_states` returned are the `view_states` specified when the `ReadCondition` was created. `view_states` can be `NEW_VIEW_STATE`, `NOT_NEW_VIEW_STATE` or both.

3.5.8 Class QueryCondition

`QueryCondition` objects are specialized `ReadCondition` objects that allow the application to specify a filter on the locally available data. The `DataReader` objects accept a set of `QueryCondition` objects for the `DataReader` and provide support (in conjunction with `WaitSet` objects) for an alternative communication style between the Data Distribution Service and the application (i.e., state-based rather than event-based).

Query Function

`QueryCondition` objects allow an application to specify the data samples it is interested in (by specifying the desired sample-states, view-states, instance-states and query expression); see the parameter definitions for `DataReader's read/take` operations. This allows the Data Distribution Service to trigger the condition only when suitable information is available. `QueryCondition` objects are to be used in conjunction with a `WaitSet`. More than one `QueryCondition` may be attached to the same `DataReader`.

The query (`query_expression`) is similar to an SQL WHERE clause and can be parameterized by arguments that are dynamically changeable with the `set_query_parameters` operation.

The interface description of this class is as follows:

```
 class QueryCondition
{
//
// inherited from ReadCondition
//
// SampleStateMask
//    get_sample_state_mask
//       (void);

// ViewStateMask
//    get_view_state_mask
//       (void);

// InstanceStateMask
//    get_instance_state_mask
//       (void);
```

```
    // DataReader_ptr
    //    get_datareader
    //       (void);
    // Boolean
    //    get_trigger_value
    //       (void);
    //
    // implemented API operations
    //
       char*
          get_query_expression
             (void);

       ReturnCode_t
          get_query_parameters
             (StringSeq& query_parameters);

       ReturnCode_t
          set_query_parameters
             (const StringSeq& query_parameters);
    };
```

The next paragraphs describe the usage of all `QueryCondition` operations. The inherited operations are listed but not fully described because they are not implemented in this class. The full description of these operations is given in the classes from which they are inherited.

3.5.8.1 get_datareader (inherited)

This operation is inherited and therefore not described here. See the class `ReadCondition` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
DataReader_ptr
   get_datareader
      (void);
```

3.5.8.2 get_instance_state_mask (inherited)

This operation is inherited and therefore not described here. See the class `ReadCondition` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
InstanceStateMask
   get_instance_state_mask
      (void);
```

3.5.8.3 get_query_parameters

Scope

`DDS::QueryCondition`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   get_query_parameters
      (StringSeq& query_parameters);
```

Description

This operation obtains the `query_parameters` associated with the `QueryCondition`.

Parameters

`inout StringSeq& query_parameters` - a reference to a sequence of strings that will be used to store the parameters used in the SQL expression.

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_ALREADY_DELETED` or `RETCODE_OUT_OF_RESOURCES`.

Detailed Description

This operation obtains the `query_parameters` associated with the `QueryCondition`. That is, the parameters specified on the last successful call to `set_query_parameters` or, if `set_query_parameters` was never called, the arguments specified when the `QueryCondition` were created.

The resulting handle contains a sequence of strings with the parameters used in the SQL expression (*i.e.*, the `%n` tokens in the expression). The number of parameters in the result sequence will exactly match the number of `%n` tokens in the query expression associated with the `QueryCondition`.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the existing set of query parameters applied to this `QueryCondition` has successfully been copied into the specified `query_parameters` parameter.
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_ALREADY_DELETED`* - the `QueryCondition` has already been deleted.

- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.

3.5.8.4 get_query_expression

Scope

`DDS::QueryCondition`

Synopsis

```
#include <ccpp_dds_dcps.h>
char*
   get_query_expression
      (void);
```

Description

This operation returns the query expression associated with the `QueryCondition`.

Parameters

<none>

Return Value

*char** - Result value is a reference to the query expression associated with the `QueryCondition`.

Detailed Description

This operation returns the query expression associated with the `QueryCondition`. That is, the expression specified when the `QueryCondition` was created. The operation will return `NULL` when there was an internal error or when the `QueryCondition` was already deleted. If there were no parameters, an empty sequence is returned.

3.5.8.5 get_sample_state_mask (inherited)

This operation is inherited and therefore not described here. See the class `ReadCondition` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
SampleStateMask
   get_sample_state_mask
      (void);
```

3.5.8.6 get_trigger_value (inherited)

This operation is inherited and therefore not described here. See the class `ReadCondition` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
Boolean
   get_trigger_value
      (void);
```

3.5.8.7 get_view_state_mask (inherited)

This operation is inherited and therefore not described here. See the class `ReadCondition` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
ViewStateMask
   get_view_state_mask
      (void);
```

3.5.8.8 set_query_parameters

Scope

`DDS::QueryCondition`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
   set_query_parameters
      (const StringSeq& parameters);
```

Description

This operation changes the query parameters associated with the QueryCondition.

Parameters

`in const StringSeq& query_parameters` - a sequence of strings which are the parameters used in the SQL query string (i.e., the "%n" tokens in the expression).

Return Value

`ReturnCode_t` - Possible return codes of the operation are: `RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_BAD_PARAMETER`, `RETCODE_ALREADY_DELETED` or `RETCODE_OUT_OF_RESOURCES`.

Detailed Description

This operation changes the query parameters associated with the `QueryCondition`. The parameter `query_parameters` is a sequence of strings which are the parameter values used in the SQL query string (i.e., the "%n" tokens in the expression). The number of values in `query_parameters` must be equal or greater than the highest referenced %n token in the `query_expression` (e.g. if `%1` and `%8` are used as parameter in the `query_expression`, the `query_parameters` should at least contain `n+1 = 9` values).

Return Code

When the operation returns:

- *`RETCODE_OK`* - the query parameters associated with the `QueryCondition` are changed.
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_BAD_PARAMETER`* - the number of parameters in `query_parameters` does not match the number of "%n" tokens in the expression for this `QueryCondition` or one of the parameters is an illegal parameter.
- *`RETCODE_ALREADY_DELETED`* - the `QueryCondition` has already been deleted.
- *`RETCODE_OUT_OF_RESOURCES`* - the Data Distribution Service ran out of resources to complete this operation.

3.5.9 Class DataReaderView (abstract)

A DataReaderView allows the application to create an additional view on the dataset stored in a DataReader. The view is expressed by an (optional) alternative key list specified in the DataReaderViewQos, which allows it to specify an alternative storage spectrum. Applications might prefer such an alternative storage spectrum (for example by adding or removing key-fields) because it may help them to process the samples in a different order/cohesion than what they will have when they use the original key-list.

A DataReaderView has the following properties:

- Any DataReaderView belongs to exactly one DataReader.
- A DataReader can have zero to many DataReaderViews attached (all with their own key_list definitions).

- The DataReaderView has the same interface as the DataReader, with its `read` and `take` variants, including `w_condition` and `next_instance`, `next_sample`, *etc.*. It also supports `ReadConditions` and `QueryConditions` like a DataReader does.
- Any sample that is inserted into the DataReader will introduce a corresponding DataViewSample in all its attached DataReaderViews in a ViewInstance as defined by the keys specified in the DataReaderView Qos `key_list` when the view was created.
- Like samples in a DataReader, DataViewSamples in a DataReaderView belong to exactly one ViewInstance. Instances in the dataReaderView do not have any instance state information though. The instance state information found in the SampleInfo for each DataReaderView sample is copied from the corresponding DataReader sample.
- Whenever a sample is taken from the DataReader, its corresponding samples in all attached DataReaderViews will be removed as well. The same goes for samples that are pushed out of the DataReader instance history (in case of a `KEEP_LAST HistoryQosPolicy`) or for samples whose lifespan expired.
- A ViewInstance always has an infinite history depth; samples can not be pushed out of the view.
- Whenever a sample is taken from a DataReaderView, it is removed from that DataReaderView but not from the DataReader, nor from any of its other views. If all samples in a ViewInstance are taken, then that ViewInstance is destroyed.

DataReaderView is an abstract class. It is specialized for each particular application data type. For a fictional application data type "`Foo`" (defined in the module `SPACE`) the specialized class would be `SPACE::FooDataReaderView`.

The interface description of this class is as follows:

```
class DataReaderView
{
//
// inherited from class Entity
//
// StatusCondition_ptr
// get_statuscondition
//     (void);
// StatusMask
// get_status_changes
//     (void);
// ReturnCode_t
//enable
//     (void);
//
```

```
 // abstract operations (implemented in the data type specific
DataReaderView
 //
 // ReturnCode_t
 //get_key_value
 //     (<data>& key_holder,
 //      InstanceHandle_t handle);
 //
 // InstanceHandle_t
 // lookup_instance
 //     (const <data>& instance_data)
 //
 // ReturnCode_t
 // read
 //      (<data>Seq& data_values,
 //       SampleInfoSeq& info_seq,
 //       Long max_samples,
 //       SampleStateMask sample_states,
 //       ViewStateMask view_states,
 //       InstanceStateMask instance_states);
 //
 // ReturnCode_t
 // read_instance
 //      (<data>Seq& data_values,
 //       SampleInfoSeq& info_seq,
 //       Long max_samples,
 //       InstanceHandle_t a_handle,
 //       SampleStateMask sample_states,
 //       ViewStateMask view_states,
 //       InstanceStateMask instance_states);
 //
 // ReturnCode_t
 //      read_next_instance
 //     (<data>Seq& data_values,
 //      SampleInfoSeq& info_seq,
 //      Long max_samples,
 //      InstanceHandle_t a_handle,
 //      SampleStateMask sample_states,
 //      ViewStateMask view_states,
 //      InstanceStateMask instance_states);
 //
 // ReturnCode_t
 //read_next_instance_w_condition
 //     (<data>Seq& data_values,
 //      SampleInfoSeq& info_seq,
 //      Long max_samples,
 //      InstanceHandle_t a_handle,
 //      ReadCondition_ptr a_condition);
 //
 // ReturnCode_t
```

```
//read_next_sample
//     (<data>& data_values,
//      SampleInfo& sample_info);
//
// ReturnCode_t
//read_w_condition
//     (<data>Seq& data_values,
//      SampleInfoSeq& info_seq,
//      Long max_samples,
//      ReadCondition_ptr a_condition);
//
// ReturnCode_t
// return_loan
//     (<data>Seq& data_values,
//      SampleInfoSeq& info_seq);
//
// ReturnCode_t
// take
//      (<data>Seq& data_values,
//       SampleInfoSeq& info_seq,
//       Long max_samples,
//       SampleStateMask sample_states,
//       ViewStateMask view_states,
//       InstanceStateMask instance_states);
//
// ReturnCode_t
// take_instance
//      (<data>Seq& data_values,
//       SampleInfoSeq& info_seq,
//       Long max_samples,
//       InstanceHandle_t a_handle,
//       SampleStateMask sample_states,
//       ViewStateMask view_states,
//       InstanceStateMask instance_states);
//
// ReturnCode_t
//      take_next_instance
//     (<data>Seq& data_values,
//       SampleInfoSeq& info_seq,
//      Long max_samples,
//      InstanceHandle_t a_handle,
//      SampleStateMask sample_states,
//      ViewStateMask view_states,
//      InstanceStateMask instance_states);
//
// ReturnCode_t
//take_next_instance_w_condition
//     (<data>Seq& data_values,
//      SampleInfoSeq& info_seq,
//      Long max_samples,
```

```
//      InstanceHandle_t a_handle,
//      ReadCondition_ptr a_condition);
//
// ReturnCode_t
//take_next_sample
//     (<data>& data_values,
//      SampleInfo& sample_info);
//
// ReturnCode_t
//take_w_condition
//     (<data>Seq& data_values,
//      SampleInfoSeq& info_seq,
//      Long max_samples,
//      ReadCondition_ptr a_condition);
//
// implemented API operations

QueryCondition_ptr
  create_querycondition
    (SampleStateMask sample_states,
     ViewStateMask view_states,
     InstanceStateMask instance_states,
     const char* query_expression,
     const StringSeq& query_parameters);

ReadCondition_ptr
  create_readcondition
    (SampleStateMask sample_states,
     ViewStateMask view_states,
     InstanceStateMask instance_states);

ReturnCode_t
  delete_contained_entities
    (void);

ReturnCode_t
  delete_readcondition
    (ReadCondition_ptr a_condition);

DataReader_ptr
  get_datareader
    (void);

ReturnCode_t
  get_qos
    (DataReaderViewQos& qos);

ReturnCode_t
  set_qos
    (const DataReaderViewQos& qos);
```

The following paragraphs describe the usage of all DataReaderView operations. The inherited and abstract operations are listed but not fully described because they are not implemented in this class. The full descriptions of these operations are given in the classes from which they are inherited and in the data type specific classes in which they are implemented.

Because the DataReaderView closely follows DataReader semantics, a lot of operations are identical. In those cases where the operation on the DataReaderView is identical to the one on the DataReader, a full description is not given but the operation on the DataReader or its respective type specific class is referenced.

3.5.9.1 create_querycondition

Scope

```
DDS::DataReaderView
```

Synopsis

```
#include <ccpp_dds_dcps.h>
QueryCondition_ptr
  create_querycondition
    (SampleStateMask sample_states,
     ViewStateMask view_states,
     InstanceStateMask instance_states,
     const char* query_expression,
     const StringSeq& query_parameters);
```

Description

This operation creates a new QueryCondition for the DataReaderView. For a full description please refer to Section 3.5.2.2, *create_querycondition*, on page 365, which describes this operation in detail for the DataReader class.

3.5.9.2 create_readcondition

Scope

```
DDS::DataReaderView
```

Synopsis

```
#include <ccpp_dds_dcps.h>
ReadCondition_ptr
  create_readcondition
    (SampleStateMask sample_states,
     ViewStateMask view_states,
     InstanceStateMask instance_states);
```

Description

This operation creates a new ReadCondition for the DataReaderView. For a full description please refer to Section 3.5.2.3, *create_readcondition*, on page 367, which describes this operation in detail for the DataReader class.

3.5.9.3 delete_contained_entities

Scope

```
DDS::DataReaderView
```

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  delete_contained_entities
    (void);
```

Description

This operation deletes all the entitiesthat were created by means of one of the "`create_`" operations on the DataReaderView. For a full description please refer to Section 3.5.2.5, *delete_contained_entities*, on page 369, which describes this operation in detail for the DataReader class.

3.5.9.4 delete_readcondition

Scope

```
DDS::DataReaderView
```

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  delete_readcondition
    (ReadCondition_ptr a_condition);
```

Description

This operation deletes a ReadCondition or QueryCondition which is attached to the DataReaderView. For a full description please refer to Section 3.5.2.5, *delete_contained_entities*, on page 369, which describes this operation in detail for the DataReader class.

3.5.9.5 enable (inherited)

This operation is inherited and therefore not described here. See Section 3.1.1, *Class Entity (abstract)*, on page 26, for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  enable
    (void);
```

3.5.9.6 get_datareader

Scope

```
DDS::DataReaderView
```

Synopsis

```
#include <ccpp_dds_dcps.h>
DataReader_ptr
  get_datareader
    (void);
```

Description

Retrieves the DataReader to which this DataReaderView is attached.

Parameters

```
<none>
```

Return Value

`DataReader_ptr` - A pointer to the DataReader.

Detailed Description

This operation returns a pointer to the DataReader from which the DataReaderView was originally created. If the DataReader cannot be retrieved, `NULL` is returned.

3.5.9.7 get_key_value (abstract)

This abstract operation is defined as a generic operation, which is implemented by the `<type>DataReaderView` class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type `Foo`-derived `FooDataReaderView` class (see Section 3.5.10, *Class FooDataReaderView*, on page 481).

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  get_key_value
    (<data>& key_holder,
     InstanceHandle_t handle);
```

3.5.9.8 get_qos

Scope

`DDS::DataReaderView`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  get_qos
    (DataReaderViewQos& qos);
```

Description

This operation allows access to the existing set of QoS policies for a DataReaderView. For a full description please refer to Section 3.5.2.16, *get_qos*, on page 379, which describes this operation in detail for the DataReader class.

Parameters

`inout DataReaderViewQos& qos` - a reference to the destination DataReaderViewQos struct in which the QosPolicy settings will be copied.

Return Value

`ReturnCode_t` - Possible return codes of the operation are:
`RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_ALREADY_DELETED` or `RETCODE_OUT_OF_RESOURCES`.

Detailed Description

This operation allows access to the existing set of QoS policies of a DataReaderView on which this operation is used. This DataReaderViewQos is stored at the location pointed to by the qos parameter.

Return Code

When the operation returns:

- *`RETCODE_OK`* - the existing set of QoSPolicy values applied to this DataReaderView has successfully been copied into the specified DataReaderViewQos parameter.
- *`RETCODE_ERROR`* - an internal error has occurred.
- *`RETCODE_ALREADY_DELETED`* - the DataReaderView has already been deleted.
- *`RETCODE_OUT_OF_RESOURCES`* - the Data Distribution Service ran out of resources to complete this operation.

3.5.9.9 get_status_changes (inherited)

This operation is inherited and therefore not described here. See Section 3.1.1, *Class Entity (abstract)*, on page 26, for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
 StatusMask
  get_status_changes
    (void);
```

3.5.9.10 get_statuscondition (inherited)

This operation is inherited and therefore not described here. See Section 3.1.1, *Class Entity (abstract)*, on page 26, for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
StatusCondition_ptr
  get_statuscondition
    (void);
```

3.5.9.11 lookup_instance (abstract)

This abstract operation is defined as a generic operation, which is implemented by the `<type>DataReaderView` class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type `Foo`-derived `FooDataReaderView` class (Section 3.5.10, *Class FooDataReaderView*, on page 481).

Synopsis

```
#include <ccpp_dds_dcps.h>
InstanceHandle_t
  lookup_instance
    (const <data>& instance_data)
```

3.5.9.12 read (abstract)

This abstract operation is defined as a generic operation, which is implemented by the `<type>DataReaderView` class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type `Foo`-derived `FooDataReaderView` class (Section 3.5.10, *Class FooDataReaderView*, on page 481).

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  read
    (<data>Seq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     SampleStateMask sample_states,
     ViewStateMask view_states,
     InstanceStateMask instance_states);
```

3.5.9.13 read_instance (abstract)

This abstract operation is defined as a generic operation, which is implemented by the `<type>DataReaderView` class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type `Foo`-derived `FooDataReaderView` class (Section 3.5.10, *Class FooDataReaderView*, on page 481).

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  read_instance
    (<data>Seq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     InstanceHandle_t a_handle,
     SampleStateMask sample_states,
     ViewStateMask view_states,
     InstanceStateMask instance_states);
```

3.5.9.14 read_next_instance (abstract)

This abstract operation is defined as a generic operation, which is implemented by the `<type>DataReaderView` class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type `Foo`-derived `FooDataReaderView` class (Section 3.5.10, *Class FooDataReaderView*, on page 481).

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  read_next_instance
     (<data>Seq& data_values,
     SampleInfoSeq& info_seq,
```

```
    Long max_samples,
    InstanceHandle_t a_handle,
    SampleStateMask sample_states,
    ViewStateMask view_states,
    InstanceStateMask instance_states);
```

3.5.9.15 read_next_instance_w_condition (abstract)

This abstract operation is defined as a generic operation, which is implemented by the <type>DataReaderView class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type Foo-derived FooDataReaderView class (Section 3.5.10, *Class FooDataReaderView*, on page 481).

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  read_next_instance_w_condition
    (<data>Seq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     InstanceHandle_t a_handle,
     ReadCondition_ptr a_condition);
```

3.5.9.16 read_next_sample (abstract)

This abstract operation is defined as a generic operation, which is implemented by the <type>DataReaderView class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type Foo-derived FooDataReaderView class (Section 3.5.10, *Class FooDataReaderView*, on page 481).

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  read_next_sample
   (<data>& data_values,
    SampleInfo& sample_info);
```

3.5.9.17 read_w_condition (abstract)

This abstract operation is defined as a generic operation, which is implemented by the <type>DataReaderView class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be

used. For further explanation see the description for the fictional data type Foo-derived FooDataReaderView class (Section 3.5.10, *Class FooDataReaderView*, on page 481).

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  read_w_condition
    (<data>Seq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     ReadCondition_ptr a_condition);
```

3.5.9.18 return_loan (abstract)

This abstract operation is defined as a generic operation, which is implemented by the <type>DataReaderView class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type Foo derived FooDataReaderView class (Section 3.5.10, *Class FooDataReaderView*, on page 481).

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  return_loan
    (<data>Seq& data_values,
     SampleInfoSeq& info_seq);
```

3.5.9.19 set_qos

Scope

```
DDS::DataReaderView
```

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  set_qos
    (const DataReaderViewQos& qos);
```

Description

This operation replaces the existing set of QosPolicy settings for a DataReaderView.

Parameters

in const DataReaderViewQos& qos - `qos` contains the new set of QosPolicy settings for the DataReader.

Return Value

ReturnCode_t - Possible return codes of the operation are:
`RETCODE_OK`, `RETCODE_ERROR`, `RETCODE_BAD_PARAMETER`, `RETCODE_ALREADY_DELETED`, `RETCODE_OUT_OF_RESOURCES` or `RETCODE_IMMUTABLE_POLICY`.

Detailed Description

This operation replaces the existing set of QosPolicy settings for a DataReaderView.

The parameter qos contains the QosPolicy settings which is checked for self-consistency and mutability. When the application tries to change a QosPolicy setting for an enabled DataReader, which can only be set before the DataReader is enabled, the operation will fail and a `RETCODE_IMMUTABLE_POLICY` is returned. In other words, the application must provide the presently set QosPolicy settings in case of the immutable QosPolicy settings. Only the mutable QosPolicy settings can be changed.

The set of QosPolicy settings specified by the qos parameter are applied on top of the existing QoS, replacing the values of any policies previously set (provided that the operation returned `RETCODE_OK`).

Return Code

When the operation returns:

- *RETCODE_OK* - the new DataReaderQos is set.
- *RETCODE_ERROR* - an internal error has occurred.
- *RETCODE_BAD_PARAMETER* - the parameter qos is not a valid DataReaderQos. It contains a QosPolicy setting with an invalid `Duration_t` value or an enum value that is outside its legal boundaries.
- *RETCODE_ALREADY_DELETED* - the DataReader has already been deleted.
- *RETCODE_OUT_OF_RESOURCES* - the Data Distribution Service ran out of resources to complete this operation.
- *RETCODE_IMMUTABLE_POLICY* - the parameter `qos` contains an immutable QosPolicy setting with a value different from the one set during enabling of the DataReaderView.

3.5.9.20 take (abstract)

This abstract operation is defined as a generic operation, which is implemented by the `<type>DataReaderView` class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type `Foo`-derived `FooDataReaderView` class (Section 3.5.10, *Class FooDataReaderView*, on page 481).

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  take
    (<data>Seq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     SampleStateMask sample_states,
     ViewStateMask view_states,
     InstanceStateMask instance_states);
```

3.5.9.21 take_instance (abstract)

This abstract operation is defined as a generic operation, which is implemented by the `<type>DataReaderView` class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type `Foo`-derived `FooDataReaderView` class (Section 3.5.10, *Class FooDataReaderView*, on page 481).

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  take_instance
    (<data>Seq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     InstanceHandle_t a_handle,
     SampleStateMask sample_states,
     ViewStateMask view_states,
     InstanceStateMask instance_states);
```

3.5.9.22 take_next_instance (abstract)

This abstract operation is defined as a generic operation, which is implemented by the `<type>DataReaderView` class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be

used. For further explanation see the description for the fictional data type Foo-derived FooDataReaderView class (Section 3.5.10, *Class FooDataReaderView*, on page 481).

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  take_next_instance
    (<data>Seq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     InstanceHandle_t a_handle,
     SampleStateMask sample_states,
     ViewStateMask view_states,
     InstanceStateMask instance_states);
```

3.5.9.23 take_next_instance_w_condition (abstract)

This abstract operation is defined as a generic operation, which is implemented by the <type>DataReaderView class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type Foo-derived FooDataReaderView class (Section 3.5.10, *Class FooDataReaderView*, on page 481).

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  take_next_instance_w_condition
    (<data>Seq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     InstanceHandle_t a_handle,
     ReadCondition_ptr a_condition);
```

3.5.9.24 take_next_sample (abstract)

This abstract operation is defined as a generic operation, which is implemented by the <type>DataReaderView class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type Foo-derived FooDataReaderView class (Section 3.5.10, *Class FooDataReaderView*, on page 481).

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
```

```
take_next_sample
  (<data>& data_values,
   SampleInfo& sample_info);
```

3.5.9.25 take_w_condition (abstract)

This abstract operation is defined as a generic operation, which is implemented by the `<type>DataReaderView` class. Therefore, to use this operation, the data type specific implementation of this operation in its respective derived class must be used. For further explanation see the description for the fictional data type `Foo`-derived `FooDataReaderView` class (Section 3.5.10, *Class FooDataReaderView*, on page 481).

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  take_w_condition
    (<data>Seq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     ReadCondition_ptr a_condition);
```

3.5.10 Class FooDataReaderView

The preprocessor generates from IDL type descriptions the `<type>DataReaderView` classes. For each application data type which is used as Topic data type, a typed class `<type>DataReaderView` is derived from the `DataReaderView` class. In this paragraph, the class `FooDataReaderView` in the namespace `SPACE` describes the operations of these derived `<type>DataReaderView` classes as an example for the fictional type `Foo` (defined in the module `SPACE`).

The interface description of this class is as follows:

```
class FooDataReaderView
{
//
// inherited from class Entity
//
// StatusCondition_ptr
// get_statuscondition
//     (void);
// StatusMask
// get_status_changes
//     (void);
// ReturnCode_t
//enable
//     (void);
//
```

```
// inherited from class DataReaderView
//
// QueryCondition_ptr
//   create_querycondition
//     (SampleStateMask sample_states,
//      ViewStateMask view_states,
//      InstanceStateMask instance_states,
//      const char* query_expression,
//      const StringSeq& query_parameters);
//
// ReadCondition_ptr
//   create_readcondition
//     (SampleStateMask sample_states,
//      ViewStateMask view_states,
//      InstanceStateMask instance_states);
//
// ReturnCode_t
//   delete_contained_entities
//     (void);
//
// ReturnCode_t
//   delete_readcondition
//     (ReadCondition_ptr a_condition);
//
// DataReader_ptr
//   get_datareader
//     (void);
//
// ReturnCode_t
//   get_qos
//     (DataReaderViewQos& qos);
//
// ReturnCode_t
//   set_qos
//     (const DataReaderViewQos& qos);
//
//
// implemented API operations
//
ReturnCode_t
  get_key_value
    (Foo& key_holder,
     InstanceHandle_t handle);

InstanceHandle_t
  lookup_instance
    (const Foo& instance_data)

ReturnCode_t
  read
```

```
    (FooSeq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     SampleStateMask sample_states,
     ViewStateMask view_states,
     InstanceStateMask instance_states);

ReturnCode_t
  read_instance
    (FooSeq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     InstanceHandle_t a_handle,
     SampleStateMask sample_states,
     ViewStateMask view_states,
     InstanceStateMask instance_states);

ReturnCode_t
  read_next_instance
    (FooSeq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     InstanceHandle_t a_handle,
     SampleStateMask sample_states,
     ViewStateMask view_states,
     InstanceStateMask instance_states);

ReturnCode_t
  read_next_instance_w_condition
    (FooSeq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     InstanceHandle_t a_handle,
     ReadCondition_ptr a_condition);

ReturnCode_t
  read_next_sample
    (Foo& data_values,
     SampleInfo& sample_info);

ReturnCode_t
  read_w_condition
    (FooSeq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     ReadCondition_ptr a_condition);

ReturnCode_t
  return_loan
    (FooSeq& data_values,
```

```
      SampleInfoSeq& info_seq);

ReturnCode_t
  take
    (FooSeq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     SampleStateMask sample_states,
     ViewStateMask view_states,
     InstanceStateMask instance_states);

ReturnCode_t
  take_instance
    (FooSeq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     InstanceHandle_t a_handle,
     SampleStateMask sample_states,
     ViewStateMask view_states,
     InstanceStateMask instance_states);

ReturnCode_t
  take_next_instance
    (FooSeq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     InstanceHandle_t a_handle,
     SampleStateMask sample_states,
     ViewStateMask view_states,
     InstanceStateMask instance_states);

ReturnCode_t
  take_next_instance_w_condition
    (FooSeq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     InstanceHandle_t a_handle,
     ReadCondition_ptr a_condition);

ReturnCode_t
  take_next_sample
    (Foo& data_values,
     SampleInfo& sample_info);

ReturnCode_t
  take_w_condition
    (FooSeq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     ReadCondition_ptr a_condition);
```

The following paragraphs describe the usage of all `FooDataReaderView` operations. The inherited operations are listed but not fully described because they are not implemented in this class. Full descriptions of these operations are given in the classes from which they are inherited.

3.5.10.1 create_querycondition (inherited)

This operation is inherited and therefore not described here. See the class `DataReaderView` (Section 3.5.9, *Class DataReaderView (abstract)*, on page 465) for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
QueryCondition_ptr
  create_querycondition
    (SampleStateMask sample_states,
     ViewStateMask view_states,
     InstanceStateMask instance_states,
     const char* query_expression,
     const StringSeq& query_parameters);
```

3.5.10.2 create_readcondition (inherited)

This operation is inherited and therefore not described here. See the class `DataReaderView` (Section 3.5.9, *Class DataReaderView (abstract)*, on page 465) for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
ReadCondition_ptr
  create_readcondition
    (SampleStateMask sample_states,
     ViewStateMask view_states,
     InstanceStateMask instance_states);
```

3.5.10.3 delete_contained_entities

This operation is inherited and therefore not described here. See the class `DataReaderView` (Section 3.5.9, *Class DataReaderView (abstract)*, on page 465) for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  delete_contained_entities
    (void);
```

3.5.10.4 delete_readcondition (inherited)

This operation is inherited and therefore not described here. See the class `DataReaderView` (Section 3.5.9, *Class DataReaderView (abstract)*, on page 465) for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  delete_readcondition
    (ReadCondition_ptr a_condition);
```

3.5.10.5 enable (inherited)

This operation is inherited and therefore not described here. See the class `Entity` (Section 3.1.1, *Class Entity (abstract)*, on page 26) for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  enable
    (void);
```

3.5.10.6 get_datareader (inherited)

This operation is inherited and therefore not described here. See the class `DataReaderView` (Section 3.5.9, *Class DataReaderView (abstract)*, on page 465) for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
DataReader_ptr
  get_datareader
    (void);
```

3.5.10.7 get_key_value

Scope

```
SPACE::FooDataReaderView
```

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  get_key_value
    (Foo& key_holder,
     InstanceHandle_t handle);
```

NOTE: This operation is not yet implemented. It is scheduled for a future release.

3.5.10.8 get_qos (inherited)

This operation is inherited and therefore not described here. See the class `DataReaderView` (Section 3.5.9, *Class DataReaderView (abstract)*, on page 465) for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  get_qos
    (DataReaderViewQos& qos);
```

3.5.10.9 get_status_changes (inherited)

This operation is inherited and therefore not described here. See the class `Entity` for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
StatusMask
  get_status_changes
    (void);
```

3.5.10.10 get_statuscondition (inherited)

This operation is inherited and therefore not described here. See the class `Entity` (Section 3.1.1, *Class Entity (abstract)*, on page 26) for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
StatusCondition_ptr
  get_statuscondition
    (void);
```

3.5.10.11 lookup_instance

Scope

```
SPACE::FooDataReaderView
```

Synopsis

```
#include <ccpp_dds_dcps.h>
InstanceHandle_t
  lookup_instance
    (const Foo& instance_data)
```

Description

This operation returns the value of the instance handle which corresponds to the `instance_data`. For a full description please refer to Section 3.5.2.67, *lookup_instance*, on page 414, which describes this operation in detail for the DataReader class. Note that instances in the `FooDataReaderView` are not defined by the keys of the TopicDescription but by the key list in the DataReaderView QosPolicy.

3.5.10.12 read

Scope

`SPACE::FooDataReaderView`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  read
    (FooSeq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     SampleStateMask sample_states,
     ViewStateMask view_states,
     InstanceStateMask instance_states);
```

Description

This operation reads a sequence of `Foo` samples from the `FooDataReaderView`. For a full description please refer to Section 3.5.2.68, *read*, on page 415, which describes this operation in detail for the DataReader class.

3.5.10.13 read_instance

Scope

`SPACE::FooDataReaderView`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  read_instance
    (FooSeq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     InstanceHandle_t a_handle,
     SampleStateMask sample_states,
     ViewStateMask view_states,
     InstanceStateMask instance_states);
```

Description

This operation reads a sequence of `Foo` samples of a single instance from the `FooDataReaderView`. For a full description please refer to Section 3.5.2.69, *read_instance*, on page 419, which describes this operation in detail for the DataReader class.

3.5.10.14 read_next_instance

Scope

```
SPACE::FooDataReaderView
```

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  read_next_instance
    (FooSeq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     InstanceHandle_t a_handle,
     SampleStateMask sample_states,
     ViewStateMask view_states,
     InstanceStateMask instance_states);
```

Description

This operation reads a sequence of `Foo` samples of the next single instance from the `FooDataReaderView`. For a full description please refer to Section 3.5.2.70, *read_next_instance*, on page 421, which describes this operation in detail for the DataReader class.

3.5.10.15 read_next_instance_w_condition

Scope

```
SPACE::FooDataReaderView
```

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  read_next_instance_w_condition
    (FooSeq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     InstanceHandle_t a_handle,
     ReadCondition_ptr a_condition);
```

Description

This operation reads a sequence of `Foo` samples of the next single instance from the `FooDataReaderView`, filtered by a ReadCondition or QueryCondition. For a full description please refer to Section 3.5.2.71, *read_next_instance_w_condition*, on page 424, which describes this operation in detail for the DataReader class.

3.5.10.16 read_next_sample

Scope

```
SPACE::FooDataReaderView
```

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  read_next_sample
   (Foo& data_values,
    SampleInfo& sample_info);
```

NOTE: This operation is not yet implemented. It is scheduled for a future release.

3.5.10.17 read_w_condition

Scope

```
SPACE::FooDataReaderView
```

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  read_w_condition
    (FooSeq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     ReadCondition_ptr a_condition);
```

Description

This operation reads a sequence of `Foo` samples from the `FooDataReaderView`, filtered by a ReadCondition or QueryCondition. For a full description please refer to Section 3.5.2.73, *read_w_condition*, on page 426, which describes this operation in detail for the DataReader class.

3.5.10.18 return_loan

Scope

```
SPACE::FooDataReaderView
```

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  return_loan
    (FooSeq& data_values,
     SampleInfoSeq& info_seq);
```

Description

This operation indicates to the DataReaderView that the application is done accessing the sequence of `data_values` and `info_seq`. For a full description please refer to Section 3.5.2.74, *return_loan*, on page 427, which describes this operation in detail for the DataReader class.

3.5.10.19 set_qos (inherited)

This operation is inherited and therefore not described here. See the class `DataReaderView` (Section 3.5.9, *Class DataReaderView (abstract)*, on page 465) for further explanation.

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  set_qos
    (const DataReaderViewQos& qos);
```

3.5.10.20 take

Scope

```
SPACE::FooDataReaderView
```

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  take
    (FooSeq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     SampleStateMask sample_states,
     ViewStateMask view_states,
     InstanceStateMask instance_states);
```

Description

This operation reads a sequence of `Foo` samples from the `FooDataReaderView` and by doing so, removes the data from the `FooDataReaderView`, but not from the `FooDataReader` that it belongs to. For a full description please refer to Section 3.5.2.77, *take*, on page 430, which describes this operation in detail for the DataReader class.

3.5.10.21 take_instance

Scope

```
SPACE::FooDataReaderView
```

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  take_instance
    (FooSeq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     InstanceHandle_t a_handle,
     SampleStateMask sample_states,
     ViewStateMask view_states,
     InstanceStateMask instance_states);
```

Description

This operation reads a sequence of `Foo` samples of a single instance from the `FooDataReaderView` and by doing so, removes the data from the `FooDataReaderView`, but not from the `FooDataReader` that it belongs to. For a full description please refer to Section 3.5.2.78, *take_instance*, on page 431, which describes this operation in detail for the DataReader class.

3.5.10.22 take_next_instance

Scope

```
SPACE::FooDataReaderView
```

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  take_next_instance
    (FooSeq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     InstanceHandle_t a_handle,
     SampleStateMask sample_states,
```

```
    ViewStateMask view_states,
    InstanceStateMask instance_states);
```

Description

This operation reads a sequence of `Foo` samples of the next single instance from the `FooDataReaderView` and by doing so, removes the data from the `FooDataReaderView`, but not from the `FooDataReader` that it belongs to. For a full description please refer to Section 3.5.2.79, *take_next_instance*, on page 433, which describes this operation in detail for the DataReader class.

3.5.10.23 take_next_instance_w_condition

Scope

`SPACE::FooDataReaderView`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  take_next_instance_w_condition
    (FooSeq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     InstanceHandle_t a_handle,
     ReadCondition_ptr a_condition);
```

Description

This operation reads a sequence of `Foo` samples of the next single instance from the `FooDataReaderView`, filtered by a `ReadCondition` or `QueryCondition` and by doing so, removes the data from the `FooDataReaderView`, but not from the `FooDataReader` that it belongs to. For a full description please refer to Section 3.5.2.80, *take_next_instance_w_condition*, on page 435, which describes this operation in detail for the DataReader class.

3.5.10.24 take_next_sample

Scope

`SPACE::FooDataReaderView`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  take_next_sample
    (Foo& data_values,
     SampleInfo& sample_info);
```

NOTE: This operation is not yet implemented. It is scheduled for a future release.

3.5.10.25 take_w_condition

Scope

`SPACE::FooDataReaderView`

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
  take_w_condition
    (FooSeq& data_values,
     SampleInfoSeq& info_seq,
     Long max_samples,
     ReadCondition_ptr a_condition);
```

Description

This operation reads a sequence of `Foo` samples from the `FooDataReaderView`, filtered by a `ReadCondition` or `QueryCondition` and by doing so, removes the data from the `FooDataReaderView`, but not from the `FooDataReader` that it belongs to. For a full description please refer to Section 3.5.2.82, *take_w_condition*, on page 437, which describes this operation in detail for the DataReader class.

3.6 QosProvider

The QosProvider API allows users to specify the QoS settings of their DCPS entities outside of application code in XML. The QosProvider is delivered as part of the DCPS API of Vortex OpenSplice and has no factory. It is not associated with a `DomainParticipant`, so it can be be obtained by a normal allocation.

3.6.1 Class QosProvider

The `QosProvider` class provides access to the QoS settings that are specified in an XML file. The interface is as follows:

```
class QosProvider
{
    /* Constructor */
    QosProvider (
        const char *uri,
        const char *profile);

    /* API operations */
    ReturnCode_t
        get_participant_qos(
            DomainParticipantQos &qos,
            const char *id);
```

```
        ReturnCode_t
            get_topic_qos(
                TopicQos &qos,
                const char *id);

        ReturnCode_t
            get_subscriber_qos(
                SubscriberQos &qos,
                const char *id);

        ReturnCode_t
            get_datareader_qos(
                DataReaderQos &qos,
                const char *id);

        ReturnCode_t
            get_publisher_qos(
                PublisherQos &qos,
                const char *id);

        ReturnCode_t
            get_datawriter_qos(
                DataWriterQos &qos,
                const char *id);
    }
```

3.6.1.1 QosProvider

Synopsis

```
#include <ccpp_dds_dcps.h>
    QosProvider(
        const char *uri,
        const char *profile);
```

Description

Constructs a new `QosProvider` based on the provided `uri` and `profile`.

Parameters

*in char * uri* - A Uniform Resource Identifier (URI) that points to the location where the QoS profile needs to be loaded from. Currently only URI's with a 'file' scheme that point to an XML file are supported. If profiles and/or QoS settings are not uniquely identifiable by name within the resource pointed to by `uri`, a random one of them will be stored.

*in char * profile* - The name of the QoS profile that serves as the default QoS profile for the `get_*_qos(...)` operations.

Return Value

A `QosProvider` instance that is instantiated with all profiles and/or QoS's loaded from the location specified by the provided `uri`.

Initialization of the `QosProvider` will fail under the following conditions:

- No `uri` is provided.
- The resource pointed to by `uri` cannot be found.
- The content of the resource pointed to by `uri` is malformed (*e.g.*, malformed XML).

When initialisation fails (for example, due to a parse error or when the resource identified by `uri` cannot be found), any subsequent operations on the `QosProvider` will return `DDS::RETCODE_PRECONDITION_NOT_MET`.

3.6.1.2 get_participant_qos

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
    get_participant_qos(
        DomainParticipantQos &qos,
        const char *id);
```

Description

Resolves the `DomainParticipantQos` identified by the `id` from the `uri` the `QosProvider _this` is associated with.

Parameters

`inout DomainParticipantQos & qos` - The destination `DomainParticipantQos` in which the QoS policy settings will be copied.

`in char * id` - The fully-qualified name that identifies a QoS within the `uri` associated with the `QosProvider` or a name that identifies a QoS within the `uri` associated with the `QosProvider` instance relative to its default QoS profile. `Id`'s starting with '`::`' are interpreted as fully-qualified names and all others are interpreted as names relative to the default QoS profile of the `QosProvider` instance. When `id` is *`NULL`* it is interpreted as a non-named QoS within the default QoS profile associated with the `QosProvider`.

Return Value

The operation may return:

- *`DDS::RETCODE_OK`* - If `qos` has been initialized successfully.

- *DDS::RETCODE_NO_DATA* - If no DomainParticipantQos that matches the provided id can be found within the uri associated with the QosProvider.
- *DDS::RETCODE_BAD_PARAMETER* - If qos == DOMAINPARTICIPANT_QOS_DEFAULT.
- *DDS::RETCODE_PRECONDITION_NOT_MET* - If the QosProvider instance is not properly initialized.
- *DDS::RETCODE_OUT_OF_RESOURCES* - If not enough memory is available to perform the operation.
- *DDS::RETCODE_ERROR* - If an internal error occurred.

3.6.1.3 get_topic_qos

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
    get_topic_qos(
        TopicQos &qos,
        const char *id);
```

Description

Resolves the TopicQos identified by the id from the uri the QosProvider is associated with.

Parameters

inout TopicQos & qos - The destination TopicQos in which the QoS policy settings will be copied.

*in char * id* - The fully-qualified name that identifies a QoS within the uri associated with the QosProvider or a name that identifies a QoS within the uri associated with the QosProvider instance relative to its default QoS profile. Id's starting with '::' are interpreted as fully-qualified names and all others are interpreted as names relative to the default QoS profile of the QosProvider instance. When id is *NULL* it is interpreted as a non-named QoS within the default QoS profile associated with the QosProvider.

Return Value

The operation may return:

- *DDS::RETCODE_OK* - If qos has been initialized successfully.
- *DDS::RETCODE_NO_DATA* - If no TopicQos that matches the provided id can be found within the uri associated with the QosProvider.
- *DDS::RETCODE_BAD_PARAMETER* - If qos == TOPIC_QOS_DEFAULT.

- *DDS::RETCODE_PRECONDITION_NOT_MET* - If the QosProvider instance is not properly initialized.
- *DDS::RETCODE_OUT_OF_RESOURCES* - If not enough memory is available to perform the operation.
- *DDS::RETCODE_ERROR* - If an internal error occurred.

3.6.1.4 get_subscriber_qos

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
    get_subscriber_qos(
        SubscriberQos &qos,
        const char *id);
```

Description

Resolves the SubscriberQos identified by the id from the uri the QosProvider is associated with.

Parameters

inout SubscriberQos & qos - The destination SubscriberQos in which the QoS policy settings will be copied.

*in char * id* - The fully-qualified name that identifies a QoS within the uri associated with the QosProvider or a name that identifies a QoS within the uri associated with the QosProvider instance relative to its default QoS profile. Id's starting with '::' are interpreted as fully-qualified names and all others are interpreted as names relative to the default QoS profile of the QosProvider instance. When id is *NULL* it is interpreted as a non-named QoS within the default QoS profile associated with the QosProvider.

Return Value

The operation may return:

- *DDS::RETCODE_OK* - If qos has been initialized successfully.
- *DDS::RETCODE_NO_DATA* - If no SubscriberQos that matches the provided id can be found within the uri associated with the QosProvider.
- *DDS::RETCODE_BAD_PARAMETER* - If qos == SUBSCRIBER_QOS_DEFAULT.
- *DDS::RETCODE_PRECONDITION_NOT_MET* - If the QosProvider instance is not properly initialized.
- *DDS::RETCODE_OUT_OF_RESOURCES* - If not enough memory is available to perform the operation.

- *DDS::RETCODE_ERROR* - If an internal error occurred.

3.6.1.5 get_datareader_qos

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
    get_datareader_qos(
        DataReaderQos &qos,
        const char *id);
```

Description

Resolves the `DataReaderQos` identified by the `id` from the `uri` the `QosProvider` is associated with.

Parameters

inout DataReaderQos & qos - The destination `DataReaderQos` in which the QoS policy settings will be copied.

*in char * id* - The fully-qualified name that identifies a QoS within the uri associated with the `QosProvider` or a name that identifies a QoS within the `uri` associated with the `QosProvider` instance relative to its default QoS profile. `Id`'s starting with '`::`' are interpreted as fully-qualified names and all others are interpreted as names relative to the default QoS profile of the `QosProvider` instance. When `id` is *NULL* it is interpreted as a non-named QoS within the default QoS profile associated with the `QosProvider`.

Return Value

The operation may return:

- *DDS::RETCODE_OK* - If `qos` has been initialized successfully.
- *DDS::RETCODE_NO_DATA* - If no `DataReaderQos` that matches the provided `id` can be found within the `uri` associated with the `QosProvider`.
- *DDS::RETCODE_BAD_PARAMETER* - If `qos == DATAREADER_QOS_DEFAULT`.
- *DDS::RETCODE_PRECONDITION_NOT_MET* - If the `QosProvider` instance is not properly initialized.
- *DDS::RETCODE_OUT_OF_RESOURCES* - If not enough memory is available to perform the operation.
- *DDS::RETCODE_ERROR* - If an internal error occurred.

3.6.1.6 get_publisher_qos

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
    get_publisher_qos(
        PublisherQos &qos,
        const char *id);
```

Description

Resolves the `PublisherQos` identified by the `id` from the `uri` the `QosProvider` is associated with.

Parameters

`inout PublisherQos & qos` - The destination `PublisherQos` in which the QoS policy settings will be copied.

`in char * id` - The fully-qualified name that identifies a QoS within the `uri` associated with the `QosProvider` or a name that identifies a QoS within the `uri` associated with the `QosProvider` instance relative to its default QoS profile. `Id`'s starting with '`::`' are interpreted as fully-qualified names and all others are interpreted as names relative to the default QoS profile of the `QosProvider` instance. When `id` is *`NULL`* it is interpreted as a non-named QoS within the default QoS profile associated with the `QosProvider`.

Return Value

The operation may return:

- *`DDS::RETCODE_OK`* - If `qos` has been initialized successfully.
- *`DDS::RETCODE_NO_DATA`* - If no `PublisherQos` that matches the provided `id` can be found within the `uri` associated with the `QosProvider`.
- *`DDS::RETCODE_BAD_PARAMETER`* - If `qos == PUBLISHER_QOS_DEFAULT`.
- *`DDS::RETCODE_PRECONDITION_NOT_MET`* - If the `QosProvider` instance is not properly initialized.
- *`DDS::RETCODE_OUT_OF_RESOURCES`* - If not enough memory is available to perform the operation.
- *`DDS::RETCODE_ERROR`* - If an internal error occurred.

3.6.1.7 get_datawriter_qos

Synopsis

```
#include <ccpp_dds_dcps.h>
ReturnCode_t
```

```
get_datawriter_qos(
    DataWriterQos &qos,
    const char *id);
```

Description

Resolves the `DataWriterQos` identified by the `id` from the `uri` the `QosProvider` is associated with.

Parameters

`inout DataWriterQos & qos` - The destination `DataWriterQos` in which the QoS policy settings will be copied.

`in char * id` - The fully-qualified name that identifies a QoS within the `uri` associated with the `QosProvider` or a name that identifies a QoS within the `uri` associated with the `QosProvider` instance relative to its default QoS profile. `Id`'s starting with '`::`' are interpreted as fully-qualified names and all others are interpreted as names relative to the default QoS profile of the `QosProvider` instance. When `id` is *`NULL`* it is interpreted as a non-named QoS within the default QoS profile associated with the `QosProvider`.

Return Value

The operation may return:

- *`DDS::RETCODE_OK`* - If `qos` has been initialized successfully.
- *`DDS::RETCODE_NO_DATA`* - If no `DataWriterQos` that matches the provided `id` can be found within the `uri` associated with the `QosProvider`.
- *`DDS::RETCODE_BAD_PARAMETER`* - If `qos == DATAWRITER_QOS_DEFAULT`.
- *`DDS::RETCODE_PRECONDITION_NOT_MET`* - If the `QosProvider` instance is not properly initialized.
- *`DDS::RETCODE_OUT_OF_RESOURCES`* - If not enough memory is available to perform the operation.
- *`DDS::RETCODE_ERROR`* - If an internal error occurred.

Appendices

Appendix

A Quality Of Service

Each Entity is accompanied by an <Entity>Qos structure that implements the basic mechanism for an application to specify Quality of Service attributes. This structure consists of Entity specific QosPolicy attributes. QosPolicy attributes are structured types where each type specifies the information that controls an Entity related (configurable) attribute of the Data Distribution Service. A QosPolicy attribute struct is identified as <name>QosPolicy.

Affected Entities

Each Entity can be configured with a set of QosPolicy settings. However, any Entity cannot support any QosPolicy. For instance, a DomainParticipant supports different QosPolicy settings than a Topic or a Publisher. The set of QosPolicy settings is implemented as a struct of QosPolicy structs, identified as <Entity>Qos. Each <Entity>Qos struct only contains those QosPolicy structs relevant to the specific Entity. The <Entity>Qos struct serves as the parameter to operations which require a Qos. <Entity>Qos struct is the API implementation of the QoS. Depending on the specific <Entity>Qos, it controls the behaviour of a Topic, DataWriter, DataReader, Publisher, Subscriber, DomainParticipant or DomainParticipantFactory[1].

Basic Usage

The basic way to modify or set the <Entity>Qos is by using an get_qos operation to get all QosPolicy settings from this Entity (that is the <Entity>Qos), modify several specific QosPolicy settings and put them back using an set_qos operation to set all QosPolicy settings on this Entity (that is the <Entity>Qos). An example of these operations for the DataWriterQos are get_default_datawriter_qos and set_default_datawriter_qos, which take the DataWriterQos as a parameter.

The interface description of this struct is as follows:

```
// struct <name>QosPolicy
//     see appendix
//
```

1. Note that the DomainParticipantFactory is a special kind of entity: it does not inherit from Entity, nor does it have a Listener or StatusCondition, but its behaviour can be controlled by its own set of QosPolicies.

```
//
// struct <Entity>Qos
//
    struct DomainParticipantFactoryQos
       { EntityFactoryQosPolicy       entity_factory; };
    struct DomainParticipantQos
       { UserDataQosPolicy            user_data;
         EntityFactoryQosPolicy       entity_factory;
         SchedulingQosPolicy          watchdog_scheduling;
         SchedulingQosPolicy          listener_scheduling; };
    struct TopicQos
       { TopicDataQosPolicy           topic_data;
         DurabilityQosPolicy          durability;
         DurabilityServiceQosPolicy   durability_service;
         DeadlineQosPolicy            deadline;
         LatencyBudgetQosPolicy       latency_budget;
         LivelinessQosPolicy          liveliness;
         ReliabilityQosPolicy         reliability;
         DestinationOrderQosPolicy    destination_order;
         HistoryQosPolicy             history;
         ResourceLimitsQosPolicy      resource_limits;
         TransportPriorityQosPolicy   transport_priority;
         LifespanQosPolicy            lifespan;
         OwnershipQosPolicy           ownership; };
    struct DataWriterQos
       { DurabilityQosPolicy          durability;
         DeadlineQosPolicy            deadline;
         LatencyBudgetQosPolicy       latency_budget;
         LivelinessQosPolicy          liveliness;
         ReliabilityQosPolicy         reliability;
         DestinationOrderQosPolicy    destination_order;
         HistoryQosPolicy             history;
         ResourceLimitsQosPolicy      resource_limits;
         TransportPriorityQosPolicy   transport_priority;
         LifespanQosPolicy            lifespan;
         UserDataQosPolicy            user_data;
         OwnershipQosPolicy           ownership;
         OwnershipStrengthQosPolicy   ownership_strength;
         WriterDataLifecycleQosPolicy writer_data_lifecycle;};
    struct PublisherQos
       { PresentationQosPolicy        presentation;
         PartitionQosPolicy           partition;
         GroupDataQosPolicy           group_data;
         EntityFactoryQosPolicy       entity_factory; };
    struct DataReaderQos
       { DurabilityQosPolicy          durability;
         DeadlineQosPolicy            deadline;
         LatencyBudgetQosPolicy       latency_budget;
         LivelinessQosPolicy          liveliness;
         ReliabilityQosPolicy         reliability;
```

```
        DestinationOrderQosPolicy    destination_order;
        HistoryQosPolicy             history;
        ResourceLimitsQosPolicy      resource_limits;
        UserDataQosPolicy            user_data;
        OwnershipQosPolicy           ownership;
        TimeBasedFilterQosPolicy     time_based_filter;
        ReaderDataLifecycleQosPolicy reader_data_lifecycle;};
    struct DataReaderViewQos
       { ViewKeyQosPolicy            view_keys; }
    struct SubscriberQos
       { PresentationQosPolicy       presentation;
         PartitionQosPolicy          partition;
         GroupDataQosPolicy          group_data;
         EntityFactoryQosPolicy   entity_factory; };

//
// define <Entity>_QOS_DEFAULT
//
    #define PARTICIPANT_QOS_DEFAULT
    #define TOPIC_QOS_DEFAULT
    #define DATAWRITER_QOS_DEFAULT
    #define PUBLISHER_QOS_DEFAULT
    #define DATAREADER_QOS_DEFAULT
    #define SUBSCRIBER_QOS_DEFAULT
    #define DATAWRITER_QOS_USE_TOPIC_QOS
    #define DATAREADER_QOS_USE_TOPIC_QOS
//
// implemented API operations
//      <no operations>
//
```

The next paragraphs describe the usage of each `<Entity>Qos` struct.

DataReaderQos

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
struct DataReaderQos
      { DurabilityQosPolicy          durability;
        DeadlineQosPolicy            deadline;
        LatencyBudgetQosPolicy       latency_budget;
        LivelinessQosPolicy          liveliness;
        ReliabilityQosPolicy         reliability;
        DestinationOrderQosPolicy    destination_order;
        HistoryQosPolicy             history;
        ResourceLimitsQosPolicy      resource_limits;
```

```
UserDataQosPolicy            user_data;
OwnershipQosPolicy           ownership;
TimeBasedFilterQosPolicy     time_based_filter;
ReaderDataLifecycleQosPolicy reader_data_lifecycle;
SubscriptionKeyQosPolicy     subscription_keys;
ReaderLifespanQosPolicy      reader_lifespan;
ShareQosPolicy               share;};
```

Description

This struct provides the basic mechanism for an application to specify Quality of Service attributes for a `DataReader`.

Attributes

`DurabilityQosPolicy durability - whether the data should be stored for late joining- deadline` - the period within which a new sample is expected. See Section 3.1.3.3 on page 46 for more detailed information about these settings.

`LatencyBudgetQosPolicy latency_budget` - used by the Data Distribution Service for optimization. See Section 3.1.3.8 on page 55 for more detailed information about these settings.

`LivelinessQosPolicy liveliness` - the way the liveliness of the `DataReader` is asserted to the Data Distribution Service. See Section 3.1.3.10 on page 58 for more detailed information about these settings.

`ReliabilityQosPolicy reliability` - the reliability of the data distribution. See Section 3.1.3.16 on page 74 for more detailed information about these settings.

`DestinationOrderQosPolicy destination_order` - the order in which the `DataReader` timely orders the data. See Section 3.1.3.2 on page 44 for more detailed information about these settings.

`HistoryQosPolicy history` - how samples should be stored. See Section 3.1.3.7 on page 53 for more detailed information about these settings.

`ResourceLimitsQosPolicy resource_limits` - the maximum amount of resources to be used. See Section 3.1.3.17 on page 76 for more detailed information about these settings.

`UserDataQosPolicy user_data` - used to attach additional information to the `DataReader`. See Section 3.1.3.22 on page 82 for more detailed information about these settings.

`OwnershipQosPolicy ownership` - whether a DataWriter exclusively owns an instance. See Section 3.1.3.11 on page 60 for more detailed information about these settings.

TimeBasedFilterQosPolicy time_based_filter - the maximum data rate at which the DataReader will receive changes. See Section 3.1.3.19 on page 79 for more detailed information about these settings.

ReaderDataLifecycleQosPolicy reader_data_lifecycle - determines whether instance state changes (either NOT_ALIVE_NO_WRITERS_INSTANCE_STATE or NOT_ALIVE_DISPOSED_INSTANCE_STATE) are presented to the user when no corresponding samples are available to communicate them. Also it determines how long an instance state change remains available to a user that does not explicitly consume them. See Section 3.1.3.15 on page 71 for more detailed information about these settings.

SubscriptionKeyQosPolicy subscription_keys - Allows the DataReader to define its own set of keys on the data, different from the keys defined by the topic. See Section 3.1.3.24 on page 84 for more detailed information about these settings.

ReaderLifespanQosPolicy reader_lifespan - Automatically remove samples from the DataReader after a specified timeout. See Section 3.1.3.25 on page 86 for more detailed information about these settings.

ShareQosPolicy share - Used to share a DataReader between multiple processes. See Section 3.1.3.26 on page 86 for more detailed information about these settings.

Detailed Description

A QosPolicy can be set when the DataReader is created with the create_datareader operation (or modified with the set_qos operation). Both operations take the DataReaderQos struct as a parameter. There may be cases where several policies are in conflict. Consistency checking is performed each time the policies are modified when they are being created and, in case they are already enabled, via the set_qos operation.

Some QosPolicy have "immutable" semantics meaning that they can only be specified either at DataReader creation time or prior to calling the enable operation on the DataReader.

The initial value of the default DataReaderQos in the Subscriber are given in the following table:

Table 16 QosPolicy Values

QosPolicy	Field	Value
durability	kind	VOLATILE_DURABILITY_QOS
deadline	period	DURATION_INFINITE
latency_budget	duration	0
liveliness	kind	AUTOMATIC_LIVELINESS_QOS
	lease_duration	DURATION_INFINITE
reliability	kind	BEST_EFFORT_RELIABILITY_QOS
	max_blocking_time	100 ms
	synchronous	FALSE
destination_order	kind	BY_RECEPTION_TIMESTAMP_ DESTINATIONORDER_QOS
history	kind	KEEP_LAST_HISTORY_QOS
	depth	1
resource_limits	max_samples	LENGTH_UNLIMITED
	max_instances	LENGTH_UNLIMITED
	max_samples_per_instance	LENGTH_UNLIMITED
user_data	value.length	0
ownership	kind	SHARED_OWNERSHIP_QOS
time_based_filter	minimum_separation	0
reader_data_lifecycle	autopurge_ nowriter_samples_delay	DURATION_INFINITE
	autopurge_ disposed_samples_delay	DURATION_INFINITE
	autopurge_dispose_all	FALSE
	enable_invalid_samples	TRUE
	invalid_ sample_visibility.kind	DDS_MINIMUM_INVALID_SAMPLES
subscription_keys	use_key_list	FALSE
	key_list.length	0
reader_lifespan	use_lifespan	FALSE
	duration	DURATION_INFINITE
share	name	NULL
	enable	FALSE

DataReaderViewQos

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
 struct DataReaderViewQos
   { ViewKeyQosPolicy view_keys; };
```

Description

This struct provides the mechanism for an application to specify Quality of Service attributes for a DataReaderView.

Attributes

ViewKeyQosPolicy view_keys - a key-list that defines the view on the data set. See Section 3.1.3.27 on page 87 for more detailed information about these settings.

Detailed Description

A QosPolicy can be set when the DataReaderView is created with the `create_view` operation or modified with the `set_qos` operation.

The initial value of the default DataReaderViewQos is given in the following table:

Table 17 DATAREADERVIEW_QOS_DEFAULT

QosPolicy	Field	Value
view_keys	use_key_list	FALSE
	key_list.length	0

DataWriterQos

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
struct DataWriterQos
      { DurabilityQosPolicy          durability;
        DeadlineQosPolicy            deadline;
        LatencyBudgetQosPolicy       latency_budget;
        LivelinessQosPolicy          liveliness;
        ReliabilityQosPolicy         reliability;
```

```
DestinationOrderQosPolicy    destination_order;
HistoryQosPolicy             history;
ResourceLimitsQosPolicy      resource_limits;
TransportPriorityQosPolicy   transport_priority;
LifespanQosPolicy            lifespan;
UserDataQosPolicy            user_data;
OwnershipQosPolicy           ownership;
OwnershipStrengthQosPolicy   ownership_strength;
WriterDataLifecycleQosPolicy writer_data_lifecycle;};
```

Description

This struct provides the basic mechanism for an application to specify Quality of Service attributes for a `DataWriter`.

Attributes

`DurabilityQosPolicy durability` - whether the data should be stored for late joining readers. See Section 3.1.3.3 on page 46 for more detailed information about these settings.

`DeadlineQosPolicy deadline` - the period within which a new sample is written. See Section 3.1.3.1 on page 42 for more detailed information about these settings.

`LatencyBudgetQosPolicy latency_budget` - used by the Data Distribution Service for optimization. See Section 3.1.3.8 on page 55 for more detailed information about these settings.

`LivelinessQosPolicy liveliness` - the way the liveliness of the `DataWriter` is asserted to the Data Distribution Service. See Section 3.1.3.10 on page 58 for more detailed information about these settings.

`ReliabilityQosPolicy reliability` - the reliability of the data distribution. See Section 3.1.3.16 on page 74 for more detailed information about these settings.

`DestinationOrderQosPolicy destination_order` - the order in which the `DataReader` timely orders the data. See Section 3.1.3.2 on page 44 for more detailed information about these settings.

`HistoryQosPolicy history` - how samples should be stored. See Section 3.1.3.7 on page 53 for more detailed information about these settings.

`ResourceLimitsQosPolicy resource_limits` - the maximum amount of resources to be used. See Section 3.1.3.17 on page 76 for more detailed information about these settings.

`TransportPriorityQosPolicy transport_priority` - a priority hint for the underlying transport layer. See Section 3.1.3.21 on page 81 for more detailed information about these settings.

LifespanQosPolicy lifespan - the maximum duration of validity of the data written by the DataWriter. See Section 3.1.3.9 on page 57 for more detailed information about these settings.

UserDataQosPolicy user_data - used to attach additional information to the DataWriter. See Section 3.1.3.22 on page 82 for more detailed information about these settings.

OwnershipQosPolicy ownership - whether a DataWriter exclusively owns an instance. See Section 3.1.3.11 on page 60 for more detailed information about these settings.

OwnershipStrengthQosPolicy ownership_strength - the strength to determine the ownership. See Section 3.1.3.12 on page 62 for more detailed information about these settings.

WriterDataLifecycleQosPolicy writer_data_lifecycle - whether unregistered instances are disposed of automatically or not. See Section 3.1.3.23 on page 82 for more detailed information about these settings.

Detailed Description

A QosPolicy can be set when the DataWriter is created with the create_datawriter operation (or modified with the set_qos operation). Both operations take the DataWriterQos struct as a parameter. There may be cases where several policies are in conflict. Consistency checking is performed each time the policies are modified when they are being created and, in case they are already enabled, via the set_qos operation.

Some QosPolicy have "immutable" semantics meaning that they can only be specified either at DataWriter creation time or prior to calling the enable operation on the DataWriter.

The initial values of the default DataWriterQos in the Publisher are given in the following table:

Table 18 DATAWRITER_QOS_DEFAULT

QosPolicy	Field	Value
durability	kind	VOLATILE_DURABILITY_QOS
deadline	period	DURATION_INFINITE
latency_budget	duration	0
liveliness	kind	AUTOMATIC_LIVELINESS_QOS
	lease_duration	DURATION_INFINITE

Table 18 DATAWRITER_QOS_DEFAULT (Continued)

QosPolicy	Field	Value
reliability	kind	RELIABLE_RELIABILITY_QOS
	max_blocking_time	100 ms
	synchronous	FALSE
destination_order	kind	BY_RECEPTION_TIMESTAMP_ DESTINATIONORDER_QOS
history	kind	KEEP_LAST_HISTORY_QOS
	depth	1
resource_limits	max_samples	LENGTH_UNLIMITED
	max_instances	LENGTH_UNLIMITED
	max_samples_per_instance	LENGTH_UNLIMITED
transport_priority	value	0
lifespan	duration	DURATION_INFINITE
user_data	value.length	0
ownership	kind	SHARED_OWNERSHIP_QOS
ownership_strength	value	0
writer_data_lifecycle	autodispose_ unregistered_instances	TRUE

DomainParticipantFactoryQos

Synopsis

```
#include <ccpp_dds_dcps.h>
struct DomainParticipantFactoryQos
         { EntityFactoryQosPolicy entity_factory; };
```

Description

This struct provides the basic mechanism for an application to specify Quality of Service attributes for a `DomainParticipantFactory`.

Attributes

`EntityFactoryQosPolicy entity_factory` - whether a just created `DomainParticipant` should be enabled. See Section 3.1.3.5 on page 51 for more detailed information about these settings.

Detailed Description

The QosPolicy cannot be set at creation time, since the DomainParticipantFactory is a pre-existing object that can only be obtained with the DomainParticipantFactory::get_instance operation or its alias TheParticipantFactory. Therefore its QosPolicy is initialized to a default value according to the following table:

Table 19 Default values for DomainParticipantFactoryQos

QosPolicy	Attribute	Value
entity_factory	autoenable_created_entities	TRUE

After creation the QosPolicy can be modified with the set_qos operation on the DomainParticipantFactory, which takes the DomainParticipantFactoryQos struct as a parameter.

DomainParticipantQos

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
struct DomainParticipantQos
       { UserDataQosPolicy          user_data;
         EntityFactoryQosPolicy     entity_factory;
         SchedulingQosPolicy        watchdog_scheduling;
         SchedulingQosPolicy        listener_scheduling; };
```

Description

This struct provides the basic mechanism for an application to specify Quality of Service attributes for a DomainParticipant.

Attributes

UserDataQosPolicy user_data - used to attach additional information to the DomainParticipant. See Section 3.1.3.22 on page 82 for more detailed information about these settings.

EntityFactoryQosPolicy entity_factory - whether a just created Entity should be enabled. See Section 3.1.3.5 on page 51 for more detailed information about these settings.

SchedulingQosPolicy watchdog_scheduling - the scheduling parameters used to create the watchdog thread. See Section 3.1.3.18 on page 77 for more detailed information about these settings.

SchedulingQosPolicy listener_scheduling - the scheduling parameters used to create the listener thread. See Section 3.1.3.18 on page 77 for more detailed information about these settings.

Detailed Description

A DomainParticipant will spawn different threads for different purposes:

- A listener thread is spawned to perform the callbacks to all Listener objects attached to the various Entities contained in the DomainParticipant. The scheduling parameters for this thread can be specified in the listener_scheduling field of the DomainParticipantQos.
- A watchdog thread is spawned to report the the Liveliness of all Entities contained in the DomainParticipant whose LivelinessQosPolicyKind in their LivelinessQosPolicy is set to AUTOMATIC_LIVELINESS_QOS. The scheduling parameters for this thread can be specified in the watchdog_scheduling field of the DomainParticipantQos.

A QosPolicy can be set when the DomainParticipant is created with the create_participant operation (or modified with the set_qos operation). Both operations take the DomainParticipantQos struct as a parameter. There may be cases where several policies are in conflict. Consistency checking is performed each time the policies are modified when they are being created and, in case they are already enabled, via the set_qos operation.

Some QosPolicy have “immutable” semantics meaning that they can only be specified either at DomainParticipant creation time or prior to calling the enable operation on the DomainParticipant.

The initial value of the default DomainParticipantQos in the DomainParticipantFactory are given in the following table:

Table 20 PARTICIPANT_QOS_DEFAULT

QosPolicy	Field	Value
user_data	value.length	0
entity_factory	autoenable_created_entities	True
watchdog_scheduling	scheduling_class.kind	SCHEDULE_DEFAULT
	scheduling_priority_kind.kind	PRIORITY_RELATIVE
	scheduling_priority	0

Table 20 PARTICIPANT_QOS_DEFAULT

QosPolicy	Field	Value
listener_scheduling	scheduling_class.kind	SCHEDULE_DEFAULT
	scheduling_priority_kind.kind	PRIORITY_RELATIVE
	scheduling_priority	0

PublisherQos

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
struct PublisherQos
       { PresentationQosPolicy    presentation;
         PartitionQosPolicy       partition;
         GroupDataQosPolicy       group_data;
         EntityFactoryQosPolicy   entity_factory; };
```

Description

This struct provides the basic mechanism for an application to specify Quality of Service attributes for a `Publisher`.

Attributes

`PresentationQosPolicy presentation` - the dependency of changes to data-instances. See Section 3.1.3.14 on page 64 for more detailed information about these settings.

`PartitionQosPolicy partition` - the partitions in which the `Publisher` is active. See Section 3.1.3.13 on page 63 for more detailed information about these settings.

`GroupDataQosPolicy group_data` - used to attach additional information to the `Publisher`. See Section 3.1.3.6 on page 52 for more detailed information about these settings.

`EntityFactoryQosPolicy entity_factory` - whether a just created `DataWriter` should be enabled. See Section 3.1.3.5 on page 51 for more detailed information about these settings.

Detailed Description

A QosPolicy can be set when the Publisher is created with the create_publisher operation (or modified with the set_qos operation). Both operations take the PublisherQos struct as a parameter. There may be cases where several policies are in conflict. Consistency checking is performed each time the policies are modified when they are being created and, in case they are already enabled, via the set_qos operation.

Some QosPolicy have "immutable" semantics meaning that they can only be specified either at Publisher creation time or prior to calling the enable operation on the Publisher.

The initial value of the default PublisherQos in the DomainParticipant are given in the following table:

Table 21 PUBLISHER_QOS_DEFAULT

QosPolicy	Field	Value
presentation	access_scope	INSTANCE_PRESENTATION_QOS
	coherent_access	FALSE
	ordered_access	FALSE
partition	name.length	0
group_data	value.length	0
entity_factory	autoenable_created_entities	TRUE

SubscriberQos

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
struct SubscriberQos
       { PresentationQosPolicy        presentation;
         PartitionQosPolicy           partition;
         GroupDataQosPolicy           group_data;
         EntityFactoryQosPolicy       entity_factory;
          ShareQosPolicy                  share; };
```

Description

This struct provides the basic mechanism for an application to specify Quality of Service attributes for a Subscriber.

Attributes

PresentationQosPolicy presentation - the dependency of changes to data-instances. See Section 3.1.3.14 on page 64 for more detailed information about these settings.

PartitionQosPolicy partition - the partitions in which the Subscriber is active. See Section 3.1.3.13 on page 63 for more detailed information about these settings.

GroupDataQosPolicy group_data - used to attach additional information to the Subscriber. See Section 3.1.3.6 on page 52 for more detailed information about these settings.

EntityFactoryQosPolicy entity_factory - whether a just created DataReader should be enabled. See Section 3.1.3.5 on page 51 for more detailed information about these settings.

ShareQosPolicy share - Used to share a Subscriber between multiple processes. See Section 3.1.3.26 on page 86 for more detailed information about these settings.

Detailed Description

A QosPolicy can be set when the Subscriber is created with the create_subscriber operation (or modified with the set_qos operation). Both operations take the SubscriberQos struct as a parameter. There may be cases where several policies are in conflict. Consistency checking is performed each time the policies are modified when they are being created and, in case they are already enabled, via the set_qos operation.

Some QosPolicy have "immutable" semantics meaning that they can only be specified either at Subscriber creation time or prior to calling the enable operation on the Subscriber.

The initial value of the default SubscriberQos in the DomainParticipant are given in the following table:

Table 22 SUBSCRIBER_QOS_DEFAULT

QosPolicy	Field	Value
presentation	access_scope	INSTANCE_PRESENTATION_QOS
	coherent_access	FALSE
	ordered_access	FALSE
partition	name.length	0
group_data	value.length	0

Table 22 SUBSCRIBER_QOS_DEFAULT

QosPolicy	Field	Value
entity_factory	autoenable_ created_entities	TRUE
share	name	NULL
	enable	FALSE

TopicQos

Scope

DDS

Synopsis

```
#include <ccpp_dds_dcps.h>
struct TopicQos
       { TopicDataQosPolicy           topic_data;
         DurabilityQosPolicy          durability;
         DurabilityServiceQosPolicy   durability_service;
          DeadlineQosPolicy            deadline;
         LatencyBudgetQosPolicy       latency_budget;
         LivelinessQosPolicy          liveliness;
         ReliabilityQosPolicy         reliability;
         DestinationOrderQosPolicy    destination_order;
         HistoryQosPolicy             history;
         ResourceLimitsQosPolicy      resource_limits;
         TransportPriorityQosPolicy   transport_priority;
         LifespanQosPolicy            lifespan;
         OwnershipQosPolicy           ownership; };
```

Description

This struct provides the basic mechanism for an application to specify Quality of Service attributes for a `Topic`.

Attributes

`TopicDataQosPolicy topic_data` - used to attach additional information to the `Topic`. See Section 3.1.3.20 on page 80 for more detailed information about these settings.

`DurabilityQosPolicy durability` - whether the data should be stored for late joining readers. See Section 3.1.3.3 on page 46 for more detailed information about these settings.

DurabilityServiceQosPolicy durability_service - the behaviour of the "transinet/persistent service" of the Data Distribution System regarding Transient and Persistent `Topic` instances. See Section 3.1.3.4 on page 49 for more detailed information about these settings.

DeadlineQosPolicy deadline - the period within which a new sample is expected or written. See Section 3.1.3.1 on page 42 for more detailed information about these settings.

LatencyBudgetQosPolicy latency_budget - used by the Data Distribution Service for optimization. See Section 3.1.3.8 on page 55 for more detailed information about these settings.

LivelinessQosPolicy liveliness - the way the liveliness of the `Topic` is asserted to the Data Distribution Service. See Section 3.1.3.10 on page 58 for more detailed information about these settings.

ReliabilityQosPolicy reliability - the reliability of the data distribution. See Section 3.1.3.16 on page 74 for more detailed information about these settings.

DestinationOrderQosPolicy destination_order - the order in which the `DataReader` timely orders the data. See Section 3.1.3.2 on page 44 for more detailed information about these settings.

HistoryQosPolicy history - how samples should be stored. See Section 3.1.3.7 on page 53 for more detailed information about these settings.

ResourceLimitsQosPolicy resource_limits - the maximum amount of resources to be used. See Section 3.1.3.17 on page 76 for more detailed information about these settings.

TransportPriorityQosPolicy transport_priority - a priority hint for the underlying transport layer. See Section 3.1.3.21 on page 81 for more detailed information about these settings.

LifespanQosPolicy lifespan - the maximum duration of validity of the data written by a `DataWriter`. See Section 3.1.3.9 on page 57 for more detailed information about these settings.

OwnershipQosPolicy ownership - whether a `DataWriter` exclusively owns an instance. See Section 3.1.3.11 on page 60 for more detailed information about these settings.

Detailed Description

A `QosPolicy` can be set when the `Topic` is created with the `create_topic` operation (or modified with the `set_qos` operation). Both operations take the `TopicQos` struct as a parameter. There may be cases where several policies are in

conflict. Consistency checking is performed each time the policies are modified when they are being created and, in case they are already enabled, via the `set_qos` operation.

Some `QosPolicy` have "immutable" semantics meaning that they can only be specified either at `Topic` creation time or prior to calling the enable operation on the `Topic`.

The initial value of the default `TopicQos` in the `DomainParticipant` are given in the following table:

Table 23 TOPIC_QOS_DEFAULT

QosPolicy	Field	Value
topic_data	value.length	0
durability	kind	VOLATILE_DURABILITY_QOS
durability_service	service_cleanup_delay	0
	history_kind	KEEP_LAST_HISTORY_QOS
	history_depth	1
	max_samples	LENGTH_UNLIMITED
	max_instances	LENGTH_UNLIMITED
	max_samples_per_instance	LENGTH_UNLIMITED
deadline	period	DURATION_INFINITE
latency_budget	duration	0
liveliness	kind	AUTOMATIC_LIVELINESS_QOS
	lease_duration	DURATION_INFINITE
reliability	kind	BEST_EFFORT_RELIABILITY_QOS
	max_blocking_time	100 ms
	synchronous	FALSE
destination_order	kind	BY_RECEPTION_TIMESTAMP_ DESTINATIONORDER_QOS
history	kind	KEEP_LAST_HISTORY_QOS
	depth	1
resource_limits	max_samples	LENGTH_UNLIMITED
	max_instances	LENGTH_UNLIMITED
	max_samples_per_instance	LENGTH_UNLIMITED
transport_priority	value	0
lifespan	duration	DURATION_INFINITE
ownership	kind	SHARED_OWNERSHIP_QOS

Appendix

B API Constants and Types

These constants and types are taken from the `ccpp_dds_dcps.h` include file.

```
/* ----------------------------------------------------------
 * Duration and Time
 * ----------------------------------------------------------*/
  struct Duration_t
  {
    Long sec;
    ULong nanosec;
  };

  const Long DURATION_INFINITE_SEC      = (Long)2147483647;
  const ULong DURATION_INFINITE_NSEC    = (ULong)2147483647UL;
  const Long DURATION_ZERO_SEC          = (Long)0;
  const ULong DURATION_ZERO_NSEC        = (ULong)0UL;

  const ::DDS::Duration_t DURATION_INFINITE =
    { DURATION_INFINITE_SEC, DURATION_INFINITE_NSEC };
  const ::DDS::Duration_t DURATION_ZERO =
    {0L,0U};

  struct Time_t
   {
     Long sec;
     ULong nanosec;
   };


/* ----------------------------------------------------------
 * Pre-defined values
 * ---------------------------------------------- */
  const LongLong HANDLE_NIL             = (LongLong)0x0;
  const Long LENGTH_UNLIMITED           = (Long)-1;
  const Long TIMESTAMP_INVALID_SEC      = (Long)-1;
  const ULong TIMESTAMP_INVALID_NSEC    = (ULong)4294967295UL;

/*
------------------------------------------------------------------
 * Return Codes
 *
------------------------------------------------------------------
*/
  const Long RETCODE_OK                     = (Long)0;
```

```
  const Long RETCODE_ERROR                  = (Long)1;
  const Long RETCODE_UNSUPPORTED            = (Long)2;
  const Long RETCODE_BAD_PARAMETER          = (Long)3;
  const Long RETCODE_PRECONDITION_NOT_MET   = (Long)4;
  const Long RETCODE_OUT_OF_RESOURCES       = (Long)5;
  const Long RETCODE_NOT_ENABLED            = (Long)6;
  const Long RETCODE_IMMUTABLE_POLICY       = (Long)7;
  const Long RETCODE_INCONSISTENT_POLICY    = (Long)8;
  const Long RETCODE_ALREADY_DELETED        = (Long)9;
  const Long RETCODE_TIMEOUT                = (Long)10;
  const Long RETCODE_NO_DATA                = (Long)11;
  const Long RETCODE_ILLEGAL_OPERATION      = (Long)12;



/*
------------------------------------------------------------------
 * Status to support listeners and conditions
 *
------------------------------------------------------------------
*/
  const ULong INCONSISTENT_TOPIC_STATUS           = (ULong)1UL;
  const ULong OFFERED_DEADLINE_MISSED_STATUS      = (ULong)2UL;
  const ULong REQUESTED_DEADLINE_MISSED_STATUS    = (ULong)4UL;
  const ULong OFFERED_INCOMPATIBLE_QOS_STATUS     = (ULong)32UL;
  const ULong REQUESTED_INCOMPATIBLE_QOS_STATUS   = (ULong)64UL;
  const ULong SAMPLE_LOST_STATUS                  = (ULong)128UL;
  const ULong SAMPLE_REJECTED_STATUS              = (ULong)256UL;
  const ULong DATA_ON_READERS_STATUS              = (ULong)512UL;
  const ULong DATA_AVAILABLE_STATUS               = (ULong)1024UL;
  const ULong LIVELINESS_LOST_STATUS              = (ULong)2048UL;
  const ULong LIVELINESS_CHANGED_STATUS           = (ULong)4096UL;
  const ULong PUBLICATION_MATCHED_STATUS          = (ULong)8192UL;
  const ULong SUBSCRIPTION_MATCHED_STATUS         = (ULong)16384UL;
  const ULong ALL_DATA_DISPOSED_TOPIC_STATUS   = (ULong)2147483648UL;

/* Note: ANY_STATUS is deprecated, please use spec version
 * specific constants.
*/
  const ::DDS::StatusKind ANY_STATUS                  = 0x7FE7;
/* STATUS_MASK_ANY_V1_2 is all standardised status bits
 * as of V1.2 of the specification.
*/
  const ::DDS::StatusKind STATUS_MASK_ANY_V1_2        = 0x7FE7;
  const ::DDS::StatusKind STATUS_MASK_NONE            = 0x0;

/* ---------------------------------------------- * States
 * ------------------------------------------------------ */
/*
 * Sample states to support reads
```

```
 */
  const ULong READ_SAMPLE_STATE         = (ULong)1UL;
  const ULong NOT_READ_SAMPLE_STATE     = (ULong)2UL;

/*
 * This is a bit mask SampleStateKind
 */
  const ULong ANY_SAMPLE_STATE          = (ULong)65535UL;

/*
 * View states to support reads
 */
  const ULong NEW_VIEW_STATE            = (ULong)1UL;
  const ULong NOT_NEW_VIEW_STATE        = (ULong)2UL;

/*
 * This is a bit mask ViewStateKind
 */
  const ULong ANY_SAMPLE_STATE          = (ULong)65535UL;

/*
 * Instance states to support reads
 */
  const ULong ALIVE_INSTANCE_STATE                = (ULong)1UL;
  const ULong NOT_ALIVE_DISPOSED_INSTANCE_STATE   = (ULong)2UL;
  const ULong NOT_ALIVE_NO_WRITERS_INSTANCE_STATE = (ULong)4UL;

/*
 * This is a bit mask InstanceStateKind
 */
  const ULong ANY_INSTANCE_STATE                  = (ULong)65535UL;
  const ULong NOT_ALIVE_INSTANCE_STATE            = (ULong)6UL;


/* ---------------------------------------------------
 * Participant Factory define
 * --------------------------------------------------- */
 #define TheParticipantFactory
    (::DDS::DomainParticipantFactory::get_instance())


/* ---------------------------------------------------
 * Qos defines
 * --------------------------------------------------- */
#define TheParticipantFactory
    (::DDS::DomainParticipantFactory::get_instance())
#define PARTICIPANT_QOS_DEFAULT
    (*::DDS::DomainParticipantFactory::participant_qos_default())
#define TOPIC_QOS_DEFAULT
```

```
    (*::DDS::DomainParticipantFactory::topic_qos_default())
#define PUBLISHER_QOS_DEFAULT
    (*::DDS::DomainParticipantFactory::publisher_qos_default())
#define SUBSCRIBER_QOS_DEFAULT
    (*::DDS::DomainParticipantFactory::subscriber_qos_default())
#define DATAREADER_QOS_DEFAULT
    (*::DDS::DomainParticipantFactory::datareader_qos_default())
#define DATAREADER_QOS_USE_TOPIC_QOS
   (*::DDS::DomainParticipantFactory::datareader_qos_use_topic_qos())
#define DATAWRITER_QOS_DEFAULT
    (*::DDS::DomainParticipantFactory::datawriter_qos_default())
#define DATAWRITER_QOS_USE_TOPIC_QOS
   (*::DDS::DomainParticipantFactory::datawriter_qos_use_topic_qos())


/* ------------------------------------------------------
 * QosPolicy
 * ------------------------------------------------- */
  const String USERDATA_QOS_POLICY_NAME               =
    (String)"UserData";
  const String DURABILITY_QOS_POLICY_NAME             =
    (String)"Durability";
  const String PRESENTATION_QOS_POLICY_NAME           =
    (String)"Presentation";
  const String DEADLINE_QOS_POLICY_NAME               =
    (String)"Deadline";
  const String LATENCYBUDGET_QOS_POLICY_NAME          =
    (String)"LatencyBudget";
  const String OWNERSHIP_QOS_POLICY_NAME              =
    (String)"Ownership";
  const String OWNERSHIPSTRENGTH_QOS_POLICY_NAME      =
    (String)"OwnershipStrength";
  const String LIVELINESS_QOS_POLICY_NAME             =
    (String)"Liveliness";
  const String TIMEBASEDFILTER_QOS_POLICY_NAME        =
     String)"TimeBasedFilter";
  const String PARTITION_QOS_POLICY_NAME              =
    (String)"Partition";
  const String RELIABILITY_QOS_POLICY_NAME            =
    (String)"Reliability";
  const String DESTINATIONORDER_QOS_POLICY_NAME       =
    (String)"DestinationOrder";
  const String HISTORY_QOS_POLICY_NAME                =
    (String)"History";
  const String RESOURCELIMITS_QOS_POLICY_NAME         =
    (String)"ResourceLimits";
  const String ENTITYFACTORY_QOS_POLICY_NAME          =
    (String)"EntityFactory";
  const String WRITERDATALIFECYCLE_QOS_POLICY_NAME    =
    (String)"WriterDataLifecycle";
```

```
const String READERDATALIFECYCLE_QOS_POLICY_NAME    =
  (String)"ReaderDataLifecycle";
const String TOPICDATA_QOS_POLICY_NAME              =
  (String)"TopicData";
const String GROUPDATA_QOS_POLICY_NAME              =
  (String)"GroupData";
const String TRANSPORTPRIORITY_QOS_POLICY_NAME      =
  (String)"TransportPriority";
const String LIFESPAN_QOS_POLICY_NAME               =
  (String)"Lifespan";
const String DURABILITYSERVICE_QOS_POLICY_NAME      =
  (String)"DurabilityService";


const Long INVALID_QOS_POLICY_ID                = (Long)0;
const Long USERDATA_QOS_POLICY_ID               = (Long)1;
const Long DURABILITY_QOS_POLICY_ID             = (Long)2;
const Long PRESENTATION_QOS_POLICY_ID           = (Long)3;
const Long DEADLINE_QOS_POLICY_ID               = (Long)4;
const Long LATENCYBUDGET_QOS_POLICY_ID          = (Long)5;
const Long OWNERSHIP_QOS_POLICY_ID              = (Long)6;
const Long OWNERSHIPSTRENGTH_QOS_POLICY_ID      = (Long)7;
const Long LIVELINESS_QOS_POLICY_ID             = (Long)8;
const Long TIMEBASEDFILTER_QOS_POLICY_ID        = (Long)9;
const Long PARTITION_QOS_POLICY_ID              = (Long)10;
const Long RELIABILITY_QOS_POLICY_ID            = (Long)11;
const Long DESTINATIONORDER_QOS_POLICY_ID       = (Long)12;
const Long HISTORY_QOS_POLICY_ID                = (Long)13;
const Long RESOURCELIMITS_QOS_POLICY_ID         = (Long)14;
const Long ENTITYFACTORY_QOS_POLICY_ID          = (Long)15;
const Long WRITERDATALIFECYCLE_QOS_POLICY_ID    = (Long)16;
const Long READERDATALIFECYCLE_QOS_POLICY_ID    = (Long)17;
const Long TOPICDATA_QOS_POLICY_ID              = (Long)18;
const Long GROUPDATA_QOS_POLICY_ID              = (Long)19;
const Long TRANSPORTPRIORITY_QOS_POLICY_ID      = (Long)20;
const Long LIFESPAN_QOS_POLICY_ID               = (Long)21;
const Long DURABILITYSERVICE_QOS_POLICY_ID      = (Long)22;
```

Appendix

C Platform Specific Model IDL Interface

The IDL code in the next paragraphs are taken from the *OMG C++ Language Mapping Specification*.

dds_dcps.idl

```
#define DOMAINID_TYPE_NATIVE long
#define HANDLE_TYPE_NATIVE long long
#define HANDLE_NIL_NATIVE 0
#define BUILTIN_TOPIC_KEY_TYPE_NATIVE long
#define TheParticipantFactory
#define PARTICIPANT_QOS_DEFAULT
#define TOPIC_QOS_DEFAULT
#define PUBLISHER_QOS_DEFAULT
#define SUBSCRIBER_QOS_DEFAULT
#define DATAWRITER_QOS_DEFAULT
#define DATAREADER_QOS_DEFAULT
#define DATAWRITER_QOS_USE_TOPIC_QOS
#define DATAREADER_QOS_USE_TOPIC_QOS
module DDS {
    typedef DOMAINID_TYPE_NATIVE DomainId_t;
    typedef HANDLE_TYPE_NATIVE InstanceHandle_t;
    typedef BUILTIN_TOPIC_KEY_TYPE_NATIVE BuiltinTopicKey_t[3];
    typedef sequence<InstanceHandle_t> InstanceHandleSeq;
    typedef long ReturnCode_t;
    typedef long QosPolicyId_t;
    typedef sequence<string> StringSeq;
    struct Duration_t {
   long sec;
   unsigned long nanosec;
    };
    struct Time_t {
   long sec;
   unsigned long nanosec;
    };
    //
    // Pre-defined values
    //
    const InstanceHandle_t HANDLE_NIL = HANDLE_NIL_NATIVE;
    const long LENGTH_UNLIMITED = -1;
    const long DURATION_INFINITE_SEC = 0x7fffffff;
```

```
const unsigned long DURATION_INFINITE_NSEC= 0x7fffffff;
const long DURATION_ZERO_SEC= 0;
const unsigned long DURATION_ZERO_NSEC= 0;
const long TIMESTAMP_INVALID_SEC= -1;
const unsigned long TIMESTAMP_INVALID_NSEC= 0xffffffff;
const DomainId_t DOMAIN_ID_DEFAULT= 0x7fffffff;
//
// Return codes
//
const ReturnCode_t RETCODE_OK                     = 0;
const ReturnCode_t RETCODE_ERROR                  = 1;
const ReturnCode_t RETCODE_UNSUPPORTED            = 2;
const ReturnCode_t RETCODE_BAD_PARAMETER          = 3;
const ReturnCode_t RETCODE_PRECONDITION_NOT_MET   = 4;
const ReturnCode_t RETCODE_OUT_OF_RESOURCES       = 5;
const ReturnCode_t RETCODE_NOT_ENABLED            = 6;
const ReturnCode_t RETCODE_IMMUTABLE_POLICY       = 7;
const ReturnCode_t RETCODE_INCONSISTENT_POLICY    = 8;
const ReturnCode_t RETCODE_ALREADY_DELETED        = 9;
const ReturnCode_t RETCODE_TIMEOUT                = 10;
const ReturnCode_t RETCODE_NO_DATA                = 11;
const ReturnCode_t RETCODE_ILLEGAL_OPERATION      = 12;

//
// Status to support listeners and conditions
//
typedef unsigned long StatusKind;
typedef unsigned long StatusMask; // bit-mask StatusKind
const StatusKind INCONSISTENT_TOPIC_STATUS        = 0x0001 << 0;
const StatusKind OFFERED_DEADLINE_MISSED_STATUS   = 0x0001 << 1;
const StatusKind REQUESTED_DEADLINE_MISSED_STATUS = 0x0001 << 2;
const StatusKind OFFERED_INCOMPATIBLE_QOS_STATUS  = 0x0001 << 5;
const StatusKind REQUESTED_INCOMPATIBLE_QOS_STATUS= 0x0001 << 6;
const StatusKind SAMPLE_LOST_STATUS               = 0x0001 << 7;
const StatusKind SAMPLE_REJECTED_STATUS           = 0x0001 << 8;
const StatusKind DATA_ON_READERS_STATUS           = 0x0001 << 9;
const StatusKind DATA_AVAILABLE_STATUS            = 0x0001 << 10;
const StatusKind LIVELINESS_LOST_STATUS           = 0x0001 << 11;
const StatusKind LIVELINESS_CHANGED_STATUS        = 0x0001 << 12;
const StatusKind PUBLICATION_MATCHED_STATUS       = 0x0001 << 13;
const StatusKind SUBSCRIPTION_MATCHED_STATUS      = 0x0001 << 14;
const StatusKind ALL_DATA_DISPOSED_TOPIC_STATUS   = 0x0001 << 31;
struct InconsistentTopicStatus {
   long total_count;
   long total_count_change;
};
struct SampleLostStatus {
   long total_count;
   long total_count_change;
};
```

```
enum SampleRejectedStatusKind {
   NOT_REJECTED,
   REJECTED_BY_INSTANCE_LIMIT,
   REJECTED_BY_SAMPLES_LIMIT,
   REJECTED_BY_SAMPLES_PER_INSTANCE_LIMIT
};
struct SampleRejectedStatus {
   long total_count;
   long total_count_change;
   SampleRejectedStatusKind last_reason;
   InstanceHandle_t last_instance_handle;
};
struct LivelinessLostStatus {
   long total_count;
   long total_count_change;
};
struct LivelinessChangedStatus {
   long alive_count;
   long not_alive_count;
   long alive_count_change;
   long not_alive_count_change;
   InstanceHandle_t last_publication_handle;
};
struct OfferedDeadlineMissedStatus {
   long total_count;
   long total_count_change;
   InstanceHandle_t last_instance_handle;
};
struct RequestedDeadlineMissedStatus {
   long total_count;
   long total_count_change;
   InstanceHandle_t last_instance_handle;
};
struct QosPolicyCount {
   QosPolicyId_t policy_id;
   long count;
};
typedef sequence<QosPolicyCount> QosPolicyCountSeq;
struct OfferedIncompatibleQosStatus {
   long total_count;
   long total_count_change;
   QosPolicyId_t last_policy_id;
   QosPolicyCountSeq policies;
};
struct RequestedIncompatibleQosStatus {
   long total_count;
   long total_count_change;
   QosPolicyId_t last_policy_id;
   QosPolicyCountSeq policies;
};
```

```
struct PublicationMatchedStatus {
   long total_count;
   long total_count_change;
   long current_count;
   long current_count_change;
   InstanceHandle_t last_subscription_handle;
};
struct SubscriptionMatchedStatus {
   long total_count;
   long total_count_change;
   long current_count;
   long current_count_change;
   InstanceHandle_t last_publication_handle;
};
struct AllDataDisposedTopicStatus {
   long total_count;
   long total_count_change;
};
//
// Listeners
//
interface Listener;
interface Entity;
interface TopicDescription;
interface Topic;
interface ContentFilteredTopic;
interface MultiTopic;
interface DataWriter;
interface DataReader;
interface Subscriber;
interface Publisher;
typedef sequence<Topic> TopicSeq;
typedef sequence<DataReader> DataReaderSeq;
interface Listener {
};
interface TopicListener : Listener {
void
   on_inconsistent_topic(
       in Topic the_topic,
       in InconsistentTopicStatus status);
};
interface ExtTopicListener : TopicListener {
void
  on_all_data_disposed(in Topic the_topic);
};
interface DataWriterListener : Listener {
void
   on_offered_deadline_missed(
       in DataWriter writer,
       in OfferedDeadlineMissedStatus status);
```

```
void
    on_offered_incompatible_qos(
        in DataWriter writer,
        in OfferedIncompatibleQosStatus status);
void
    on_liveliness_lost(
        in DataWriter writer,
        in LivelinessLostStatus status);
void
    on_publication_matched(
        in DataWriter writer,
        in PublicationMatchedStatus status);
 };
 interface PublisherListener : DataWriterListener {
 };
 interface DataReaderListener : Listener {
void
    on_requested_deadline_missed(
        in DataReader reader,
        in RequestedDeadlineMissedStatus status);
void
    on_requested_incompatible_qos(
        in DataReader reader,
        in RequestedIncompatibleQosStatus status);
void
    on_sample_rejected(
        in DataReader reader,
        in SampleRejectedStatus status);
void
    on_liveliness_changed(
        in DataReader reader,
        in LivelinessChangedStatus status);
void
    on_data_available(
        in DataReader reader);
void
    on_subscription_matched(
        in DataReader reader,
        in SubscriptionMatchedStatus status);
void
    on_sample_lost(
        in DataReader reader,
        in SampleLostStatus status);
 };
 interface SubscriberListener : DataReaderListener {
void
    on_data_on_readers(
        in Subscriber subs);
 };
 interface DomainParticipantListener : TopicListener,
```

```
                        PublisherListener,
                        SubscriberListener {
 };
 interface ExtDomainParticipantListener :
                       DomainParticipantListener,
                       ExtTopicListener {
 };
 //
 // Conditions
 //
 interface Condition {
boolean
get_trigger_value();
 };
 typedef sequence<Condition> ConditionSeq;
 interface WaitSet {
ReturnCode_t
wait(
    inout ConditionSeq active_conditions,
    in Duration_t timeout);
ReturnCode_t
attach_condition(
    in Condition cond);
ReturnCode_t
detach_condition(
    in Condition cond);
ReturnCode_t
get_conditions(
    inout ConditionSeq attached_conditions);
 };
 interface GuardCondition : Condition {
ReturnCode_t
set_trigger_value(
    in boolean value);
 };
 interface StatusCondition : Condition {
StatusMask
get_enabled_statuses();
ReturnCode_t
set_enabled_statuses(
    in StatusMask mask);
Entity
get_entity();
 };
 // Sample states to support reads
 typedef unsigned long SampleStateKind;
 typedef sequence <SampleStateKind> SampleStateSeq;
 const SampleStateKind READ_SAMPLE_STATE = 0x0001 << 0;
 const SampleStateKind NOT_READ_SAMPLE_STATE = 0x0001 << 1;
 // This is a bit-mask SampleStateKind
```

```
 typedef unsigned long SampleStateMask;
 const SampleStateMask ANY_SAMPLE_STATE = 0xffff;
 // View states to support reads
 typedef unsigned long ViewStateKind;
 typedef sequence<ViewStateKind> ViewStateSeq;
 const ViewStateKind NEW_VIEW_STATE = 0x0001 << 0;
 const ViewStateKind NOT_NEW_VIEW_STATE = 0x0001 << 1;
 // This is a bit-mask ViewStateKind
 typedef unsigned long ViewStateMask;
 const ViewStateMask ANY_VIEW_STATE = 0xffff;
 // Instance states to support reads
 typedef unsigned long InstanceStateKind;
 typedef sequence<InstanceStateKind> InstanceStateSeq;
 const InstanceStateKind ALIVE_INSTANCE_STATE = 0x0001 << 0;
const InstanceStateKind NOT_ALIVE_DISPOSED_INSTANCE_STATE = 0x0001
        << 1;
 const InstanceStateKind NOT_ALIVE_NO_WRITERS_INSTANCE_STATE =
        0x0001 << 2;
 // This is a bit-mask InstanceStateKind
 typedef unsigned long InstanceStateMask;
 const InstanceStateMask ANY_INSTANCE_STATE = 0xffff;
 const InstanceStateMask NOT_ALIVE_INSTANCE_STATE = 0x006;
 interface ReadCondition : Condition {
SampleStateMask
get_sample_state_mask();
ViewStateMask
get_view_state_mask();
InstanceStateMask
get_instance_state_mask();
DataReader
get_datareader();
 };
 interface QueryCondition : ReadCondition {
string
get_query_expression();
ReturnCode_t
get_query_parameters(
    inout StringSeq query_parameters);
ReturnCode_t
set_query_parameters(
    in StringSeq query_parameters);
 };
 //
 // Qos
 //
 const string USERDATA_QOS_POLICY_NAME         = "UserData";
 const string DURABILITY_QOS_POLICY_NAME       = "Durability";
 const string PRESENTATION_QOS_POLICY_NAME     = "Presentation";
 const string DEADLINE_QOS_POLICY_NAME         = "Deadline";
 const string LATENCYBUDGET_QOS_POLICY_NAME    = "LatencyBudget";
```

```
const string OWNERSHIP_QOS_POLICY_NAME        = "Ownership";
const string OWNERSHIPSTRENGTH_QOS_POLICY_NAME=
       "OwnershipStrength";
const string LIVELINESS_QOS_POLICY_NAME       = "Liveliness";
const string TIMEBASEDFILTER_QOS_POLICY_NAME= "TimeBasedFilter";
const string PARTITION_QOS_POLICY_NAME        = "Partition";
const string RELIABILITY_QOS_POLICY_NAME      = "Reliability";
const string DESTINATIONORDER_QOS_POLICY_NAME =
       "DestinationOrder";
const string HISTORY_QOS_POLICY_NAME          = "History";
const string RESOURCELIMITS_QOS_POLICY_NAME= "ResourceLimits";
const string ENTITYFACTORY_QOS_POLICY_NAME    = "EntityFactory";
const string WRITERDATALIFECYCLE_QOS_POLICY_NAM=
       "WriterDataLifecycle";
const string READERDATALIFECYCLE_QOS_POLICY_NAM=
       "ReaderDataLifecycle";
const string TOPICDATA_QOS_POLICY_NAME        = "TopicData";
const string GROUPDATA_QOS_POLICY_NAME        = "GroupData";
const string TRANSPORTPRIORITY_QOS_POLICY_NAME=
       "TransportPriority";
const string LIFESPAN_QOS_POLICY_NAME         = "Lifespan";
const string DURABILITYSERVICE_QOS_POLICY_NAME=
       "DurabilityService";
const QosPolicyId_t INVALID_QOS_POLICY_ID           = 0;
const QosPolicyId_t USERDATA_QOS_POLICY_ID          = 1;
const QosPolicyId_t DURABILITY_QOS_POLICY_ID        = 2;
const QosPolicyId_t PRESENTATION_QOS_POLICY_ID      = 3;
const QosPolicyId_t DEADLINE_QOS_POLICY_ID          = 4;
const QosPolicyId_t LATENCYBUDGET_QOS_POLICY_ID     = 5;
const QosPolicyId_t OWNERSHIP_QOS_POLICY_ID         = 6;
const QosPolicyId_t OWNERSHIPSTRENGTH_QOS_POLICY_ID = 7;
const QosPolicyId_t LIVELINESS_QOS_POLICY_ID        = 8;
const QosPolicyId_t TIMEBASEDFILTER_QOS_POLICY_ID   = 9;
const QosPolicyId_t PARTITION_QOS_POLICY_ID         = 10;
const QosPolicyId_t RELIABILITY_QOS_POLICY_ID       = 11;
const QosPolicyId_t DESTINATIONORDER_QOS_POLICY_ID  = 12;
const QosPolicyId_t HISTORY_QOS_POLICY_ID           = 13;
const QosPolicyId_t RESOURCELIMITS_QOS_POLICY_ID    = 14;
const QosPolicyId_t ENTITYFACTORY_QOS_POLICY_ID     = 15;
const QosPolicyId_t WRITERDATALIFECYCLE_QOS_POLICY_ID= 16;
const QosPolicyId_t READERDATALIFECYCLE_QOS_POLICY_ID= 17;
const QosPolicyId_t TOPICDATA_QOS_POLICY_ID         = 18;
const QosPolicyId_t GROUPDATA_QOS_POLICY_ID         = 19;
const QosPolicyId_t TRANSPORTPRIORITY_QOS_POLICY_ID = 20;
const QosPolicyId_t LIFESPAN_QOS_POLICY_ID          = 21;
const QosPolicyId_t DURABILITYSERVICE_QOS_POLICY_ID = 22;
struct UserDataQosPolicy {
sequence<octet> value;
};
struct TopicDataQosPolicy {
```

```
sequence<octet> value;
 };
 struct GroupDataQosPolicy {
sequence<octet> value;
 };
 struct TransportPriorityQosPolicy {
long value;
 };
 struct LifespanQosPolicy {
Duration_t duration;
 };
 enum DurabilityQosPolicyKind {
VOLATILE_DURABILITY_QOS,
TRANSIENT_LOCAL_DURABILITY_QOS,
TRANSIENT_DURABILITY_QOS,
PERSISTENT_DURABILITY_QOS
 };
 struct DurabilityQosPolicy {
DurabilityQosPolicyKind kind;
 };
 enum PresentationQosPolicyAccessScopeKind {
INSTANCE_PRESENTATION_QOS,
TOPIC_PRESENTATION_QOS,
GROUP_PRESENTATION_QOS
 };
 struct PresentationQosPolicy {
    PresentationQosPolicyAccessScopeKind access_scope;
    boolean coherent_access;
    boolean ordered_access;
 };
 struct DeadlineQosPolicy {
    Duration_t period;
 };
 struct LatencyBudgetQosPolicy {
    Duration_t duration;
 };
 enum OwnershipQosPolicyKind {
    SHARED_OWNERSHIP_QOS,
    EXCLUSIVE_OWNERSHIP_QOS
 };
 struct OwnershipQosPolicy {
    OwnershipQosPolicyKind kind;
 };
 struct OwnershipStrengthQosPolicy {
    long value;
 };
 enum LivelinessQosPolicyKind {
    AUTOMATIC_LIVELINESS_QOS,
    MANUAL_BY_PARTICIPANT_LIVELINESS_QOS,
    MANUAL_BY_TOPIC_LIVELINESS_QOS
```

```
};
struct LivelinessQosPolicy {
   LivelinessQosPolicyKind kind;
   Duration_t lease_duration;
};
struct TimeBasedFilterQosPolicy {
   Duration_t minimum_separation;
};
struct PartitionQosPolicy {
   StringSeq name;
};
enum ReliabilityQosPolicyKind {
   BEST_EFFORT_RELIABILITY_QOS,
   RELIABLE_RELIABILITY_QOS
};
struct ReliabilityQosPolicy {
   ReliabilityQosPolicyKind kind;
   Duration_t max_blocking_time;
   boolean synchronous;
};
enum DestinationOrderQosPolicyKind {
   BY_RECEPTION_TIMESTAMP_DESTINATIONORDER_QOS,
   BY_SOURCE_TIMESTAMP_DESTINATIONORDER_QOS
};
struct DestinationOrderQosPolicy {
   DestinationOrderQosPolicyKind kind;
};
enum HistoryQosPolicyKind {
   KEEP_LAST_HISTORY_QOS,
   KEEP_ALL_HISTORY_QOS
};
struct HistoryQosPolicy {
   HistoryQosPolicyKind kind;
   long depth;
};
struct ResourceLimitsQosPolicy {
   long max_samples;
   long max_instances;
   long max_samples_per_instance;
};
struct EntityFactoryQosPolicy {
   boolean autoenable_created_entities;
};
struct WriterDataLifecycleQosPolicy {
   boolean autodispose_unregistered_instances;
};
enum InvalidSampleVisibilityQosPolicyKind {
   NO_INVALID_SAMPLES,
   MINIMUM_INVALID_SAMPLES,
   ALL_INVALID_SAMPLES
```

```
};
struct InvalidSampleVisibilityQosPolicy {
  InvalidSampleVisibilityQosPolicyKind kind;
};
struct ReaderDataLifecycleQosPolicy {
  Duration_t autopurge_nowriter_samples_delay;
  Duration_t autopurge_disposed_samples_delay;
  Boolean autopurge_dispose_all;
  Boolean enable_invalid_samples; /* deprecated */
  InvalidSampleVisibilityQosPolicy invalid_sample_visibility;
};
struct DurabilityServiceQosPolicy {
    Duration_t service_cleanup_delay;
    HistoryQosPolicyKind history_kind;
    long history_depth;
    long max_samples;
    long max_instances;
    long max_samples_per_instance;
};
struct DomainParticipantFactoryQos {
    EntityFactoryQosPolicy entity_factory;
};
struct DomainParticipantQos {
  UserDataQosPolicy user_data;
  EntityFactoryQosPolicy entity_factory;
};
struct TopicQos {
  TopicDataQosPolicy topic_data;
  DurabilityQosPolicy durability;
  DurabilityServiceQosPolicy durability_service;
  DeadlineQosPolicy deadline;
  LatencyBudgetQosPolicy latency_budget;
  LivelinessQosPolicy liveliness;
  ReliabilityQosPolicy reliability;
  DestinationOrderQosPolicy destination_order;
  HistoryQosPolicy history;
  ResourceLimitsQosPolicy resource_limits;
  TransportPriorityQosPolicy transport_priority;
  LifespanQosPolicy lifespan;
  OwnershipQosPolicy ownership;
};
struct DataWriterQos {
  DurabilityQosPolicy durability;
  DeadlineQosPolicy deadline;
  LatencyBudgetQosPolicy latency_budget;
  LivelinessQosPolicy liveliness;
  ReliabilityQosPolicy reliability;
  DestinationOrderQosPolicy destination_order;
  HistoryQosPolicy history;
  ResourceLimitsQosPolicy resource_limits;
```

```
   TransportPriorityQosPolicy transport_priority;
   LifespanQosPolicy lifespan;
   UserDataQosPolicy user_data;
   OwnershipQosPolicy ownership;
   OwnershipStrengthQosPolicy ownership_strength;
   WriterDataLifecycleQosPolicy writer_data_lifecycle;
};
struct PublisherQos {
   PresentationQosPolicy presentation;
   PartitionQosPolicy partition;
   GroupDataQosPolicy group_data;
   EntityFactoryQosPolicy entity_factory;
};
struct DataReaderQos {
   DurabilityQosPolicy durability;
   DeadlineQosPolicy deadline;
   LatencyBudgetQosPolicy latency_budget;
   LivelinessQosPolicy liveliness;
   ReliabilityQosPolicy reliability;
   DestinationOrderQosPolicy destination_order;
   HistoryQosPolicy history;
   ResourceLimitsQosPolicy resource_limits;
   UserDataQosPolicy user_data;
   OwnershipQosPolicy ownership;
   TimeBasedFilterQosPolicy time_based_filter;
   ReaderDataLifecycleQosPolicy reader_data_lifecycle;
};
struct SubscriberQos {
   PresentationQosPolicy presentation;
   PartitionQosPolicy partition;
   GroupDataQosPolicy group_data;
   EntityFactoryQosPolicy entity_factory;
};
//
struct ParticipantBuiltinTopicData {
   BuiltinTopicKey_t key;
   UserDataQosPolicy user_data;
};
struct TopicBuiltinTopicData {
   BuiltinTopicKey_t key;
   string name;
   string type_name;
   DurabilityQosPolicy durability;
   DeadlineQosPolicy deadline;
   LatencyBudgetQosPolicy latency_budget;
   LivelinessQosPolicy liveliness;
   ReliabilityQosPolicy reliability;
   TransportPriorityQosPolicy transport_priority;
   LifespanQosPolicy lifespan;
   DestinationOrderQosPolicy destination_order;
```

```
    HistoryQosPolicy history;
    ResourceLimitsQosPolicy resource_limits;
    OwnershipQosPolicy ownership;
    TopicDataQosPolicy topic_data;
};
struct PublicationBuiltinTopicData {
    BuiltinTopicKey_t key;
    BuiltinTopicKey_t participant_key;
    string topic_name;
    string type_name;
    DurabilityQosPolicy durability;
    DeadlineQosPolicy deadline;
    LatencyBudgetQosPolicy latency_budget;
    LivelinessQosPolicy liveliness;
    ReliabilityQosPolicy reliability;
    LifespanQosPolicy lifespan;
    UserDataQosPolicy user_data;
    OwnershipStrengthQosPolicy ownership_strength;
    PresentationQosPolicy presentation;
    PartitionQosPolicy partition;
    TopicDataQosPolicy topic_data;
    GroupDataQosPolicy group_data;
};
struct SubscriptionBuiltinTopicData {
    BuiltinTopicKey_t key;
    BuiltinTopicKey_t participant_key;
    string topic_name;
    string type_name;
    DurabilityQosPolicy durability;
    DeadlineQosPolicy deadline;
    LatencyBudgetQosPolicy latency_budget;
    LivelinessQosPolicy liveliness;
    ReliabilityQosPolicy reliability;
    DestinationOrderQosPolicy destination_order;
    UserDataQosPolicy user_data;
    TimeBasedFilterQosPolicy time_based_filter;
    PresentationQosPolicy presentation;
    PartitionQosPolicy partition;
    TopicDataQosPolicy topic_data;
    GroupDataQosPolicy group_data;
};
//
interface Entity {
//  ReturnCode_t
//  set_qos(
//      in EntityQos qos);
//
//  ReturnCode_t
//  get_qos(
//      inout EntityQos qos);
```

```
 //
 //  ReturnCode_t
 //  set_listener(
 //      in Listener l,
 //      in StatusMask mask);
 //
 //  Listener
 //  get_listener();
ReturnCode_t
enable();
StatusCondition
get_statuscondition();
StatusMask
get_status_changes();
 };
 //
 interface DomainParticipant : Entity {
     // Factory interfaces
Publisher
create_publisher(
    in PublisherQos qos,
    in PublisherListener a_listener,
    in StatusMask mask);
ReturnCode_t
delete_publisher(
    in Publisher p);
Subscriber
create_subscriber(
    in SubscriberQos qos,
    in SubscriberListener a_listener,
    in StatusMask mask);
ReturnCode_t
delete_subscriber(
    in Subscriber s);
Subscriber
get_builtin_subscriber();
Topic
create_topic(
    in string topic_name,
    in string type_name,
    in TopicQos qos,
    in TopicListener a_listener,
    in StatusMask mask);
ReturnCode_t
delete_topic(
    in Topic a_topic);
Topic
find_topic(
    in string topic_name,
    in Duration_t timeout);
```

```
TopicDescription
lookup_topicdescription(
    in string name);
ContentFilteredTopic
create_contentfilteredtopic(
    in string name,
    in Topic related_topic,
    in string filter_expression,
    in StringSeq expression_parameters);
ReturnCode_t
delete_contentfilteredtopic(
    in ContentFilteredTopic a_contentfilteredtopic);
MultiTopic
create_multitopic(
    in string name,
    in string type_name,
    in string subscription_expression,
    in StringSeq expression_parameters);
ReturnCode_t
delete_multitopic(
    in MultiTopic a_multitopic);
ReturnCode_t
delete_contained_entities();
ReturnCode_t
set_qos(
    in DomainParticipantQos qos);
ReturnCode_t
get_qos(
    inout DomainParticipantQos qos);
ReturnCode_t
set_listener(
    in DomainParticipantListener a_listener,
    in StatusMask mask);
DomainParticipantListener
get_listener();
ReturnCode_t
ignore_participant(
    in InstanceHandle_t handle);
ReturnCode_t
ignore_topic(
    in InstanceHandle_t handle);
ReturnCode_t
ignore_publication(
    in InstanceHandle_t handle);
ReturnCode_t
ignore_subscription(
    in InstanceHandle_t handle);
DomainId_t
get_domain_id();
ReturnCode_t
```

```
assert_liveliness();
ReturnCode_t
set_default_publisher_qos(
    in PublisherQos qos);
ReturnCode_t
get_default_publisher_qos(
    inout PublisherQos qos);
ReturnCode_t
set_default_subscriber_qos(
    in SubscriberQos qos);
ReturnCode_t
get_default_subscriber_qos(
    inout SubscriberQos qos);
ReturnCode_t
set_default_topic_qos(
    in TopicQos qos);
ReturnCode_t
get_default_topic_qos(
    inout TopicQos qos);
boolean
contains_entity(
    in InstanceHandle_t a_handle);
ReturnCode_t
get_current_time(
    inout Time_t current_time);
};
interface DomainParticipantFactory {
//
//  DomainParticipantFactory
//  get_instance();
//
DomainParticipant
create_participant(
    in DomainId_t domainId,
    in DomainParticipantQos qos,
    in DomainParticipantListener a_listener,
    in StatusMask mask);
ReturnCode_t
delete_participant(
    in DomainParticipant a_participant);
DomainParticipant
lookup_participant(
    in DomainId_t domainId);
ReturnCode_t
set_default_participant_qos(
    in DomainParticipantQos qos);
ReturnCode_t
get_default_participant_qos(
    inout DomainParticipantQos qos);
```

```
ReturnCode_t
set_qos(
    in DomainParticipantFactoryQos qos);
ReturnCode_t
get_qos(
    inout DomainParticipantFactoryQos qos);
ReturnCode_t
delete_domain
   (in Domain a_domain);
Domain
lookup_domain
   (in DomainId_t domainId);
ReturnCode_t
   create_persistent_snapshot(
      in string partition_expression,
      in string topic_expression,
      in string URI);
ReturnCode_t
   delete_contained_entities();
};
interface TypeSupport {
//  ReturnCode_t
//  register_type(
//      in DomainParticipant domain,
//      in string type_name);
//
//  string
//  get_type_name();
};
//
interface TopicDescription {
string
   get_type_name();
string
   get_name();
DomainParticipant
      get_participant();
};
interface Topic : Entity, TopicDescription {
ReturnCode_t
set_qos(
    in TopicQos qos);
ReturnCode_t
   get_qos(
    inout TopicQos qos);
ReturnCode_t
   set_listener(
    in TopicListener a_listener,
    in StatusMask mask);
TopicListener_ptr
```

```
get_listener();
// Access the status
ReturnCode_t
get_inconsistent_topic_status(
    inout InconsistentTopicStatus a_status);
ReturnCode_t
get_all_data_disposed_topic_status(
   inout AllDataDisposedTopicStatus a_status);
 };
 interface ContentFilteredTopic : TopicDescription {
string
get_filter_expression();
ReturnCode_t
get_expression_parameters(
    inout StringSeq expression_parameters);
ReturnCode_t
set_expression_parameters(
    in StringSeq expression_parameters);
Topic
get_related_topic();
 };
 interface MultiTopic : TopicDescription {
string
get_subscription_expression();
ReturnCode_t
get_expression_parameters(
    inout StringSeq expression_parameters);
ReturnCode_t
set_expression_parameters(
    in StringSeq expression_parameters);
 };
 //
 interface Publisher : Entity {
DataWriter
create_datawriter(
    in Topic a_topic,
    in DataWriterQos qos,
    in DataWriterListener a_listener,
    in StatusMask mask);
ReturnCode_t
delete_datawriter(
    in DataWriter a_datawriter);
DataWriter
lookup_datawriter(
    in string topic_name);
ReturnCode_t
delete_contained_entities();
ReturnCode_t
set_qos(
    in PublisherQos qos);
```

```
ReturnCode_t
get_qos(
    inout PublisherQos qos);
ReturnCode_t
set_listener(
    in PublisherListener a_listener,
    in StatusMask mask);
PublisherListener
get_listener();
ReturnCode_t
suspend_publications();
ReturnCode_t
resume_publications();
ReturnCode_t
begin_coherent_changes();
ReturnCode_t
end_coherent_changes();
ReturnCode_t
wait_for_acknowledgments(
    in Duration_t max_wait);
DomainParticipant
get_participant();
ReturnCode_t
set_default_datawriter_qos(
    in DataWriterQos qos);
ReturnCode_t
get_default_datawriter_qos(
    inout DataWriterQos qos);
ReturnCode_t
copy_from_topic_qos(
    inout DataWriterQos a_datawriter_qos,
    in TopicQos a_topic_qos);
};
interface DataWriter : Entity {
//  InstanceHandle_t
//  register_instance(
//      in Data instance_data);
//
//  InstanceHandle_t
//  register_instance_w_timestamp(
//      in Data instance_data,
//      in Time_t source_timestamp);
//
//  ReturnCode_t
//  unregister_instance(
//      in Data instance_data,
//      in InstanceHandle_t handle);
//
//  ReturnCode_t
//  unregister_instance_w_timestamp(
```

```
//      in Data instance_data,
//      in InstanceHandle_t handle,
//      in Time_t source_timestamp);
//
//  ReturnCode_t
//  write(
//      in Data instance_data,
//      in InstanceHandle_t handle);
//
//  ReturnCode_t
//  write_w_timestamp(
//      in Data instance_data,
//      in InstanceHandle_t handle,
//      in Time_t source_timestamp);
//
//  ReturnCode_t
//  dispose(
//      in Data instance_data,
//      in InstanceHandle_t instance_handle);
//
//  ReturnCode_t
//  dispose_w_timestamp(
//      in Data instance_data,
//      in InstanceHandle_t instance_handle,
//      in Time_t source_timestamp);
//
//  ReturnCode_t
//  get_key_value(
//      inout Data key_holder,
//      in InstanceHandle_t handle);
//
//  InstanceHandle_t lookup_instance(
//      in Data instance_data);
ReturnCode_t
set_qos(
    in DataWriterQos qos);
ReturnCode_t
get_qos(
    inout DataWriterQos qos);
ReturnCode_t
set_listener(
    in DataWriterListener a_listener,
    in StatusMask mask);
DataWriterListener
get_listener();
Topic
get_topic();
Publisher
get_publisher();
ReturnCode_t
```

```
wait_for_acknowledgments(
    in Duration_t max_wait);
// Access the status
ReturnCode_t
get_liveliness_lost_status(
    inout LivelinessLostStatus status);
ReturnCode_t
get_offered_deadline_missed_status(
    inout OfferedDeadlineMissedStatus status);
ReturnCode_t
get_offered_incompatible_qos_status(
    inout OfferedIncompatibleQosStatus status);
ReturnCode_t
get_publication_matched_status(
    inout PublicationMatchedStatus status);
ReturnCode_t
   assert_liveliness();
ReturnCode_t
   get_matched_subscriptions(
    inout InstanceHandleSeq subscription_handles);
ReturnCode_t
   get_matched_subscription_data(
    inout SubscriptionBuiltinTopicData subscription_data,
    in InstanceHandle_t subscription_handle);
};
//
interface Subscriber : Entity {
DataReader
create_datareader(
    in TopicDescription a_topic,
    in DataReaderQos qos,
    in DataReaderListener a_listener,
    in StatusMask mask);
ReturnCode_t
delete_datareader(
    in DataReader a_datareader);
ReturnCode_t
delete_contained_entities();
DataReader
lookup_datareader(
    in string topic_name);
ReturnCode_t
get_datareaders(
    inout DataReaderSeq readers,
    in SampleStateMask sample_states,
    in ViewStateMask view_states,
    in InstanceStateMask instance_states);
ReturnCode_t
notify_datareaders();
ReturnCode_t
```

```
    set_qos(
     in SubscriberQos qos);
ReturnCode_t
    get_qos(
     inout SubscriberQos qos);
ReturnCode_t
set_listener(
    in SubscriberListener a_listener,
    in StatusMask mask);
SubscriberListener
get_listener();
ReturnCode_t
begin_access();
ReturnCode_t
end_access();
DomainParticipant
get_participant();
ReturnCode_t
set_default_datareader_qos(
    in DataReaderQos qos);
ReturnCode_t
get_default_datareader_qos(
    inout DataReaderQos qos);
ReturnCode_t
copy_from_topic_qos(
    inout DataReaderQos a_datareader_qos,
    in TopicQos a_topic_qos);
};
interface DataReader : Entity {
//  ReturnCode_t
//  read(
//      inout DataSeq data_values,
//      inout SampleInfoSeq info_seq,
//      in Long max_samples,
//      in SampleStateMask sample_states,
//      in ViewStateMask view_states,
//      in InstanceStateMask instance_states);
//
//  ReturnCode_t
//  take(
//      inout DataSeq data_values,
//      inout SampleInfoSeq info_seq,
//      in Long max_samples,
//      in SampleStateMask sample_states,
//      in ViewStateMask view_states,
//      in InstanceStateMask instance_states);
//
//  ReturnCode_t
//  read_w_condition(
//      inout DataSeq data_values,
```

```
//      inout SampleInfoSeq info_seq,
//      in Long max_samples,
//      in ReadCondition a_condition);
//
//  ReturnCode_t
//  take_w_condition(
//      inout DataSeq data_values,
//      inout SampleInfoSeq info_seq,
//      in Long max_samples,
//      in ReadCondition a_condition);
//
//  ReturnCode_t
//  read_next_sample(
//      inout Data data_values,
//      inout SampleInfo sample_info);
//
//  ReturnCode_t
//  take_next_sample(
//      inout Data data_values,
//      inout SampleInfo sample_info);
//
//  ReturnCode_t
//  read_instance(
//      inout DataSeq data_values,
//      inout SampleInfoSeq info_seq,
//      in Long max_samples,
//      in InstanceHandle_t a_handle,
//      in SampleStateMask sample_states,
//      in ViewStateMask view_states,
//      in InstanceStateMask instance_states);
//
//  ReturnCode_t
//  take_instance(
//      inout DataSeq data_values,
//      inout SampleInfoSeq info_seq,
//      in Long max_samples,
//      in InstanceHandle_t a_handle,
//      in SampleStateMask sample_states,
//      in ViewStateMask view_states,
//      in InstanceStateMask instance_states);
//
//  ReturnCode_t
//  read_next_instance(
//      inout DataSeq data_values,
//      inout SampleInfoSeq info_seq,
//      in Long max_samples,
//      in InstanceHandle_t a_handle,
//      in SampleStateMask sample_states,
//      in ViewStateMask view_states,
//      in InstanceStateMask instance_states);
```

```
    //
    //  ReturnCode_t
    //  take_next_instance(
    //      inout DataSeq data_values,
    //      inout SampleInfoSeq info_seq,
    //      in Long max_samples,
    //      in InstanceHandle_t a_handle,
    //      in SampleStateMask sample_states,
    //      in ViewStateMask view_states,
    //      in InstanceStateMask instance_states);
    //
    //  ReturnCode_t
    //  read_next_instance_w_condition(
    //      inout DataSeq data_values,
    //      inout SampleInfoSeq info_seq,
    //      in Long max_samples,
    //      in InstanceHandle_t a_handle,
    //      in ReadCondition a_condition);
    //
    //  ReturnCode_t
    //  take_next_instance_w_condition(
    //      inout DataSeq data_values,
    //      inout SampleInfoSeq info_seq,
    //      in Long max_samples,
    //      in InstanceHandle_t a_handle,
    //      in ReadCondition a_condition);
    //
    //  ReturnCode_t
    //  return_loan(
    //      inout DataSeq data_values,
    //      inout SampleInfoSeq info_seq);
    //
    //  ReturnCode_t
    //  get_key_value(
    //      inout Data key_holder,
    //      in InstanceHandle_t handle);
    //
    //  InstanceHandle_t
    //  lookup_instance(
    //      in Data instance);
    ReadCondition
    create_readcondition(
        in SampleStateMask sample_states,
        in ViewStateMask view_states,
        in InstanceStateMask instance_states);
    QueryCondition
    create_querycondition(
        in SampleStateMask sample_states,
        in ViewStateMask view_states,
        in InstanceStateMask instance_states,
```

```
    in string query_expression,
    in StringSeq query_parameters);
ReturnCode_t
delete_readcondition(
    in ReadCondition a_condition);
ReturnCode_t
delete_contained_entities();
ReturnCode_t
set_qos(
    in DataReaderQos qos);
ReturnCode_t
get_qos(
    inout DataReaderQos qos);
ReturnCode_t
set_listener(
    in DataReaderListener a_listener,
    in StatusMask mask);
DataReaderListener
get_listener();
TopicDescription
get_topicdescription();
Subscriber
get_subscriber();
ReturnCode_t
get_sample_rejected_status(
    inout SampleRejectedStatus status);
ReturnCode_t
get_liveliness_changed_status(
    inout LivelinessChangedStatus status);
ReturnCode_t
get_requested_deadline_missed_status(
    inout RequestedDeadlineMissedStatus status);
ReturnCode_t
get_requested_incompatible_qos_status(
    inout RequestedIncompatibleQosStatus status);
ReturnCode_t
get_subscription_matched_status(
    inout SubscriptionMatchedStatus status);
ReturnCode_t
get_sample_lost_status(
    inout SampleLostStatus status);
ReturnCode_t
wait_for_historical_data(
    in Duration_t max_wait);
ReturnCode_t
get_matched_publications(
    inout InstanceHandleSeq publication_handles);
ReturnCode_t
get_matched_publication_data(
    inout PublicationBuiltinTopicData publication_data,
```

```
            in InstanceHandle_t publication_handle);
        };
        struct SampleInfo {
       SampleStateKind sample_state;
       ViewStateKind view_state;
       InstanceStateKind instance_state;
       Time_t source_timestamp;
       InstanceHandle_t instance_handle;
       BuiltinTopicKey_t publication_handle;
       long disposed_generation_count;
       long no_writers_generation_count;
       long sample_rank;
       long generation_rank;
       long absolute_generation_rank;
       boolean valid_data;
        };
        typedef sequence<SampleInfo> SampleInfoSeq;
};
Foo.idl
    // Implied IDL for type "Foo"
    // Example user defined structure
    struct Foo {
   long dummy;
    };
    typedef sequence<Foo> FooSeq;
    #include "dds_dcps.idl"
    interface FooTypeSupport : DDS::TypeSupport {
   DDS::ReturnCode_t
   register_type(
       in DDS::DomainParticipant participant,
       in string type_name);
   string
   get_type_name();
    };
    interface FooDataWriter : DDS::DataWriter {
   DDS::InstanceHandle_t
   register_instance(
       in Foo instance_data);
   DDS::InstanceHandle_t
   register_instance_w_timestamp(
       in Foo instance_data,
       in DDS::InstanceHandle_t handle,
       in DDS::Time_t source_timestamp);
   DDS::ReturnCode_t
   unregister_instance(
       in Foo instance_data,
       in DDS::InstanceHandle_t handle);
   DDS::ReturnCode_t
   unregister_instance_w_timestamp(
       in Foo instance_data,
```

```
    in DDS::InstanceHandle_t handle,
    in DDS::Time_t source_timestamp);
DDS::ReturnCode_t
write(
    in Foo instance_data,
    in DDS::InstanceHandle_t handle);
DDS::ReturnCode_t
write_w_timestamp(
    in Foo instance_data,
    in DDS::InstanceHandle_t handle,
    in DDS::Time_t source_timestamp);
DDS::ReturnCode_t
dispose(
    in Foo instance_data,
    in DDS::InstanceHandle_t instance_handle);
DDS::ReturnCode_t
dispose_w_timestamp(
    in Foo instance_data,
    in DDS::InstanceHandle_t instance_handle,
    in DDS::Time_t source_timestamp);
DDS::ReturnCode_t
get_key_value(
    inout Foo key_holder,
    in DDS::InstanceHandle_t handle);
DDS::InstanceHandle_t
lookup_instance(
    in Foo instance_data);
 };
 interface FooDataReader : DDS::DataReader {
DDS::ReturnCode_t
read(
    inout FooSeq data_values,
    inout DDS::SampleInfoSeq info_seq,
    in Long max_samples,
    in DDS::SampleStateMask sample_states,
    in DDS::ViewStateMask view_states,
    in DDS::InstanceStateMask instance_states);
DDS::ReturnCode_t
take(
    inout FooSeq data_values,
    inout DDS::SampleInfoSeq info_seq,
    in Long max_samples,
    in DDS::SampleStateMask sample_states,
    in DDS::ViewStateMask view_states,
    in DDS::InstanceStateMask instance_states);
DDS::ReturnCode_t
read_w_condition(
    inout FooSeq data_values,
    inout DDS::SampleInfoSeq info_seq,
    in Long max_samples,
```

```
    in DDS::ReadCondition a_condition);
DDS::ReturnCode_t
take_w_condition(
    inout FooSeq data_values,
    inout DDS::SampleInfoSeq info_seq,
    in Long max_samples,
    in DDS::ReadCondition a_condition);
DDS::ReturnCode_t
read_next_sample(
    inout Foo data_values,
    inout DDS::SampleInfo sample_info);
DDS::ReturnCode_t
take_next_sample(
    inout Foo data_values,
    inout DDS::SampleInfo sample_info);
DDS::ReturnCode_t
read_instance(
    inout FooSeq data_values,
    inout DDS::SampleInfoSeq info_seq,
    in Long max_samples,
    in DDS::InstanceHandle_t a_handle,
    in DDS::SampleStateMask sample_states,
    in DDS::ViewStateMask view_states,
    in DDS::InstanceStateMask instance_states);
DDS::ReturnCode_t
take_instance(
    inout FooSeq data_values,
    inout DDS::SampleInfoSeq info_seq,
    in Long max_samples,
    in DDS::InstanceHandle_t a_handle,
    in DDS::SampleStateMask sample_states,
    in DDS::ViewStateMask view_states,
    in DDS::InstanceStateMask instance_states);
DDS::ReturnCode_t
read_next_instance(
    inout FooSeq data_values,
    inout DDS::SampleInfoSeq info_seq,
    in Long max_samples,
    in DDS::InstanceHandle_t a_handle,
    in DDS::SampleStateMask sample_states,
    in DDS::ViewStateMask view_states,
    in DDS::InstanceStateMask instance_states);
DDS::ReturnCode_t
take_next_instance(
    inout FooSeq data_values,
    inout DDS::SampleInfoSeq info_seq,
    in Long max_samples,
    in DDS::InstanceHandle_t a_handle,
    in DDS::SampleStateMask sample_states,
    in DDS::ViewStateMask view_states,
```

```
    in DDS::InstanceStateMask instance_states);
DDS::ReturnCode_t
read_next_instance_w_condition(
    inout FooSeq data_values,
    inout DDS::SampleInfoSeq info_seq,
    in Long max_samples,
    in DDS::InstanceHandle_t a_handle,
    in DDS::ReadCondition a_condition);
DDS::ReturnCode_t
take_next_instance_w_condition(
    inout FooSeq data_values,
    inout DDS::SampleInfoSeq info_seq,
    in Long max_samples,
    in DDS::InstanceHandle_t a_handle,
    in DDS::ReadCondition a_condition);
DDS::ReturnCode_t
return_loan(
    inout FooSeq data_values,
    inout DDS::SampleInfoSeq info_seq);
DDS::ReturnCode_t
get_key_value(
    inout Foo key_holder,
    in DDS::InstanceHandle_t handle);
DDS::InstanceHandle_t
lookup_instance(
    in Foo instance);
 };
```

Appendix

D SampleStates, ViewStates and InstanceStates

Data is made available to the application by the following operations on `DataReader` objects: `read` and `take` operations. The general semantics of the `read` operations is that the application only gets access to the matching data; the data remain available in the Data Distribution Services and can be read again. The semantics of the `take` operations is that the data is not available in the Data Distribution Service; that data will no longer be accessible to the `DataReader`. Consequently, it is possible for a `DataReader` to access the same sample multiple times but only if all previous accesses were `read` operations.

Each of these operations returns an ordered collection of `Data` values and associated `SampleInfo` objects. Each data value represents an atom of data information (i.e., a value for one instance). This collection may contain samples related to the same or different instances (identified by the `key`). Multiple samples can refer to the same instance if the settings of the `HistoryQosPolicy` allow for it.

SampleInfo Class

`SampleInfo` is the information that accompanies each sample that is 'read' or 'taken'. It contains, among others, the following information:

- The `sample_state` (`READ_SAMPLE_STATE` or `NOT_READ_SAMPZWLE_STATE`)
- The `view_state` (`NEW_VIEW_STATE` or `NOT_NEW_VIEW_STATE`)
- The `instance_state` (`ALIVE_INSTANCE_STATE`, `NOT_ALIVE_DISPOSED_INSTANCE_STATE` or `NOT_ALIVE_NO_WRITERS_INSTANCE_STATE`).

sample_state

For each sample, the Data Distribution Service internally maintains a `sample_state` specific to each `DataReader`. The `sample_state` can either be `READ_SAMPLE_STATE` or `NOT_READ_SAMPLE_STATE`.

`READ_SAMPLE_STATE` indicates that the `DataReader` has already accessed that sample by means of `read`. Had the sample been accessed by `take` it would no longer be available to the `DataReader`;

- NOT_READ_SAMPLE_STATE indicates that the DataReader has not accessed that sample before.

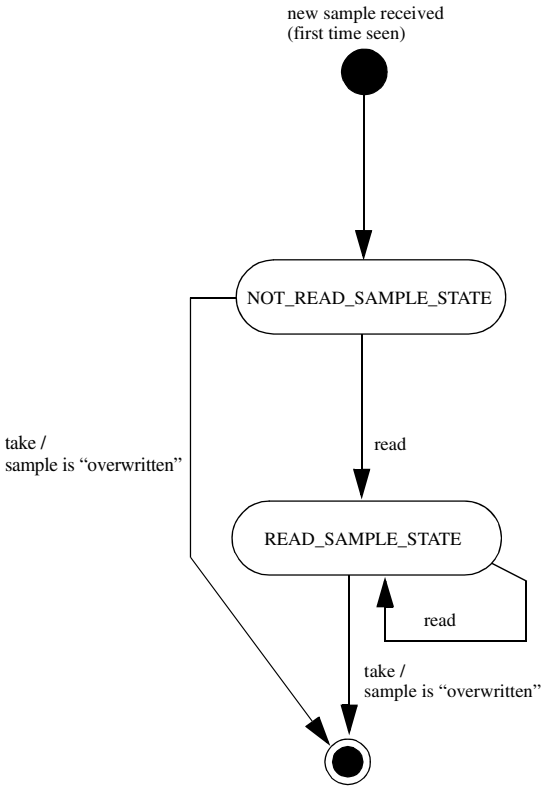

Figure 20 Single Sample sample_state State Chart

State Per Sample

The sample_state available in the SampleInfo reflect the sample_state of each sample. The sample_state can be different for all samples in the returned collection that refer to the same instance.

instance_state

For each instance the Data Distribution Service internally maintains an instance_state. The instance_state can be:

- ALIVE_INSTANCE_STATE, which indicates that
  - samples have been received for the instance

- there are live DataWriter objects writing the instance
- the instance has not been explicitly disposed of (or else samples have been received after it was disposed of)

- NOT_ALIVE_DISPOSED_INSTANCE_STATE indicates the instance was disposed of by a DataWriter, either explicitly by means of the dispose operation or implicitly in case the autodispose_unregistered_instances field of the WriterDataLyfecycleQosPolicy equals TRUE when the instance gets unregistered (see Section 3.1.3.23, *WriterDataLifecycleQosPolicy*) and no new samples for that instance have been written afterwards.
- NOT_ALIVE_NO_WRITERS_INSTANCE_STATE indicates the instance has been declared as not-alive by the DataReader because it detected that there are no live DataWriter objects writing that instance.

OwnershipQosPolicy

The precise events that cause the instance_state to change depends on the setting of the OwnershipQosPolicy:

- If OwnershipQosPolicy is set to EXCLUSIVE_OWNERSHIP_QOS, then the instance_state becomes NOT_ALIVE_DISPOSED_INSTANCE_STATE only if the DataWriter that "owns" the instance explicitly disposes of it. The instance_state becomes ALIVE_INSTANCE_STATE again only if the DataWriter that owns the instance writes it;
- If OwnershipQosPolicy is set to SHARED_OWNERSHIP_QOS, then the instance_state becomes NOT_ALIVE_DISPOSED_INSTANCE_STATE if any DataWriter explicitly disposes of the instance. The instance_state becomes ALIVE_INSTANCE_STATE as soon as any DataWriter writes the instance again.

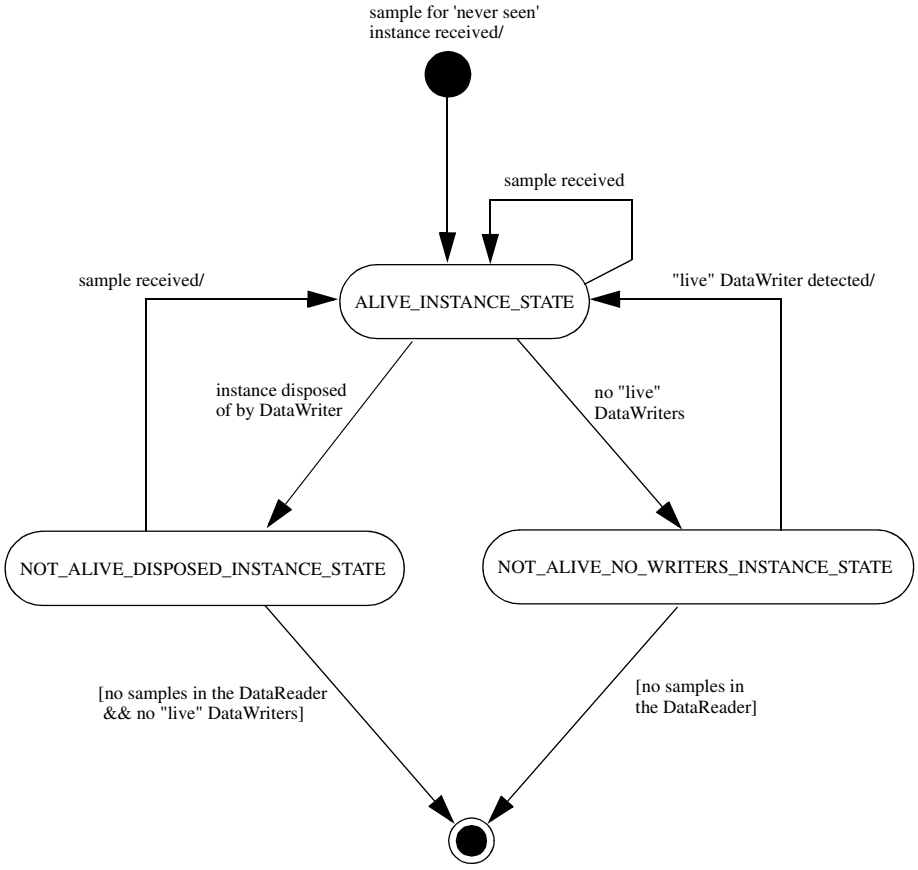

Figure 21 State Chart of the instance_state for a Single Instance

Snapshot

The `instance_state` available in the `SampleInfo` is a snapshot of the `instance_state` of the instance at the time the collection was obtained (i.e. at the time `read` or `take` was called). The `instance_state` is therefore the same for all samples in the returned collection that refer to the same instance.

view_state

For each instance (identified by the `key`), the Data Distribution Service internally maintains a `view_state` relative to each `DataReader`. The `view_state` can either be `NEW_VIEW_STATE` or `NOT_NEW_VIEW_STATE`.

NEW_VIEW_STATE indicates that either this is the first time that the DataReader has ever accessed samples of that instance, or else that the DataReader has accessed previous samples of the instance, but the instance has since been reborn (i.e. becomes not-alive and then alive again);

- NOT_NEW_VIEW_STATE indicates that the DataReader has already accessed samples of the same instance and that the instance has not been reborn since.

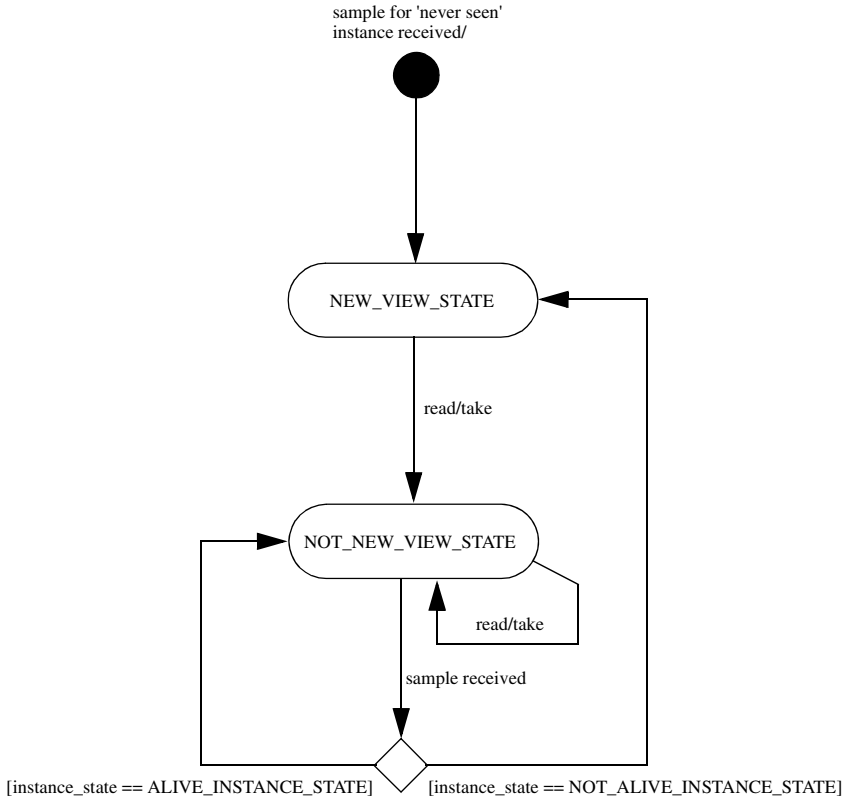

Figure 22 Single Instance view_state State Chart

Snapshot

The view_state available in the SampleInfo is a snapshot of view_state of the instance relative to the DataReader used to access the samples at the time the collection was obtained (i.e. at the time read or take was called). The view_state is therefore the same for all samples in the returned collection that refer to the same instance.

State Masks

State Definitions

All states are available as a constant. These convenience constants can be used to create a bit mask (e.g. to be used as operation parameters) by performing an AND or OR operation. They can also be used for testing whether a state is set.

The sample state definitions indicates whether or not the matching data sample has already been read:

- `READ_SAMPLE_STATE`: sample has already been read;
- `NOT_READ_SAMPLE_STATE`: sample has not been read.

The view state definitions indicates whether the `DataReader` has already seen samples for the most-current generation of the related instance:

- `NEW_VIEW_STATE`: all samples of this instance are new;
- `NOT_NEW_VIEW_STATE`: some or all samples of this instance are not new.

The instance state definitions indicates whether the instance is currently in existence or, if it has been disposed of, the reason why it was disposed of:

- `ALIVE_INSTANCE_STATE`: this instance is currently in existence;
- `NOT_ALIVE_DISPOSED_INSTANCE_STATE`: this instance was disposed of by a `DataWriter`;
- `NOT_ALIVE_NO_WRITERS_INSTANCE_STATE`: the instance has been disposed of by the `DataReader` because none of the `DataWriter` objects currently "alive" (according to the `LivelinessQosPolicy`) are writing the instance.

Pre-defined Bit Mask Definitions

For convenience, some pre-defined bit masks are available as a constant definition. These bit mask constants can be used where a state bit mask is required. They can also be used for testing whether certain bits are set.

The sample state bit mask definition selects both sample states

- `ANY_SAMPLE_STATE`: either the sample has already been read or not read

The view state bit mask definition selects both view states

- `ANY_VIEW_STATE`: either the sample has already been seen or not seen

The instance state bit mask definitions selects a combination of instance states

- `NOT_ALIVE_INSTANCE_STATE`: this instance was disposed of by a `DataWriter` or the `DataReader`
- `ANY_INSTANCE_STATE`: this Instance is either in existence or not in existence

Operations Concerning States

The application accesses data by means of the operations `read` or `take` on the `DataReader`. These operations return an ordered collection of `DataSamples` consisting of a `SampleInfo` part and a `Data` part. The way the Data Distribution Service builds this collection (i.e., the data-samples that are parts of the list as well as their order) depends on `QosPolicy` settings set on the `DataReader` and the `Subscriber`, as well as the source timestamp of the samples and the parameters passed to the `read`/`take` operations, namely:

- the desired sample states (in other words, `READ_SAMPLE_STATE`, `NOT_READ_SAMPLE_STATE`, or `ANY_SAMPLE_STATE`)
- the desired view states (in other words, `NEW_VIEW_STATE`, `NOT_NEW_VIEW_STATE`, or `ANY_VIEW_STATE`)
- the desired instance states
  `ALIVE_INSTANCE_STATE`,
  `NOT_ALIVE_DISPOSED_INSTANCE_STATE`,
  `NOT_ALIVE_NO_WRITERS_INSTANCE_STATE`,
  `NOT_ALIVE_INSTANCE_STATE`, or `ANY_INSTANCE_STATE`).

The `read` and `take` operations are non-blocking and just deliver what is currently available that matches the specified states.

On output, the collection of `Data` values and the collection of `SampleInfo` structures are of the same length and are in a one-to-one correspondence. Each `SampleInfo` provides information, such as the `source_timestamp`, the `sample_state`, `view_state`, and `instance_state`, etc., about the matching sample.

Some elements in the returned collection may not have valid data. If the `instance_state` in the `SampleInfo` is `NOT_ALIVE_DISPOSED_INSTANCE_STATE` or `NOT_ALIVE_NO_WRITERS_INSTANCE_STATE`, then the last sample for that instance in the collection, that is, the one whose `SampleInfo` has `sample_rank==0` does not contain valid data. Samples that contain no data do not count towards the limits imposed by the `ResourceLimitsQosPolicy`.

read

The act of reading a sample sets its `sample_state` to `READ_SAMPLE_STATE`. If the sample belongs to the most recent generation of the instance, it will also set the `view_state` of the instance to `NOT_NEW_VIEW_STATE`. It will not affect the `instance_state` of the instance.

take

The act of taking a sample removes it from the DataReader so it cannot be 'read' or 'taken' again. If the sample belongs to the most recent generation of the instance, it will also set the view_state of the instance to NOT_NEW_VIEW_STATE. It will not affect the instance_state of the instance.

read_w_condition

In case the ReadCondition is a 'plain' ReadCondition and not the specialized QueryCondition, the operation is equivalent to calling read and passing as sample_states, view_states and instance_states the value of the corresponding attributes in the ReadCondition. Using this operation the application can avoid repeating the same parameters specified when creating the ReadCondition.

take_w_condition

The act of taking a sample removes it from the DataReader so it cannot be 'read' or 'taken' again. If the sample belongs to the most recent generation of the instance, it will also set the view_state of the instance to NOT_NEW_VIEW_STATE. It will not affect the instance_state of the instance.

In case the ReadCondition is a 'plain' ReadCondition and not the specialized QueryCondition, the operation is equivalent to calling take and passing as sample_states, view_states and instance_states the value of the corresponding attributes in the ReadCondition. Using this operation the application can avoid repeating the same parameters specified when creating the ReadCondition.

read_next_sample

The read_next_sample operation is semantically equivalent to the read operation where the input Data sequence has max_len=1, the sample_states=NOT_READ_SAMPLE_STATE,
the view_states=ANY_VIEW_STATE,
and the instance_states=ANY_INSTANCE_STATE.

take_next_sample

The take_next_sample operation is semantically equivalent to the take operation where the input sequence has max_len=1, the sample_states=NOT_READ_SAMPLE_STATE,
the view_states=ANY_VIEW_STATE,
and the instance_states=ANY_INSTANCE_STATE.

read_instance

The act of reading a sample sets its `sample_state` to `READ_SAMPLE_STATE`. If the sample belongs to the most recent generation of the instance, it will also set the `view_state` of the instance to `NOT_NEW_VIEW_STATE`. It will not affect the `instance_state` of the instance.

take_instance

The act of taking a sample removes it from the `DataReader` so it cannot be 'read' or 'taken' again. If the sample belongs to the most recent generation of the instance, it will also set the `view_state` of the instance to `NOT_NEW_VIEW_STATE`. It will not affect the `instance_state` of the instance.

Appendix

E Class Inheritance

This appendix gives an overview of the inheritance relations of the DCPS classes.

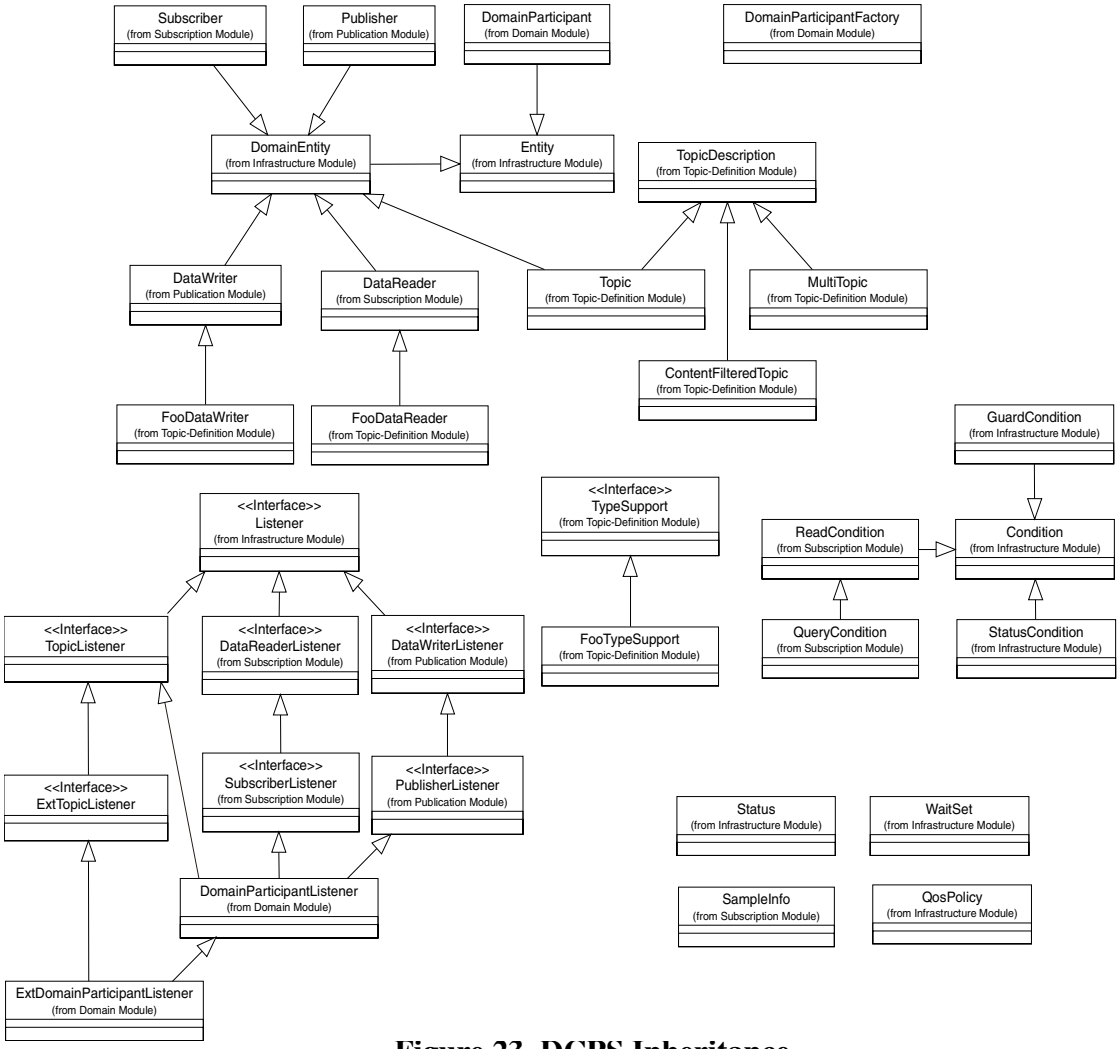

Figure 23 DCPS Inheritance

Appendix

F Listeners, Conditions and Waitsets

`Listeners` and `Conditions` (`Conditions` in conjunction with `WaitSets`) are two mechanisms that allow the application to be made aware of changes in the communication status. `Listeners` provide an event-based mechanism for the Data Distribution Service to asynchronously alert the application of the occurrence of relevant status changes. `Conditions` in conjunction with `WaitSets` provide a state-based mechanism for the Data Distribution Service to synchronously communicate the relevant status changes to the application.

Both mechanisms are based on the communication statuses associated with an `Entity` object. Not all statuses are applicable to all `Entity` objects. Which status is applicable to which `Entity` object is listed in the next table.

:

Table 24 Communication States

Entity	Status Name	Description
`Topic`	`INCONSISTENT_TOPIC_STATUS`	Another `Topic` exists with the same name but with different characteristics.
	`ALL_DATA_DISPOSED_ TOPIC_STATUS`	All instances of the `Topic` have been disposed by the `dispose_all_data` operation on that topic.
`Subscriber`	`DATA_ON_READERS_STATUS`	New information is available.

Table 24 Communication States (Continued)

Entity	Status Name	Description
DataReader	SAMPLE_REJECTED_STATUS	A (received) sample has been rejected.
	LIVELINESS_CHANGED_STATUS	The liveliness of one or more DataWriter objects, that were writing instances read through the DataReader objects has changed. Some DataWriter object have become “alive” or “not alive”.
	REQUESTED_ DEADLINE_MISSED_STATUS	The deadline that the DataReader was expecting through its DeadlineQosPolicy was not respected for a specific instance.
	REQUESTED_ INCOMPATIBLE_QOS_STATUS	A QosPolicy setting was incompatible with what is offered.
	DATA_AVAILABLE_STATUS	New information is available.
	SAMPLE_LOST_STATUS	A sample has been lost (never received).
	SUBSCRIPTION_MATCH_STATUS	The DataReader has found a DataWriter that matches the Topic and has compatible QoS.
DataWriter	LIVELINESS_LOST_STATUS	The liveliness that the DataWriter has committed through its LivelinessQosPolicy was not respected; thus DataReader objects will consider the DataWriter as no longer “active”.
	OFFERED_ DEADLINE_MISSED_STATUS	The deadline that the DataWriter has committed through its DeadlineQosPolicy was not respected for a specific instance.
	OFFERED_ INCOMPATIBLE_QOS_STATUS	A QosPolicy setting was incompatible with what was requested.
	PUBLICATION_MATCH_STATUS	The DataWriter has found DataReader that matches the Topic and has compatible QoS.

The statuses may be classified in:

- *read communication statuses*: i.e., those that are related to arrival of data, namely DATA_ON_READERS and DATA_AVAILABLE;
- *plain communication statuses*: i.e., all the others.

For each plain communication status, there is a corresponding status struct. The information from this struct can be retrieved with the operations get_<status_name>_status. For example, to get the INCONSISTENT_TOPIC status (which information is stored in the InconsistentTopicStatus struct), the

application must call the operation `get_inconsistent_topic_status`. A plain communication status can only be read from the `Entity` on which it is applicable. For the read communication statuses there is no struct available to the application.

Communication Status Event

Conceptually associated with each `Entity` communication status is a logical `StatusChangedFlag`. This flag indicates whether that particular communication status has changed since the last time the status was *'read'* by the application (there is no actual read-operation to read the `StatusChangedFlag`). The `StatusChangedFlag` is only conceptually needed to explain the behaviour of a `Listener`, therefore, it is not important whether this flag actually exists. A `Listener` will only be activated when the `StatusChangedFlag` changes from `FALSE` to `TRUE` (provided the `Listener` is attached and enabled for this particular status). The conditions which cause the `StatusChangedFlag` to change is slightly different for the plain communication status and the read communication status.

For the plain communication status, the `StatusChangedFlag` flag is initially set to `FALSE`. It becomes `TRUE` whenever the plain communication status changes and it is reset to `FALSE` each time the application accesses the plain communication status via the proper `get_<status_name>_status` operation on the `Entity`.

The communication status is also reset to `FALSE` whenever the associated `Listener` operation is called as the `Listener` implicitly accesses the status which is passed as a parameter to the operation. The fact that the status is reset prior to calling the listener means that if the application calls the `get_<status_name>_status` from inside the listener it will see the status already reset.

An exception to this rule is when the associated `Listener` is the 'nil' listener, i.e. a listener with value `NULL`. Such a listener is treated as a NOOP[1] for all statuses activated in its bit mask and the act of calling this 'nil' listener does not reset the corresponding communication statuses.

1. Short for **No-Op**eration, an instruction that does nothing.

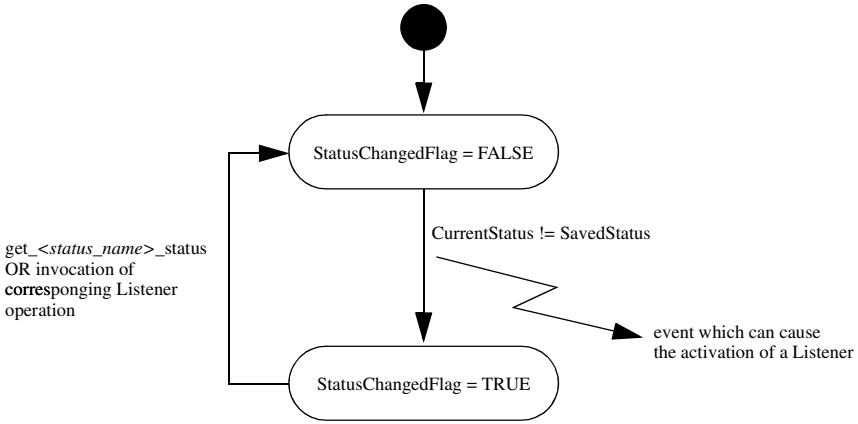

Figure 24 Plain Communication Status State Chart

For example, the value of the `StatusChangedFlag` associated with the `RequestedDeadlineMissedStatus` will become `TRUE` each time a new deadline passes (which increases the total_count field within `RequestedDeadlineMissedStatus`). The value changes to `FALSE` when the application accesses the status via the corresponding `get_requested_deadline_missed_status` operation on the proper `Entity`, or when the `on_requested_deadline_missed` operation on the `Listener` attached to this `Entity` or one its containing entities is invoked.

For the read communication status, the `StatusChangedFlag` flag is initially set to `FALSE`. It becomes `TRUE` when data arrives, or when the `InstanceState` of a contained instance changes. This can be caused by either:

- The arrival of the notification that an instance has been disposed by:
  - the `DataWriter` that owns it if its `OwnershipQosPolicyKind = EXCLUSIVE_OWNERSHIP_QOS`
  - or by any `DataWriter` if its `OwnershipQosPolicyKind = SHARED_OWNERSHIP_QOS`.
- The loss of liveliness of the `DataWriter` of an instance for which there is no other `DataWriter`.
- The arrival of the notification that an instance has been unregistered by the only `DataWriter` that is known to be writing the instance.

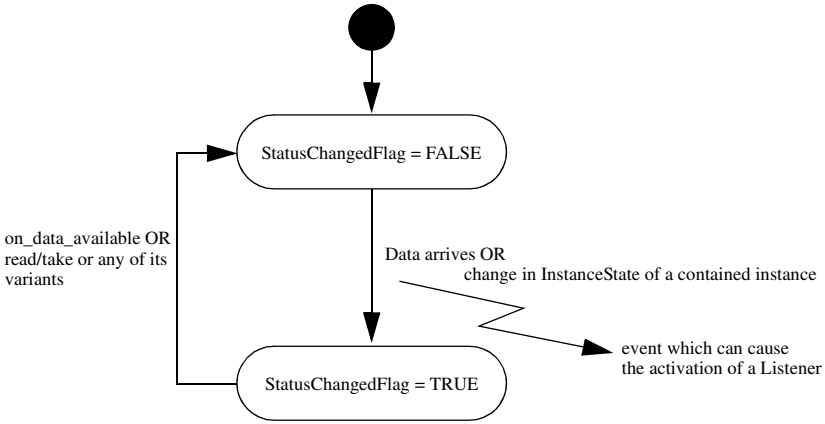

Figure 25 Read Communication Status DataReader Statecraft

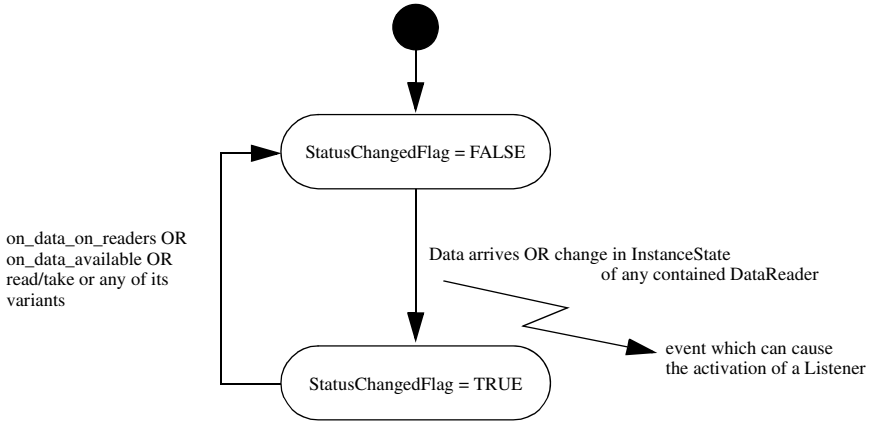

Figure 26 Subscriber Statecraft for a Read Communication Status

- The status flag of the `DATA_ON_READERS_STATUS` becomes `FALSE` when any of the following events occurs:
  - The corresponding listener operation (`on_data_on_readers`) is called on the corresponding `Subscriber`.
  - The `on_data_available` listener operation is called on any `DataReader` belonging to the `Subscriber`.

- The `read` or `take` operation (or any of its variants) is called on any `DataReader` belonging to the `Subscriber`.

Listeners

The `Listeners` provide for an event-based mechanism to asynchronous inform the application of a status change event. `Listeners` are applicable for both the read communication statuses and the plain communication statuses. When one of these status change events occur, the associated `Listener` is activated, provided some pre-conditions are satisfied. When the `Listener` is activated, it will call the corresponding `on_<status_name>` operation of that `Listener`. Each `on_<status_name>` operation available in the `Listener` of an `Entity` is also available in the `Listener` of the factory of the `Entity`.

For both the read communication statuses and the plain communication statuses a `Listener` is only activated when a `Listener` is attached to this particular `Entity` and enabled for this particular status. Statuses are enabled according the to the `StatusKindMask` parameter that was passed at creation time of the `Entity`, or that was passed to the `set_listener` operation.

When an event occurs for a particular `Entity` and for a particular status, but the applicable `Listener` is not activated for this status, the status is propagated up to the factory of this `Entity`. For this factory, the same propagation rules apply. When even the `DomainParticipantListener` is not attached or enabled for this status, the application will not be notified about this event. This means that a status change on a contained `Entity` only invokes the `Listener` of its factory if the `Listener` of the contained `Entity` itself does not handle the trigger event generated by the status change.

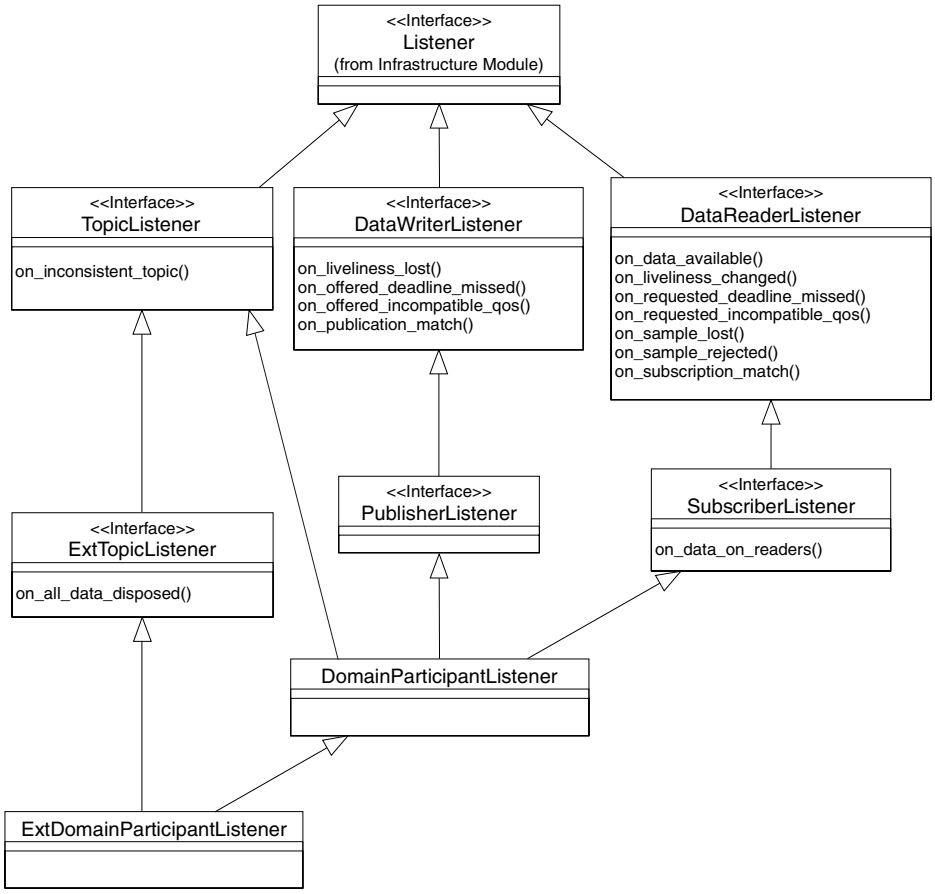

Figure 27 DCPS Listeners

The event propagation is also applicable to the read communication statuses. However, since the event here is the arrival of data, both the `DATA_ON_READERS` and `DATA_AVAILABLE` status are `TRUE`. The Data Distribution Service will first attempt to handle the `DATA_ON_READERS` status and try to activate the `SubscriberListener`. When this `Listener` is not activated for this status the event will propagate to the `DomainParticipantListener`. Only when the `DATA_ON_READERS` status can not be handled, the Data Distribution Service will attempt to handle the `DATA_AVAILABLE` status and try to activate the `DataReaderListener`. In case this `Listener` is not activated for this status the event will follow the propagation rules as described above.

Conditions and Waitsets

The Conditions in conjunction with WaitSets provide for a state-based mechanism to synchronously inform the application of status changes. A Condition can be either a ReadCondition, QueryCondition, StatusCondition or GuardCondition. To create a Condition one of the following operations can be used:

- ReadCondition created by create_readcondition
- QueryCondition created by create_querycondition
- StatusCondition retrieved by get_statuscondition on an Entity
- GuardCondition created by the C++ operation new

Note that the QueryCondition is a specialized ReadCondition. The GuardCondition is a different kind of Condition since it is not controlled by a status but directly by the application (when a GuardCondition is initially created, the trigger_value is FALSE). The StatusCondition is present by default with each Entity, therefore, it does not have to be created.

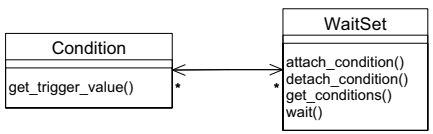

Figure 28 DCPS WaitSets

A WaitSet may have one or several Conditions attached to it. An application thread may block execution (blocking may be limited by a timeout) by waiting on a WaitSet until the trigger_value of one or more of the Conditions become TRUE. When a Condition, whose trigger_value evaluates to TRUE, is attached to a WaitSet that is currently being waited on (using the wait operation), the WaitSet will unblock immediately.

This (state-based) mechanism is generally used as follows:

- The application creates a WaitSet.
- The application indicates which relevant information it wants to be notified of, by creating or retrieving Condition objects (StatusCondition, ReadCondition, QueryCondition or GuardCondition) and attach them to a WaitSet.
- It then waits on that WaitSet (using WaitSet::wait) until the trigger_value of one or several Condition objects (in the WaitSet) become TRUE.

- When the thread is unblocked, the application uses the result of the `wait` (i.e., the list of `Condition` objects with `trigger_value==TRUE`) to actually get the information:
  - if the condition is a `StatusCondition` and the status changes refer to a plain communication status, by calling `get_status_changes` and then `get_<communication_status>` on the relevant `Entity`
  - if the condition is a `StatusCondition` and the status changes refer to the read communication status:

    `DATA_ON_READERS`, by calling `get_status_changes` and then `get_datareaders` on the relevant `Subscriber` and then `read`/`take` on the returned `DataReader` objects

    `DATA_AVAILABLE`, by calling `get_status_changes` and then `read`/`take` on the relevant `DataReader`
  - if it is a `ReadCondition` or a `QueryCondition`, by calling directly `read_w_condition`/`take_w_condition` on the `DataReader` with the `Condition` as a parameter

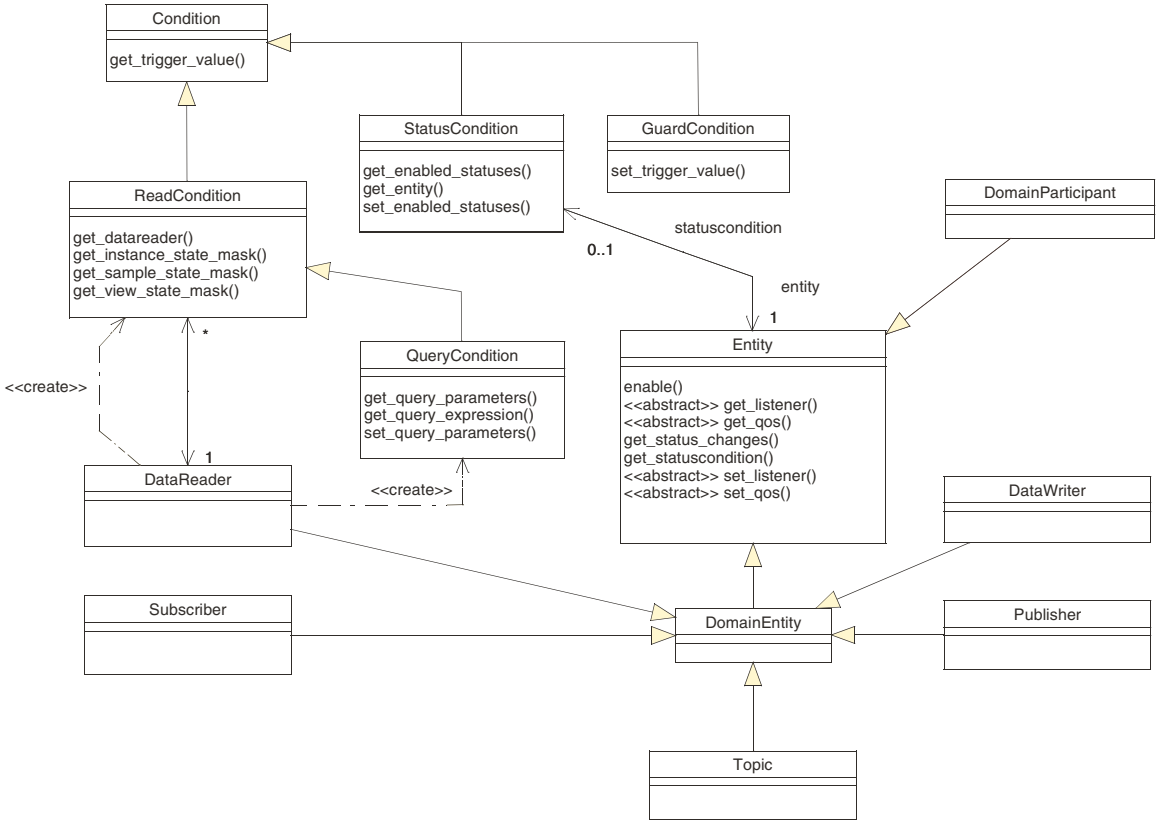

Figure 29 DCPS Conditions

No extra information is passed from the Data Distribution Service to the application when a `wait` returns only the list of triggered `Condition` objects. Therefore, it is the application responsibility to investigate which `Condition` objects have triggered the `WaitSet`.

Blocking Behaviour

The result of a `wait` operation depends on the state of the `WaitSet`, which in turn depends on whether at least one attached `Condition` has a `trigger_value` of `TRUE`. If the `wait` operation is called on `WaitSet` with state BLOCKED it will block the calling thread. If `wait` is called on a `WaitSet` with state UNBLOCKED it will return immediately. In addition, when the `WaitSet` transitions from state BLOCKED to state UNBLOCKED it wakes up the thread (if any) that had called `wait` on it. Note that there can only be one thread waiting on a single `WaitSet`.

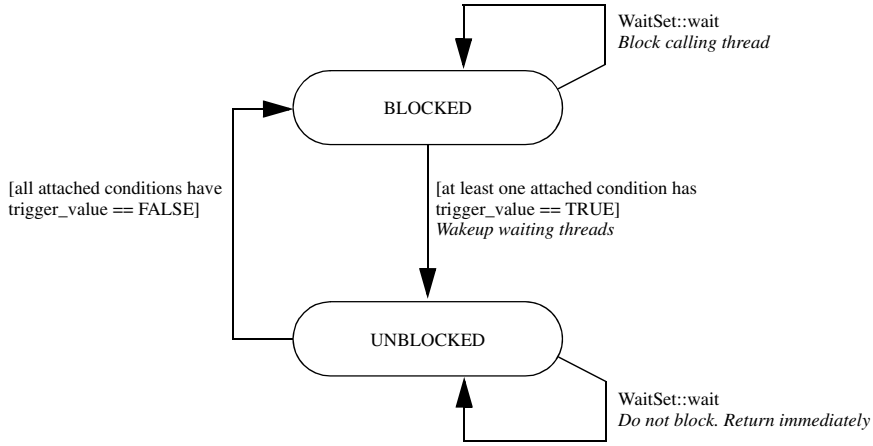

Figure 30 Blocking Behaviour of a Waitset State Chart

StatusCondition Trigger State

The `trigger_value` of a `StatusCondition` is the boolean OR of the `StatusChangedFlag` of all the communication statuses to which it is sensitive. That is, `trigger_value==FALSE` only if all the values of the `StatusChangedFlags` are FALSE.

The sensitivity of the `StatusCondition` to a particular communication status is controlled by the bit mask of `enabled_statuses` set on the `Condition` by means of the `set_enabled_statuses` operation.

ReadCondition and QueryCondition Trigger State

Similar to the `StatusCondition`, a `ReadCondition` also has a `trigger_value` that determines whether the attached `WaitSet` is BLOCKED or UNBLOCKED. However, unlike the `StatusCondition`, the `trigger_value` of the `ReadCondition` is tied to the presence of at least one sample managed by the Data Distribution Service with `SampleState`, `ViewState`, and `InstanceState` matching those of the `ReadCondition`. Additionally, for the `QueryCondition`, the data associated with the sample, must be such that the `query_expression` evaluates to `TRUE`.

The fact that the trigger_value of a `ReadCondition` is dependent on the presence of samples on the associated `DataReader` implies that a single `take` operation can potentially change the `trigger_value` of several `ReadCondition` or `QueryCondition` objects. For example, if all samples are taken, any `ReadCondition` or `QueryCondition` objects associated with the `DataReader` that had their `trigger_value==TRUE` before will see the `trigger_value` change to `FALSE`. Note that this does not guarantee that `WaitSet` objects, that had

those Condition objects separately attached to, will not be woken up. Once we have trigger_value==TRUE on a Condition it may wake up the WaitSet it was attached to, the condition transitions to trigger_value==FALSE does not 'un-wake up' the WaitSet as 'un-wakening' is not possible. The consequence is that an application blocked on a WaitSet may return from the wait with a list of Condition objects some of which are no longer “active”. This is unavoidable if multiple threads are concurrently waiting on separate WaitSet objects and taking data associated with the same DataReader Entity. In other words, a wait may return with a list of Condition objects which all have a trigger_value==FALSE. This only means that at some point one or more of the Condition objects have had a trigger_value==TRUE but no longer do.

GuardCondition Trigger State

The trigger_value of a GuardCondition is completely controlled by the application via the operation set_trigger_value. This Condition can be used to implement an application defined wake-up of the blocked thread.

Appendix

G Topic Definitions

The Data Distribution Service distributes its data in structured data types, called topics. The first step when using the Data Distribution Service consists of defining these topics. Since the Data Distribution Service supports using several programming languages, OMG IDL is used for this purpose. This appendix describes how to define the topics.

Topic Definition Example

All data distributed using the Data Distribution Service has to be defined as a topic. A topic is a structured data type, like a C++-struct with several members. Whenever the application needs to read or write data, it will be reading or writing topics. The definition of each topic it will be using has to be written in (a subset of) OMG IDL. For example:

```
module SPACE {
   struct Foo {
      long      userID;  // owner of message
      long long index;   // message index per owner
      string    content; // message body
   };
#pragma keylist Foo
};
```

This is the definition of a topic called `Foo`, used for sending and receiving messages (as an example). Even though the topic is defined using IDL, the Data Distribution Service will be using an equivalent C++-struct which is accessed by the application using the type specific operations. Generation of the typed classes is achieved by invoking the Data Distribution Service IDL pre-processor: ***`idlpp -l c++ -S <idl_filename>.idl`***, a tool which translates the IDL topic definition into an equivalent C++-definition. The `-l c++` option indicates that the C++ code has to be generated (in accordance with the *OMG C++ Language Mapping Specification*. The *`-S`* option indicates that this C-code should be *StandAlone* C++ code, in other words, it must not have any dependency on external ORB libraries. (It is also possible to use libraries from an existing ORB, so that your DDS application can also manage information coming from an external ORB. In that case you should use the CORBA-cohabitation mode, replacing the `-S` flag with a `-C` flag.). In this example, the pre-processor will generate the classes `FooTypeSupport`, `FooDataWriter` and `FooDataReader` which contain the type specific operations.

Complex Topics

The `Foo` topic is relatively simple, but the Data Distribution Service is capable of distributing more complex topics as well. In fact, any definition following the OpenSplice IDL subset is allowed. It is important to know that the pre-processor accepts all IDL constructs but only the subset is being processed.

Apart from the trivial data types, the Data Distribution Service is capable of handling fixed-length arrays, bounded and unbounded sequences, union types and enumerations. Types can be nested, e.g. a struct can contain a struct field or an array of structs, or a sequence of strings or an array of sequences containing structs.

IDL Pre-processor

This section contains the specification of the subset of OMG IDL that can be used to define the topics.

IDL-to-Host Language Mapping

The Data Distribution Service IDL pre-processor translates the IDL-definition of the topics into language specific code. This translation is executed according to the OMG IDL mappings. Since the Data Distribution Service uses data-structures only, not all IDL-features are implemented by the pre-processor. Usually, the IDL definition consists of a module defining several structs and typedefs.

Data Distribution Service IDL Keywords

The identifiers listed in this appendix are reserved for use as keywords in IDL and may not be used otherwise, unless escaped with a leading underscore.

abstract	exception	inout	provides	truncatable
any	emits	interface	public	typedef
attribute	enum	local	publishes	typeid
boolean	eventtype	long	raises	typeprefix
case	factory	module	readonly	unsigned
char	FALSE	multiple	setraises	union
component	finder	native	sequence	uses
const	fixed	Object	short	ValueBase
consumes	float	octet	string	valuetype
context	getraises	oneway	struct	void
custom	home	out	supports	wchar
default	import	primarykey	switch	wstring
double	in	private	TRUE	

Keywords must be written exactly as shown in the above list. Identifiers that collide with keywords are illegal. For example, `boolean` is a valid keyword; `Boolean` and `BOOLEAN` are illegal identifiers.

Data Distribution Service IDL Pragma Keylist

To define a topic, the content must either be a struct or a union. The pre-processor will only generate the type specific classes when topic definition is accompanied by a *<pragmakeylist>*. When the *<pragmakeylist>* has no *<field_id>*, the topic is available but no key is set. To define the keylist the definition, written in BNF-notation, is as follows:

```
<pragmakeylist>::= "#pragma keylist" <type_id> <field_id>*
<type_id>::= <struct_type_identifier>
         | <union_type_identifier>
<field_id>::= <member_declarator>
         | <element_spec_declarator>
```

In case of a struct, <type_id> is a <struct_type_identifier>. In case of a union, <type_id> is a <union_type_identifier>. The <struct_type_identifier> is the identifier used in the struct declaration. The <union_type_identifier> is the identifier used in the union declaration. The <field_id> is the identifier of a field in the struct or union identified by <type_id>. In case of a struct, <field_id> is a <member_declarator> which is one of the declarators used in the struct member. In case of a union, <field_id> is a <element_spec_declarator> which is one of the declarators used in the element specification in a case of the union.

For example, for the `Foo` example the next pragma must be used to have the pre-processor generate the typed classes (`FooTypeSupport`, `FooDataWriter` and `FooDataReader`).

```
#pragma keylist Foo userID index
```

Note that in this example the `userID` and the `index` are used as a key.

Data Distribution Service IDL subset in BNF-notation

Only a subset is used by the pre-processor. A description of the Data Distribution Service IDL subset, written in BNF-notation, is as shown below.

```
<definition>::= <type_dcl> ";"
      | <const_dcl> ";"
      | <module> ";"
<module>::= "module" <identifier> "{" <definition>+ "}"
<scoped_name>::= <identifier>
      | "::" <identifier>
      | <scoped_name> "::" <identifier>
```

```
<const_dcl>::= "const" <const_type>
        <identifier> "=" <const_exp>
<const_type>::= <integer_type>
      | <char_type>
      | <boolean_type>
      | <floating_pt_type>
      | <string_type>
      | <scoped_name>
      | <octet_type>
<const_exp>::= <or_expr>
<or_expr>::= <xor_expr>
      | <or_expr> "|" <xor_expr>
<xor_expr>::= <and_expr>
      | <xor_expr> "^" <and_expr>
<and_expr>::= <shift_expr>
      | <and_expr> "&" <shift_expr>
<shift_expr>::= <add_expr>
      | <shift_expr> ">>" <add_expr>
      | <shift_expr> "<<" <add_expr>
<add_expr>::= <mult_expr>
      | <add_expr> "+" <mult_expr>
      | <add_expr> "-" <mult_expr>
<mult_expr>::= <unary_expr>
      | <mult_expr> "*" <unary_expr>
      | <mult_expr> "/" <unary_expr>
      | <mult_expr> "%" <unary_expr>
<unary_expr>::= <unary_operator> <primary_expr>
      | <primary_expr>
<unary_operator>::= "-"
      | "+"
      | "~"
<primary_expr>::= <scoped_name>
      | <literal>
      | "(" <const_exp> ")"
<literal>::= <integer_literal>
      | <string_literal>
      | <character_literal>
      | <floating_pt_literal>
      | <boolean_literal>
<boolean_literal>::= "TRUE"
      | "FALSE"
<positive_int_const>::= <const_exp>
<type_dcl>::= "typedef" <type_declarator>
      | <struct_type>
      | <union_type>
      | <enum_type>
<type_declarator>::= <type_spec> <declarators>
<type_spec>::= <simple_type_spec>
      | <constr_type_spec>
<simple_type_spec>::= <base_type_spec>
```

```
      | <template_type_spec>
      | <scoped_name>
<base_type_spec>::= <floating_pt_type>
      | <integer_type>
      | <char_type>
      | <boolean_type>
      | <octet_type>
<template_type_spec>::= <sequence_type>
      | <string_type>
<constr_type_spec>::= <struct_type>
      | <union_type>
      | <enum_type>
<declarators>::= <declarator> { "," <declarator> }*
<declarator>::= <simple_declarator>
      | <complex_declarator>
<simple_declarator>::= <identifier>
<complex_declarator>::= <array_declarator>
<floating_pt_type>::= "float"
      | "double"
<integer_type>::= <signed_int>
      | <unsigned_int>
<signed_int>::= <signed_short_int>
      | <signed_long_int>
      | <signed_longlong_int>
<signed_short_int>::= "short"
<signed_long_int>::= "long"
<signed_longlong_int>::= "long" "long"
<unsigned_int>::= <unsigned_short_int>
      | <unsigned_long_int>
      | <unsigned_longlong_int>
<unsigned_short_int>::= "unsigned" "short"
<unsigned_long_int>::= "unsigned" "long"
<unsigned_longlong_int>::= "unsigned" "long" "long"
<char_type>::= "char"
<boolean_type>::= "boolean"
<octet_type>::= "octet"
<struct_type>::= "struct" <identifier> "{" <member_list> }"
<member_list>::= <member>+
<member>::= <type_spec> <declarators> ";"
<union_type>::= "union" <identifier> "switch"
       "(" <switch_type_spec> ")"
       "{" <switch_body> "}"
<switch_type_spec>::= <integer_type>
      | <char_type>
      | <boolean_type>
      | <enum_type>
      | <scoped_name>
<switch_body>::= <case>+
<case>::= <case_label>+ <element_spec> ";"
<case_label>::= "case" <const_exp> ":"
```

```
      | "default" ":"
<element_spec>::= <type_spec> <declarator>
<enum_type>::= "enum" <identifier>
        "{" <enumerator> { "," <enumerator> }* "}"
<enumerator>::= <identifier>
<sequence_type>::= "sequence" "<" <simple_type_spec> ","
        <positive_int_const> ">"
      | "sequence" "<" <simple_type_spec> ">"
<string_type>::= "string" "<" <positive_int_const> ">"
      | "string"
<array_declarator>::= <identifier> <fixed_array_size>+
<fixed_array_size>::= "[" <positive_int_const> "]"
```

Appendix

H DCPS Queries and Filters

A subset of SQL syntax is used in several parts of OpenSplice:

- the `filter_expression` in the `ContentFilteredTopic`
- the `topic_expression` in the `MultiTopic`
- the `query_expression` in the `QueryReadCondition`

Those expressions may use a subset of SQL, extended with the possibility to use program variables in the SQL expression. The allowed SQL expressions are defined with the BNF-grammar below. The following notational conventions are made:

- the `NonTerminals` are typeset in italics
- the `'Terminals'` are quoted and typeset in a fixed width font
- the `TOKENS` are typeset in small caps
- the notation *(element // ',')* represents a non-empty comma-separated list of *elements*

SQL Grammar in BNF

```
Expression::= FilterExpression
      | TopicExpression
      | QueryExpression

FilterExpression::= Condition

TopicExpression::= SelectFrom {Where } ';'

QueryExpression::= {Condition}

SelectFrom::= 'SELECT' Aggregation 'FROM' Selection

Aggregation::= '*'
      | (SubjectFieldSpec // ',')

SubjectFieldSpec::= FIELDNAME
      | FIELDNAME 'AS' FIELDNAME
      | FIELDNAME FIELDNAME

Selection::= TOPICNAME
      | TOPICTNAME NaturalJoin JoinItem

JoinItem::= TOPICNAME
```

```
      | TOPICNAME NaturalJoin JoinItem
      | '(' TOPICNAME NaturalJoin JoinItem ')'

NaturalJoin::= 'INNER NATURAL JOIN'
      | 'NATURAL JOIN'
      | 'NATURAL INNER JOIN'

Where::= 'WHERE' Condition

Condition::= Predicate
      | Condition 'AND' Condition
      | Condition 'OR' Condition
      | 'NOT' Condition
      | '(' Condition ')'

Predicate::= ComparisonPredicate
      | BetweenPredicate

ComparisonPredicate::= FIELDNAME RelOp Parameter
      | Parameter RelOp FIELDNAME

BetweenPredicate::= FIELDNAME 'BETWEEN' Range
      | FIELDNAME 'NOT BETWEEN' Range

RelOp::= '=' | '>' | '>=' | '<' | '<=' | '<>' | like

Range::= Parameter 'AND' Parameter

Parameter::= INTEGERVALUE
      | FLOATVALUE
      | STRING
      | ENUMERATEDVALUE
      | PARAMETER
```

i `INNER NATURAL JOIN`, `NATURAL JOIN`, and `NATURAL INNER JOIN` are all aliases, in the sense that they have the same semantics. The aliases are all supported because they all are part of the SQL standard.

SQL Token Expression

The syntax and meaning of the tokens used in the SQL grammar is described as follows:

- `FIELDNAME` - A fieldname is a reference to a field in the data-structure. The dot `'.'` is used to navigate through nested structures. The number of dots that may be used in a fieldname is unlimited. The field-name can refer to fields at any depth in the data structure. The names of the field are those specified in the IDL definition of the corresponding structure, which may or may not match the fieldnames that appear on the C mapping of the structure.

- `TOPICNAME` - A topic name is an identifier for a topic, and is defined as any series of characters `'a'`, ..., `'z'`, `'A'`, ..., `'Z'`, `'0'`, ..., `'9'`, `'_'` but may not start with a digit.
- `INTEGERVALUE` - Any series of digits, optionally preceded by a plus or minus sign, representing a decimal integer value within the range of the system. A hexadecimal number is preceded by `0x` and must be a valid hexadecimal expression.
- `FLOATVALUE` - Any series of digits, optionally preceded by a plus or minus sign and optionally including a floating point (`'.'`). A power-of-ten expression may be post-fixed, which has the syntax *`en`*, where *`n`* is a number, optionally preceded by a plus or minus sign.
- `STRING` - Any series of characters encapsulated in single quotes, except a new-line character or a right quote. A string starts with a left or right quote, but ends with a right quote.
- `ENUMERATEDVALUE` - An enumerated value is a reference to a value declared within an enumeration. The name of the value must correspond to the names specified in the IDL definition of the enumeration, and must be encapsulated in single quotes. An enum value starts with a left or right quote, but ends with a right quote.
- `PARAMETER` - A parameter is of the form *%n*, where *n* represents a natural number (zero included) smaller than 100. It refers to the $n + 1_{th}$ argument in the given context.

Note that when `RelOp` is `'like'`, Unix filename wildcards must be used for strings instead of the normal SQL wildcards. This means that any one character is `'?'`, any zero or more characters is `'*'`.

SQL Examples

Assuming Topic “Location” has as an associated type a structure with fields “flight_name, x, y, z”, and Topic “FlightPlan” has as fields “flight_id, source, destination”. The following are examples of using these expressions.

Example of a *`topic_expression`*:

```
“SELECT flight_name, x, y, z AS height FROM ‘Location’
NATURAL JOIN ‘FlightPlan’ WHERE height < 1000 AND x <23”
```

Example of a *`query_expression`* or a *`filter_expression`*:

```
“height < 1000 AND x <23”
```

Appendix

I Built-in Topics

As part of its operation, the middleware must discover and possibly keep track of the presence of remote entities such as a new participant in the domain. This information may also be important to the application, which may want to react to this discovery, or else access it on demand.

To make this information accessible to the application, the DCPS specification introduces a set of built-in topics and corresponding DataReader objects that can then be used by the application. The information is then accessed as normal application data. This approach avoids introducing a new API to access this information and allows the application to become aware of any changes in those values by means of any of the mechanisms presented in Appendix F, *Listeners, Conditions and Waitsets*.

The built-in data-readers all belong to a built-in Subscriber. This subscriber can be retrieved by using the method `get_builtin_subscriber` provided by the DomainParticipant (for details, see Section 3.2.1.16, *get_builtin_subscriber*, on page 157). The built-in DataReader objects can be retrieved by using the operation `lookup_datareader`, with the Subscriber and the topic name as parameter (for details, see Section 3.5.1.15, *lookup_datareader*, on page 353).

The QoS of the built-in Subscriber and DataReader objects is given by the following table:

Table 25 Built-in Subscriber and DataReader QoS

USER_DATA	<empty>
TOPIC_DATA	<empty>
GROUP_DATA	<empty>
DURABILITY	TRANSIENT
DURABILITY_SERVICE	service_cleanup_delay = 0 history_kind = KEEP_LAST history_depth = 1 max_samples = LENGTH_UNLIMITED max_instances = LENGTH_UNLIMITED max_samples_per_instance = LENGTH_UNLIMITED
PRESENTATION	access_scope = TOPIC coherent_access = FALSE ordered_access = FALSE

Table 25 Built-in Subscriber and DataReader QoS (continued)

DEADLINE	Period = infinite
LATENCY_BUDGET	duration = 0
OWNERSHIP	SHARED
LIVELINESS	kind = AUTOMATIC lease_duration = 0
TIME_BASED_FILTER	minimum_separation = 0
PARTITION	__BUILT-IN PARTITION__
RELIABILITY	kind = RELIABLE max_blocking_time = 100 milliseconds synchronous = FALSE
DESTINATION_ORDER	BY_RECEPTION_TIMESTAMP
HISTORY	kind = KEEP_LAST depth = 1
RESOURCE_LIMITS	max_samples = LENGTH_UNLIMITED max_instances = LENGTH_UNLIMITED max_samples_per_instance = LENGTH_UNLIMITED
READER_DATA_LIFECYCLE	autopurge_nowriter_samples_delay = infinite autopurge_disposed_samples_delay = infinite invalid_sample_visibility = MINIMUM_INVALID_SAMPLES
ENTITY_FACTORY	autoenable_created_entities = TRUE
SHARE	enable = FALSE name = NULL
READER_DATA_LIFESPAN	used = FALSE duration = INFINITE
USER_KEY	enable = FALSE expression = NULL

Built-in entities have default listener settings as well. The built-in Subscriber and all of its built-in Topics have nil listeners with all statuses appearing in their listener masks. The built-in DataReaders have nil listeners with no statuses in their masks.

The information that is accessible about the remote entities by means of the built-in topics includes all the QoS policies that apply to the corresponding remote Entity. The QoS policies appear as normal `'data'` fields inside the data read by means of the built-in Topic. Additional information is provided to identify the Entity and facilitate the application logic.

The tables below list the built-in topics, their names, and the additional information (beyond the QoS policies that apply to the remote entity) that appears in the data associated with the built-in topic.

ParticipantBuiltinTopicData

The *DCPSParticipant* topic communicates the existence of DomainParticipants by means of the ParticipantBuiltinTopicData datatype. Each ParticipantBuiltinTopicData sample in a Domain represents a DomainParticipant that participates in that Domain: a new ParticipantBuiltinTopicData instance is created when a newly added DomainParticipant is enabled, and it is disposed when that DomainParticipant is deleted. An updated ParticipantBuiltinTopicData sample is written each time the DomainParticipant modifies its UserDataQosPolicy.

Table 26 ParticipantBuiltinTopicData Members

Name	Type	Description
key	BuiltinTopicKey_t	Globally unique identifier of the participant
user_data	UserDataQosPolicy	User-defined data attached to the participant via a QosPolicy

TopicBuiltinTopicData

The *DCPSTopic* topic communicates the existence of topics by means of the TopicBuiltinTopicData datatype. Each TopicBuiltinTopicData sample in a Domain represents a Topic in that Domain: a new TopicBuiltinTopicData instance is created when a newly added Topic is enabled. However, the instance is not disposed when a Topic is deleted by its participant because a topic lifecycle is tied to the lifecycle of a Domain, not to the lifecycle of an individual participant. (See also Section 3.2.1.13, *delete_topic*, on page 154, which explains that a DomainParticipant can only delete its local proxy to the real Topic). An updated TopicBuiltinTopicData sample is written each time a Topic modifies one or more of its QosPolicy values.

Information published in the *DCPSTopicTopic* is critical to the data distribution service, therefore it cannot be disabled by means of the Domain/BuiltinTopics element in the configuration file.

Table 27 TopicBuiltinTopicData Members

Name	Type	Description
key	BuiltinTopicKey_t	Global unique identifier of the Topic
name	String	Name of the Topic
type_name	String	Type name of the Topic (*i.e.* the fully scoped IDL name)
durability	DurabilityQosPolicy	QosPolicy attached to the Topic

Table 27 TopicBuiltinTopicData Members (continued)

Name	Type	Description
durability_service	DurabilityServiceQosPolicy	QosPolicy attached to the Topic
deadline	DeadlineQosPolicy	QosPolicy attached to the Topic
latency_budget	LatencyBudgetQosPolicy	QosPolicy attached to the Topic
liveliness	LivelinessQosPolicy	QosPolicy attached to the Topic
reliability	ReliabilityQosPolicy	QosPolicy attached to the Topic
transport_priority	TransportPriorityQosPolicy	QosPolicy attached to the Topic
lifespan	LifespanQosPolicy	QosPolicy attached to the Topic
destination_order	DestinationOrderQosPolicy	QosPolicy attached to the Topic
history	HistoryQosPolicy	QosPolicy attached to the Topic
resource_limits	ResourceLimitsQosPolicy	QosPolicy attached to the Topic
ownership	OwnershipQosPolicy	QosPolicy attached to the Topic
topic_data	TopicDataQosPolicy	QosPolicy attached to the Topic

PublicationBuiltinTopicData

The *DCPSPublication* topic communicates the existence of datawriters by means of the PublicationBuiltinTopicData datatype. Each PublicationBuiltinTopicData sample in a Domain represents a datawriter in that Domain: a new PublicationBuiltinTopicData instance is created when a newly added DataWriter is enabled, and it is disposed when that DataWriter is deleted. An updated PublicationBuiltinTopicData sample is written each time the DataWriter (or the Publisher to which it belongs) modifies a QosPolicy that applies to the entities connected to it. Also will it be updated when the writer looses or regains its liveliness.

The *PublicationBuiltinTopicData* Topic is also used to return data through the get_matched_publication_data operation on the DataReader as described in Section 3.5.2.13, *get_matched_publication_data*, on page 375.

Table 28 PublicationBuiltinTopicData Members

Name	Type	Description
key	BuiltinTopicKey_t	Global unique identifier of the DataWriter
participant_key	BuiltinTopicKey_t	Global unique identifier of the Participant to which the DataWriter belongs
topic_name	String	Name of the Topic used by the DataWriter

Table 28 PublicationBuiltinTopicData Members (continued)

Name	Type	Description
type_name	String	Type name of the Topic used by the DataWriter
durability	DurabilityQosPolicy	QosPolicy attached to the DataWriter
deadline	DeadlineQosPolicy	QosPolicy attached to the DataWriter
latency_budget	LatencyBudgetQosPolicy	QosPolicy attached to the DataWriter
liveliness	LivelinessQosPolicy	QosPolicy attached to the DataWriter
reliability	ReliabilityQosPolicy	QosPolicy attached to the DataWriter
lifespan	LifespanQosPolicy	QosPolicy attached to the DataWriter
destination_order	DestinationOrderQosPolicy	QosPolicy attached to the DataWriter
user_data	UserDataQosPolicy	QosPolicy attached to the DataWriter
ownership	OwnershipQosPolicy	QosPolicy attached to the DataWriter
ownership_strength	OwnershipStrengthQosPolicy	QosPolicy attached to the DataWriter
presentation	PresentationQosPolicy	QosPolicy attached to the Publisher to which the DataWriter belongs
partition	PartitionQosPolicy	QosPolicy attached to the Publisher to which the DataWriter belongs
topic_data	TopicDataQosPolicy	QosPolicy attached to the Topic used by the DataWriter
group_data	GroupDataQosPolicy	QosPolicy attached to the Publisher to which the DataWriter belongs

SubscriptionBuiltinTopicData

The *DCPSSubscription* topic communicates the existence of datareaders by means of the SubscriptionBuiltinTopicData datatype. Each SubscriptionBuiltinTopicData sample in a Domain represents a datareader in that Domain: a new SubscriptionBuiltinTopicData instance is created when a newly added DataReader is enabled, and it is disposed when that DataReader is deleted. An updated SubscriptionBuiltinTopicData sample is written each time the DataReader (or the Subscriber to which it belongs) modifies a QosPolicy that applies to the entities connected to it.

The *SubscriptionBuiltinTopicData* Topic is also used to return data through the get_matched_subscription_data operation on the DataWriter as described in Section 3.4.2.9, *get_matched_subscription_data*, on page 276.

Table 29 SubscriptionBuiltinTopicData Members

Name	Type	Description
key	BuiltinTopicKey_t	Global unique identifier of the DataReader
participant_key	BuiltinTopicKey_t	Global unique identifier of the Participant to which the DataReader belongs
topic_name	String	Name of the Topic used by the DataReader
type_name	String	Type name of the Topic used by the DataReader
durability	DurabilityQosPolicy	QosPolicy attached to the DataReader
deadline	DeadlineQosPolicy	QosPolicy attached to the DataReader
latency_budget	LatencyBudgetQosPolicy	QosPolicy attached to the DataReader
liveliness	LivelinessQosPolicy	QosPolicy attached to the DataReader
reliability	ReliabilityQosPolicy	QosPolicy attached to the DataReader
ownership	LifespanQosPolicy	QosPolicy attached to the DataReader
destination_order	DestinationOrderQosPolicy	QosPolicy attached to the DataReader
user_data	UserDataQosPolicy	QosPolicy attached to the DataReader
time_based_filter	TimeBasedFilterQosPolicy	QosPolicy attached to the DataReader
presentation	PresentationQosPolicy	QosPolicy attached to the Subscriber to which the DataReader belongs
partition	PartitionQosPolicy	QosPolicy attached to the Subscriber to which the DataReader belongs
topic_data	TopicDataQosPolicy	QosPolicy attached to the Topic used by the DataReader
group_data	GroupDataQosPolicy	QosPolicy attached to the Subscriber to which the DataReader belongs

Other built-in topics

There are a number of other built-in topics that have not been mentioned. These topics (*e.g.* DCPSDelivery, DCPSHeartbeat and potentially some others) are proprietary and for internal use only. Users are discouraged from doing anything with these topics, so as not to interfere with internal mechanisms that rely on them. The structure of these topics may change without notification.

Bibliography

Bibliography

[1] *OMG Data Distribution Service Revised Final Adopted Specification ptc/04-03-07*, Object Management Group

[2] *OMG C++ Language Mapping Specification formal/99-07-35*, Object Management Group (OMG)

[3] *OMG The Common Object Request Broker: Architecture and Specification*, Version 3.0, formal/02-06-01, Object Management Group

Glossary

Glossary

Acronyms

Acronym	Meaning
CORBA	Common Object Request Broker Architecture
DCPS	Data Centric Publish/Subscribe
DDS	Data Distribution Service
IDL	Interface Definition Language
OMG	Object Management Group
ORB	Object Request Broker
QoS	Quality of Service
SPLICE	Subscription Paradigm for the Logical Interconnection of Concurrent Engines

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