dockeROS

Simply running ros nodes in docker containers on remote robots.

Fraunhofer IPA

Cloud Robotics

“Making use of centralized computational resources in robotics.”

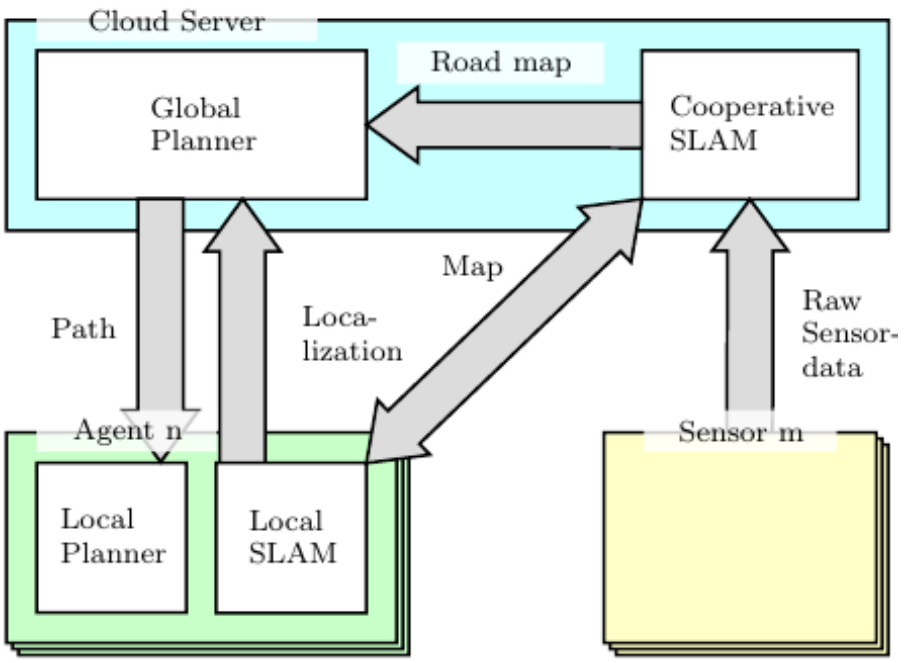
- Unlimited computational power
- **Distributed Systems**
- Usage-based billing
- On-demand Services
- **Edge Computing**

- ROS can do a lot of this
- Especially with ROS2
- Open challenge:

deployment

Fraunhofer IPA

Example: Cloud Navigation



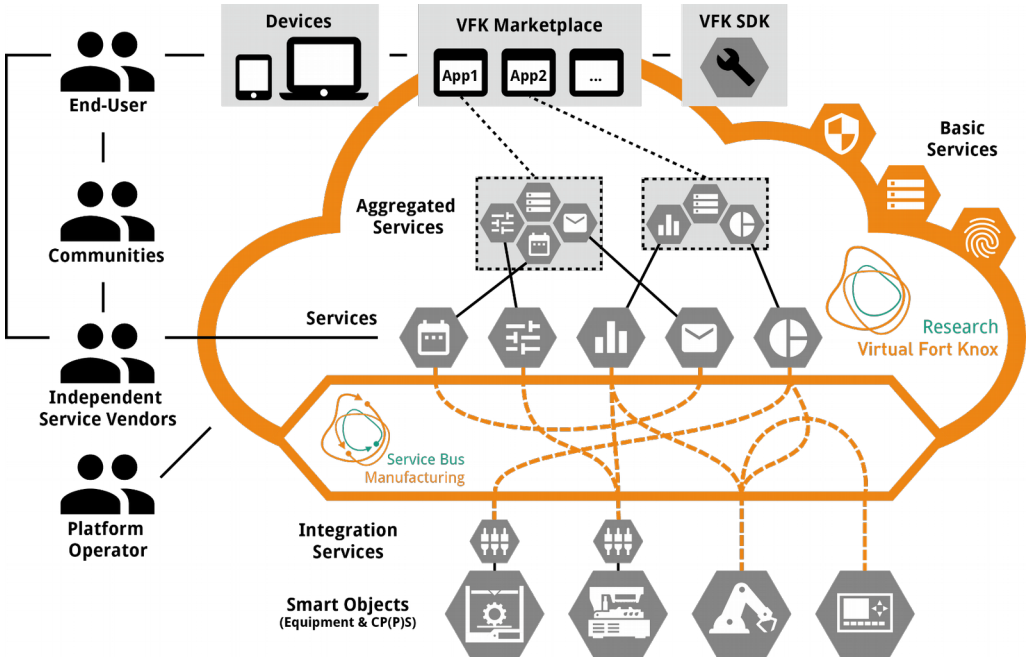
- Holistic Environment Model
- Global Planning
- External Sensors / Localization
- Cost Scaling Sensors / Computation

- Source:

Abbenseth, J., Lopez, F. G., Henkel, C., & Dörr, S. (2017). Cloud-Based Cooperative Navigation for Mobile Service Robots in Dynamic Industrial Environments. http://doi.org/10.1145/3019612.3019710

Fraunhofer IPA

Learnings from Cloud Navigation



- Cloud deployment: done
- Integration in Robot: done
- Integration to Robot: done
  - `vfk_msb_client`
- Open point: **Robot deployment**
  - Many systems
  - Industrial Environments

Fraunhofer IPA

Docker Intro

- **Image**
  - A binary contained with all its dependencies
  - A VM but **not**
- **Dockerfile**
  - Defines Image
  - Incremental

```
FROM ros:kinetic-ros-base
RUN apt-get update
RUN mkdir -p /ws/src/hello_world
COPY . /ws/src/hello_world
ENV ROS_PACKAGE_PATH=/ws/src/hello_world
RUN rosdep install -y -r --from-path /ws/src
RUN source /opt/ros/$ROS_DISTRO/setup.bash;\
 cd /ws/src;\
 catkin_init_workspace;\
 cd /ws;\
 catkin_make
RUN rm -rf /var/lib/apt/lists/*
CMD ["/ros_entrypoint.sh", \
 "rosrun", "hello_world", "talker"]
```

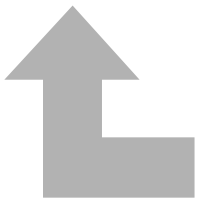
Docker Intro II

- **Registry**
  - A repository to store images
  - Public: hub.docker.com
- **Container**
  - A running image
- **Docker Host**
  - A place to run an image
  - Remotely accessible

kubernetes

dockeROS

Simply running ros nodes in docker containers on remote robots.



1. **UX**
2. **“only” plumbing**

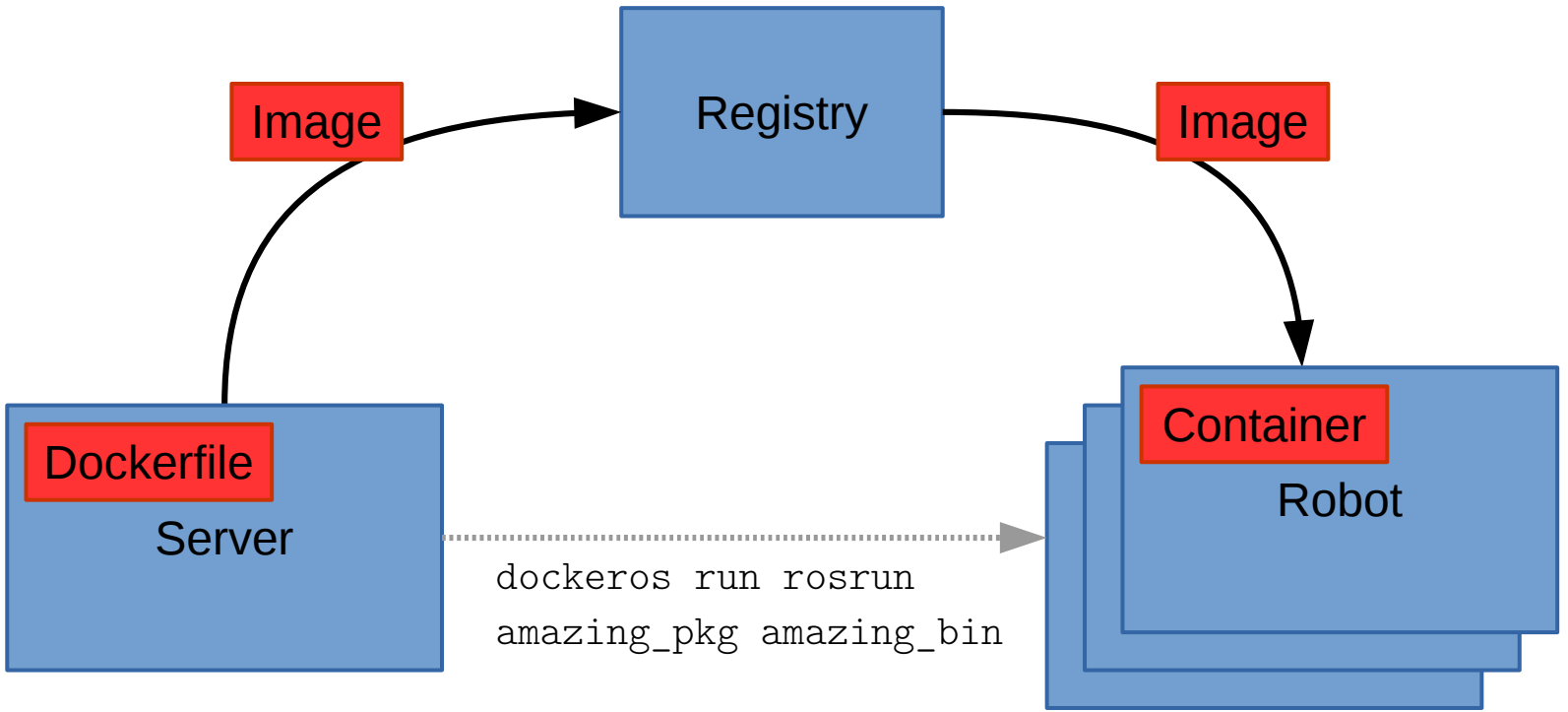
Fraunhofer IPA

dockeROS

- https://github.com/ct2034/dockeros
- License: BSD
- Reimplemented from zero
- <1000 lines of code
- Library
  - CLI
  - ...

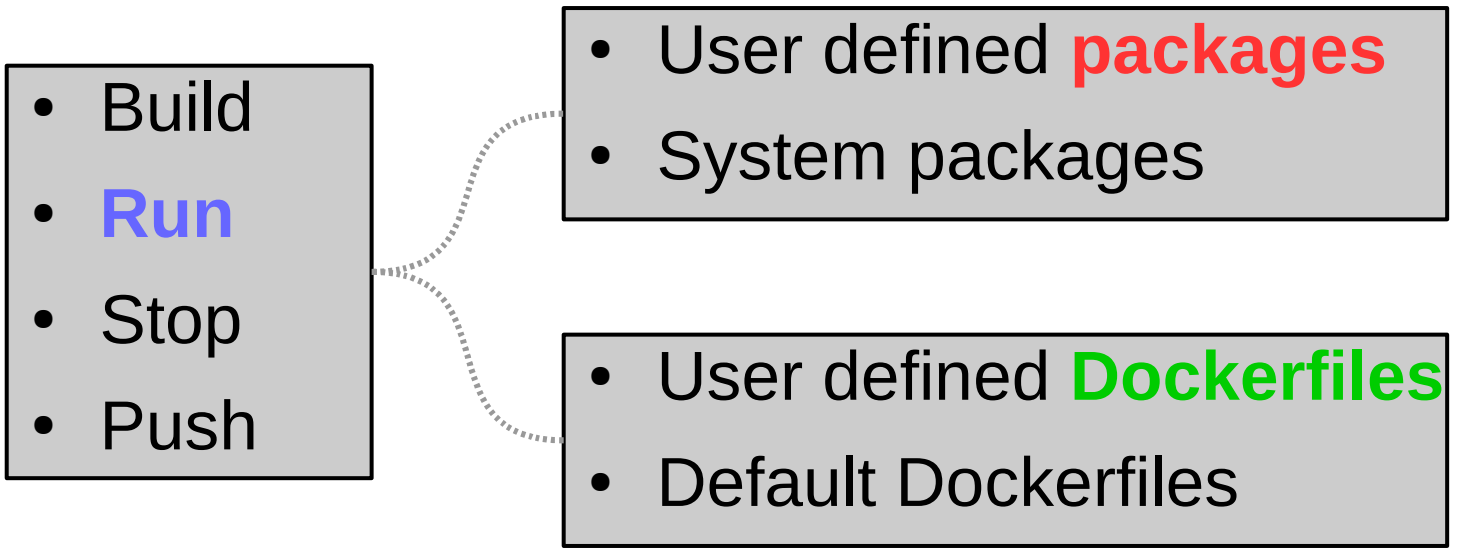
```
usage: dockeros [-h] [-e | -i HOST:PORT] [-f DOCKERFILE] [-n]
                {build,run,stop,push} ...
Simply running ros nodes in docker containers on remote robots.
positional arguments:
  {build,run,stop,push}
                        build: Creates an image that can run
roscommand
                        run: Runs an image with your_roscommand
(and builds it first)
                        stop: Stops image that runs that command
                        push: Push image to predefined registry
  roscommand            Everything after the subcommand will be
interpreted as the ros command to be run in your image
optional arguments:
  -h, --help            show this help message and exit
  -e, --env             use the existing docker environment (see
https://dockr.ly/2zMPc17 for details)
  -i HOST:PORT, --ip HOST:PORT, --host HOST:PORT
                        set the host (robot) to deploy image to
  -f DOCKERFILE, --dockerfile DOCKERFILE
                        use a custom Dockerfile
  -n, --no-build        dont (re-)build the image before running
```

dockerROS: Architecture



dockeROS: CLI

```
dockeros run rosrun amazing_pkg amazing_bin
```



Fraunhofer IPA

Edge Computing in Automation

- Web-based GUI
- Define SW running on edge devices
- dockeros is part of it

dockeROS: Bottom Line

- Simply running ros nodes in docker containers on remote robots.
- Future work:
  - Uses of library
  - roslaunch
  - ROS2
- **We are taking pull requests**
  - https://github.com/ct2034/dockeros
- Contact:
  - christian.henkel@ipa.fraunhofer.de

Fraunhofer IPA