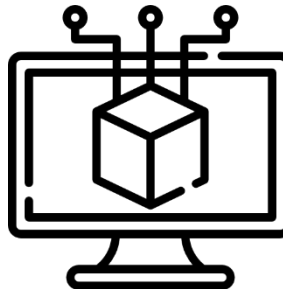
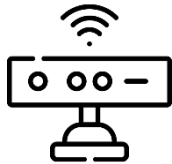


# Autonomous Driving Software Engineering

Prof. Dr.-Ing. Markus Lienkamp

Phillip Karle, M. Sc.



# Localization & Mapping II: Practice

Real-world data demonstration

Homework will be with Python as usual

## Agenda

- 1 Introduction and inspection of data base
- 2 LiDAR SLAM: Cartographer
- 3 Visual SLAM: openVSLAM

# Localization & Mapping II: Practice

**Kitti Dataset:** <http://www.cvlibs.net/datasets/kitti/>

Challenges for algorithms (SLAM, detection, etc.)

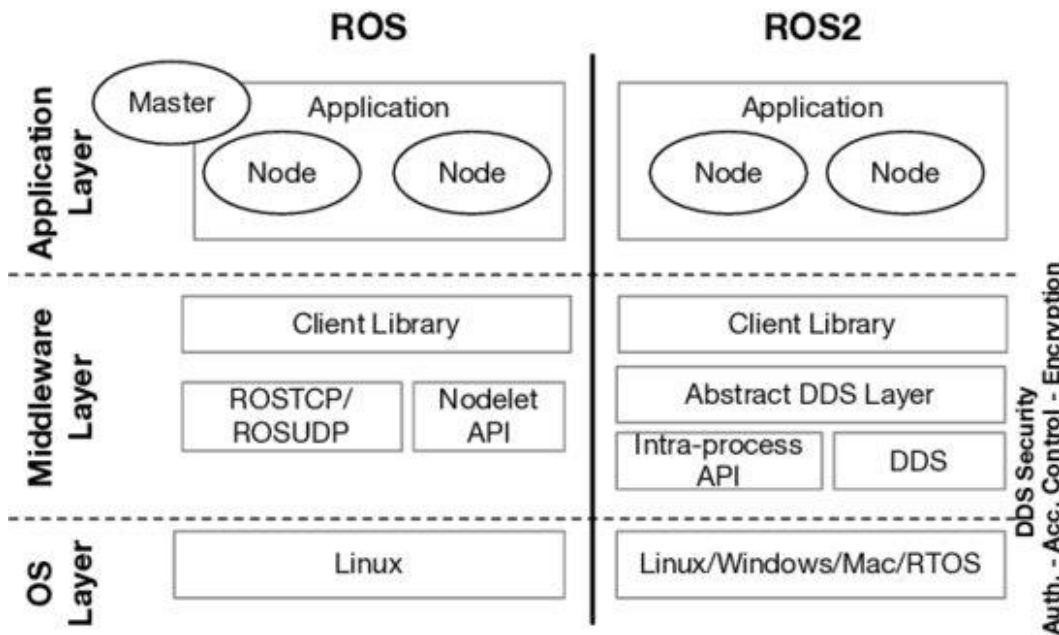


# Localization & Mapping II: Practice

## What is ROS(2) ?

Robot **O**perating **S**ystem

Middleware specialized for robot applications



# Localization & Mapping II: Practice

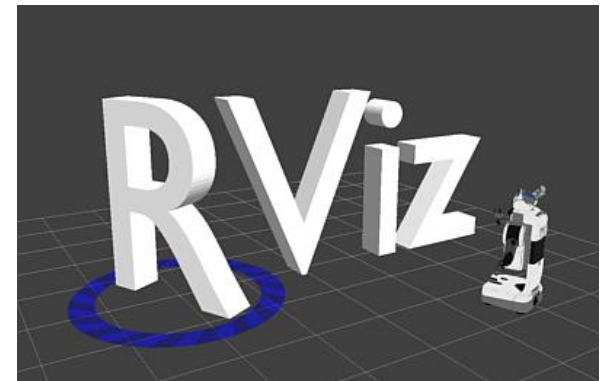
## What is ROS(2) ?

Open Source

Big community and available projects

Predefined and standardized messages

Existing tools can be used for faster development progress



# Localization & Mapping II: Practice

## Cartographer

Developed by Google

LiDAR SLAM, Graph-optimization backend (Ceres solver)

Hierarchical approach: Use of submaps

Applicable in 2D and 3D

<https://google-cartographer.readthedocs.io/en/latest/>

# Localization & Mapping II: Practice

**openVSLAM**



**OpenVSLAM**

Visual SLAM, Graph-optimization backend (g2o solver)

Indirect method: Use of ORB features

Applicable for mono- and stereo-camera

Integrated visualization, ROS and ROS2 interfaces

<https://github.com/xdspacelab/openvslam>