The Basics of ROS Applied to Self-Driving Cars

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What is ROS?

“The Robot Operating System (ROS) is a set of software libraries and tools that help you build robot applications. From drivers to state-of-the-art algorithms, and with powerful developer tools, ROS has what you need for your next robotics project. And it's all open source.”
Why Use ROS?

**Without ROS**
- Build Device Drivers
- Build a Communications Framework
- Write algorithms for perception, navigation, and motion planning
- Implement logging, control, and error handling

**With ROS**
- Logging, error handling, communications framework, drivers for standard devices
- Algorithms for perception, navigation and motion planning
- Tools for visualization, simulation and analysis
How Do SDCs Work?

Perception + Decision Making → Actuation
ROS Nodes

ROS splits these high level tasks in low level ones and spawns a Unix thread for each of them.

Perception
- Camera
- GPS
- LIDAR
- Wheel Encoder
- Radar

Decision Making
- Path Planning
- Trajectory Sampling
- Deep Learning

Actuation
- Steering
- Brakes
- Throttle

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ROS nodes communicate with each other over **topics**

- If you want to send messages, you **publish** to a topic
- If you want to receive messages, you **subscribe** to a topic

**ROS Topics**

- Camera
  - Image
  - `/camera_images`
  - images
  - Image Recognition
ROS provides over 200 predefined messages and the ability to create custom ones.

### ROS Messages

**Physical Properties**
- Time
- Rotate
- Accel
- Vel

**Sensor Reading**
- IMU
- Point Cloud
- GPS
- Image

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SDC Example
ROS Limitations
SDC Nanodegree Program

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