



ROS

Using ROS for Robots Development and Simulation

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Introduction of ROS

- **ROS** is an open-source robot operating system
- ROS is a set of software libraries and tools
- help you build robot applications from drivers to state-of-the-art algorithms
- Aims to simplify the task of creating complex and robust robot behavior across a wide variety of robotic platforms
- Prototyped at **Stanford University** and currently developed and maintained by **Willow Garage**

History of ROS

I

Indigo Igloo
April 2014



Hydro Medusa
4 September 2013



Groovy Galapagos
31 December 2012



Fuerte Turtle
23 April 2012



Electric Emys
30 August 2011



Diamondback
02 March 2011



C Turtle
02 August 2010



Box Turtle
02 March 2010

Box Turtle

History of ROS



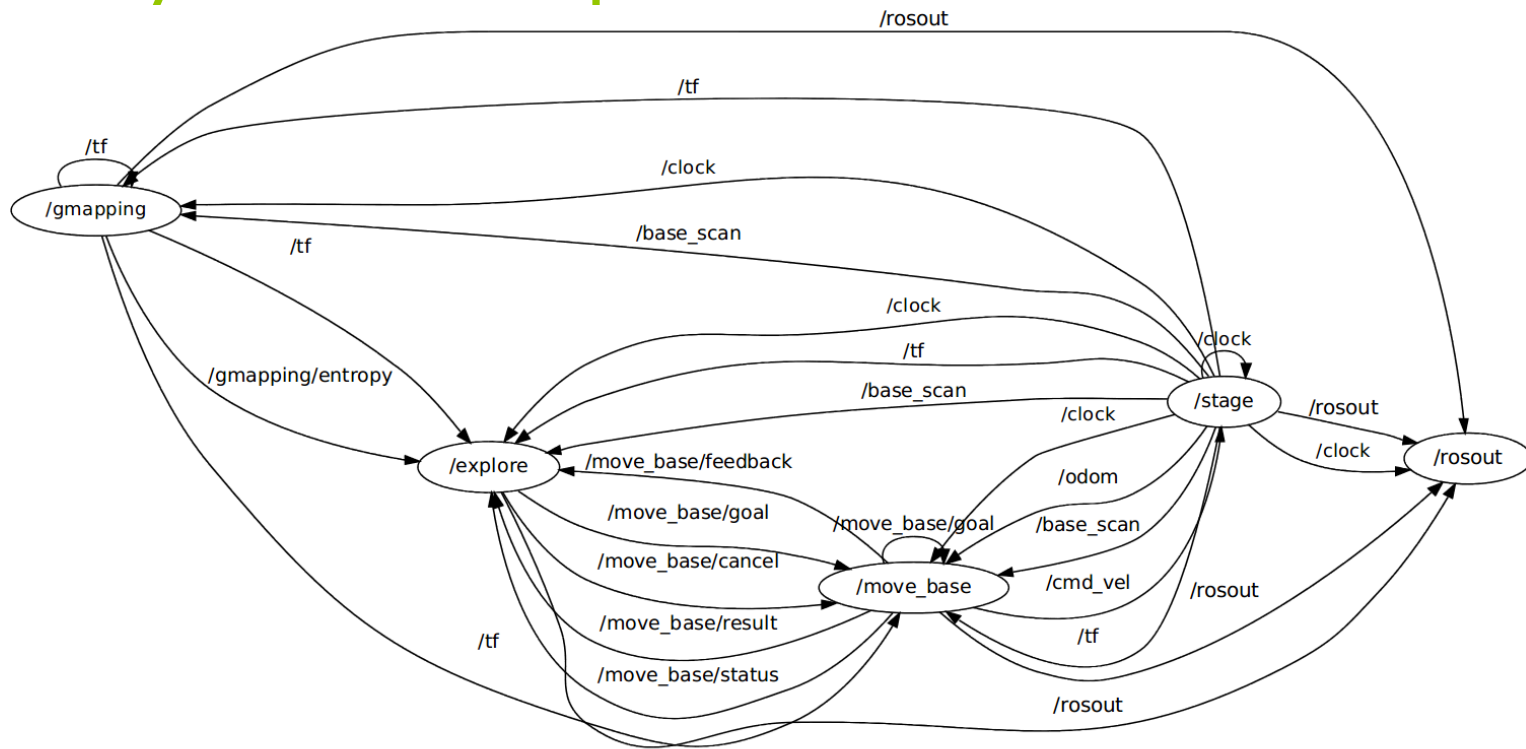
Main Features

- ◉ Best supported by Linux Ubuntu 12.04 LTS
- ◉ is a soft real-time architecture for robots
- ◉ Language independent. Support C/C++, Python, LISP, etc.
- ◉ Provides hardware abstraction, low-level device control
- ◉ Message passing between processes
- ◉ Implementation of commonly used algorithms
- ◉ Community (ecosystem) and hundreds of packages available
- ◉ Visualization / Simulation and Debugging tools

Key Concepts

- **Nodes** are processes where computation is done. Each node has a single functionality and two nodes can communicate using topics.
- **Topic** is the mechanism to send data among different nodes.
- **Master** provides name registration and lookup service to make it possible for a node to find another.
- **Message** contains data that sends information to other nodes.
- **Services** is another communication method when a response is needed.

Key Concepts

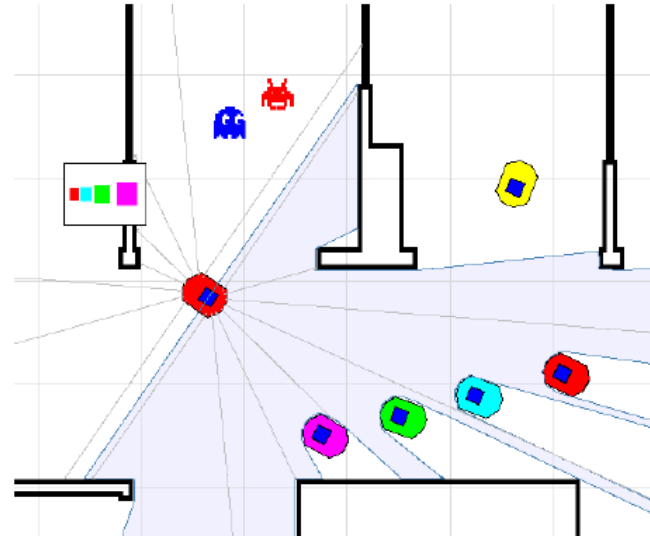
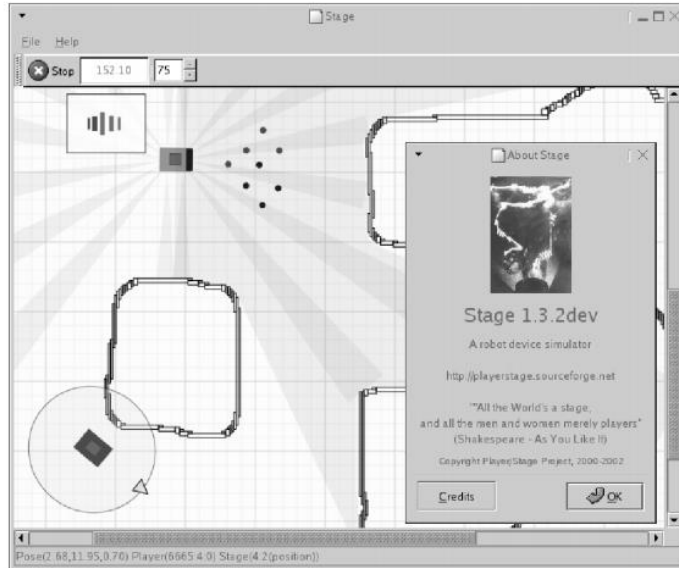


Sensors

- ◉ 1D/2D/3D range finders
- ◉ Cameras
- ◉ Force/torque/touch sensors
- ◉ Motion capture systems
- ◉ Pose estimation
- ◉ Audio/Speech recognition
- ◉ Actuator interfaces

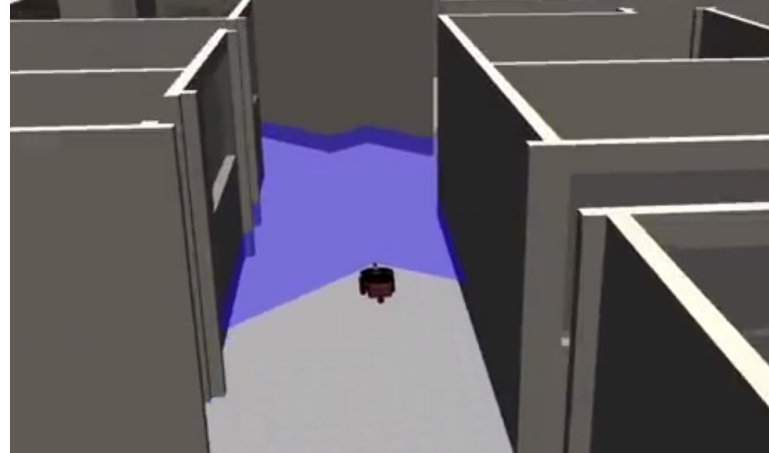
2D Simulator: Stage

- **Stage** is a 2D simulator for multi robot systems
- Models for sensors and simple objects



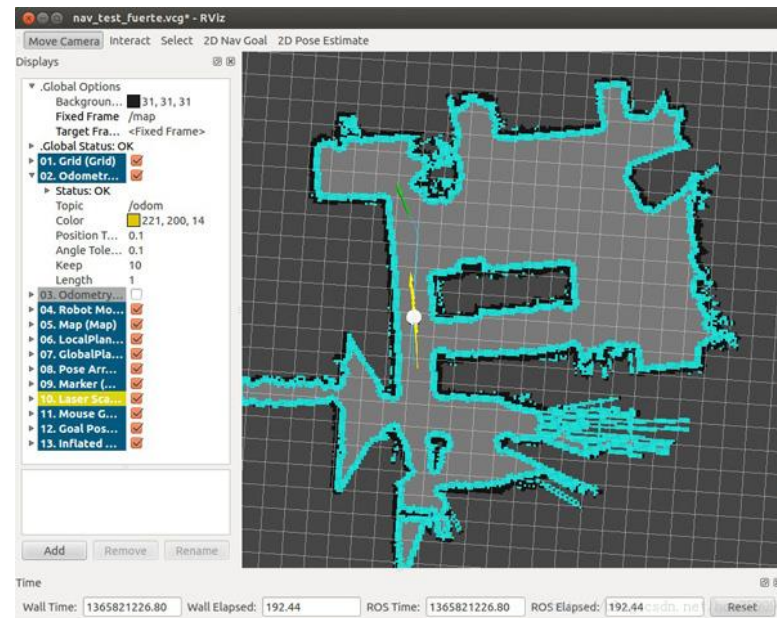
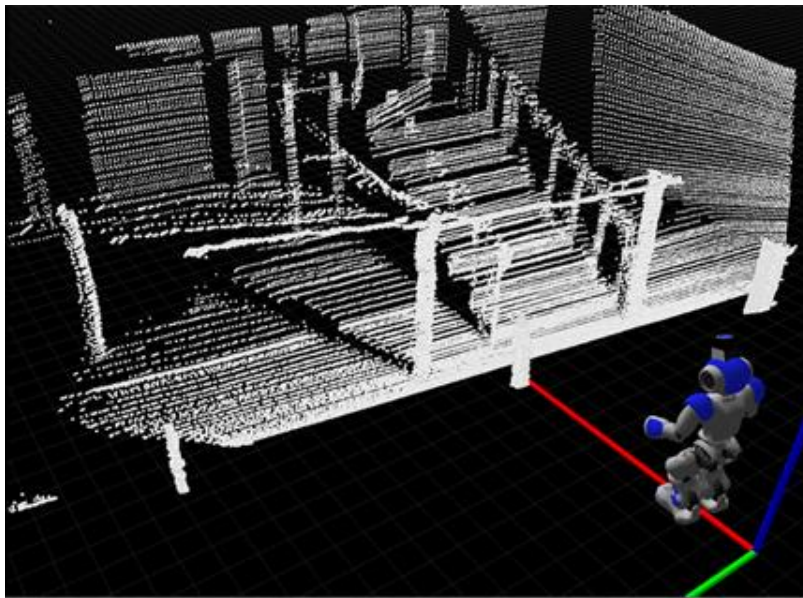
3D Simulator: Gazebo

- **Gazebo** is focused on 3D robot simulations in realistic environments
- Realistic physics / dynamics simulation (ODE/Bullet)
- Models for complex robot actuators and sensors
- Official Simulator of DARPA Robotics Challenge



rviz and Visualization

- RVIZ, on the other hand, is a 3D visualization tool of ROS
- can be used for sensor data visualization and SLAM



Robots Using ROS



Nao



Willowgarage PR2



Baxter



Care-o-Bot



Toyota Helper



Gostai Jazz



Robonaut



Peplebot



Kuka YouBot



Guardian



Husky A200



Summit



Turtlebot



Erratic



Qbo



AR.Drone



REEM-C



AscTec Pelican



Lego NXT

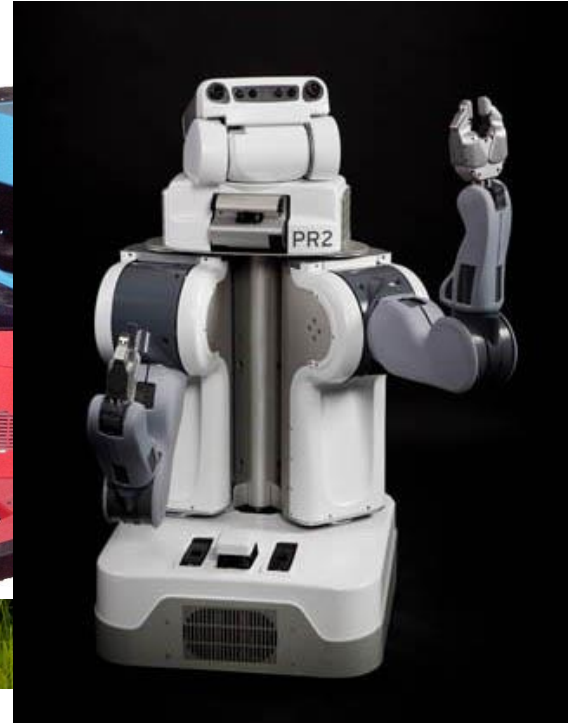


Pioneer



SIA 10D

Robots Using ROS





Thank You!