MINESWEEPERS
TOWARDS A LANDMINE-FREE WORLD
WWW.LANDMINEFREE.ORG
Robotics Operating System
Agenda

• What is ROS?
• Why should we use ROS?
• ROS Distribution
• ROS Installation

• ROS Concepts
  • Workspace
  • Package
  • Nodes
  • Master
  • Topics
  • Messages
  • Bag
  • Service
  • Parameter Server

• Q&A
What is ROS?
What is ROS? (cont.)

- **Hardware Abstraction**
- **Device Drivers**
- **Package Management**
- **Message – Passing**
  - Network
  - Process 1
    - CPU 1
    - MEM 1
  - Process 2
    - CPU 2
    - MEM 2
  - Process 3
    - CPU 3
    - MEM 3
  - Process 4
    - CPU 4
    - MEM 4

Visualizing
Why should we go for ROS?

Research work

Industry
Why should we go for ROS?
Why should we go for ROS? (cont.)

http://wiki.ros.org/Robots

http://wiki.ros.org/Sensors
## ROS Distributions

<table>
<thead>
<tr>
<th>Distribution</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROS Khebi Kamie</td>
<td>May, 2016</td>
</tr>
<tr>
<td>ROS Jade Turtle</td>
<td>May 23rd, 2015</td>
</tr>
<tr>
<td>ROS Haoyi Dragon</td>
<td>July 22nd, 2014</td>
</tr>
<tr>
<td>ROS Hydro Medusa</td>
<td>September 4th, 2013</td>
</tr>
<tr>
<td>ROS Groovy Galapagos</td>
<td>December 31, 2012</td>
</tr>
<tr>
<td>ROS Groo Octo</td>
<td>July, 2014</td>
</tr>
<tr>
<td>ROS Fuerte Turtle</td>
<td>April 23, 2012</td>
</tr>
<tr>
<td>ROS Electric Enys</td>
<td>August 30, 2011</td>
</tr>
<tr>
<td>ROS Diamondback</td>
<td>March 2, 2011</td>
</tr>
<tr>
<td>ROS C Turtle</td>
<td>August 2, 2010</td>
</tr>
<tr>
<td>ROS Box Turtle</td>
<td>March 2, 2010</td>
</tr>
</tbody>
</table>
ROS Distributions

• ROS Indigo
• Ubuntu 14.04
Installation Instruction

• Install ubuntu 14.04 on your machine or vm
• Open the terminal and update the package manager
  sudo apt-get update
• Follow the instructions in this tutorial, here
ROS Tools

- rospack
- rosininstall
- rosls
- catkin
- rosdn
- rosrnn
ROS Concepts
Work-space
Catkin

- Available for ROS Groovy and later distributions
- Sample of commands:
  - `catkin_init_workspace`
  - `catkin_make`
Example

• Creating ROS workspace, [here]
Package

• Each package folder must contain
  • package.xml
  • CMakeLists.txt
• Create package using
  • catkin_create_pkg
• Build package using catkin
  • catkin_make
Example

• Creating ROS Package, [here](#)
• Building ROS package, [here](#)
ROS Tools for Packages

- rospack
- rospack find [package_name]
- roscd [locationname[/subdir]]
- rosls [locationname[/subdir]]
More details

• About package package.xml file, find here
• About package CMakeLists.txt file, find here
Node

ROS
Node

ROS Package

Nodes
Node
... logging to ~/.ros/log/9cf88ce4-b14d-11df-8a75-00251148e8cf/roslaunch-machine_name-1303
9.log
Checking log directory for disk usage. This may take awhile.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://machine_name:33919/
ros_comm version 1.4.7

SUMMARY
========

PARAMETERS
* /rosversion
* /rosdistro

NODES

auto-starting new master
process[master]: started with pid [13054]
ROS_MASTER_URI=http://machine_name:11311/

setting /run_id to 9cf88ce4-b14d-11df-8a75-00251148e8cf
process[roscat-1]: started with pid [13067]
started core service [/rosout]
rosnode

rosnode list  
rosnode info [node name]
rosrun

rosrun [package name] [node name]
rosrun [package name] [node name] [param name]=[value]

Example found [here](#)
ROS Master
ROS Master
... logging to ~/.ros/log/9cf88ce4-b14d-11df-8a75-00251148e8cf/roslaunch-machine_name-1303
9.log
Checking log directory for disk usage. This may take awhile.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started ros launch server http://machine_name:33919/
ros_comma version 1.4.7

SUMMARY
========

PARAMETERS
  * /rosversion
  * /rosdistro

NODES

auto-starting new master
process[master]: started with pid [13054]
ROS_MASTER_URI=http://machine_name:11311/

setting /run_id to 9cf88ce4-b14d-11df-8a75-00251148e8cf
process[rosout-1]: started with pid [13067]
started core service [/rosout]
Example

- Master
  - Advertise(images)
- Camera
- Image viewer
Example
Example
ROS Master Details

• Read about XMLRPC API [here](#)
• Implementation for rosmaster package , [here](#)
Topics
Publishing
Subscribing
Topics
rqt_graph

rosrun rqt_graph rqt_graph
rostopic

• rostopic echo [topic name]
• rostopic list
• rostopic -h
Messages
Publisher
Subscriber
rostopic

- rostopic type to determine the type of the topic
- View details of the message using rosmsg show [message name]
Publishing a message on topic

- rostopic pub publishes data on to a topic currently advertised
- A good example [here](#)
ROS Bag
ROS Bag

- rosbag
- rqt_bag
Services vs Topics

ROS Node

ROS Node

ROS Node
Services

ROS Node Provider

Service 1

ROS Node Client

MINESWEEPERS
TOWARDS A LANDMINE-FREE WORLD
Services

ROS Node Provider

Service 1

ROS Node Client
Services Type

my_package/srv/PolledImage.srv -> my_package/PolledImage
rosservice

• rosservice list
• rosservice call [service name]
• rosservice type [service name]
Parameter Server
Parameter Server
Storing Parameters

/camera/left/name: leftcamera
/camera/left/exposure: 1
/camera/right/name: rightcamera
/camera/right/exposure: 1.1
Calling Parameters

/camer4a/left/name
leftcamera
Calling Parameters

/camer4a/left
name :leftcamera
Exposure : 1
Parameter Types

• XMLRPC data types for parameter values, which include:
  • 32-bit integers
  • booleans
  • strings
  • doubles
  • iso8601 dates
  • lists
  • base64-encoded binary data
Private Parameters

camera/left/~name : leftcamera
Calling Private Parameters

rosrun rospy_tutorials talker _param:=1.0
rosparam

- rosparm list
- rosparm set [parameter name] [value]
- rosparm get [parameter name]
Examples

• Creating a ros message and ros service, [here](#)
• Creating a simple ros publisher and subscriber nodes
  • Using c++, [here](#)
  • Using python, [here](#)
  • Examination

• Creating a simple ros Service and client nodes
  • Using c++, [here](#)
  • Using python, [here](#)
  • Examination
Thank you 😊