



# MINESWEEPERS

TOWARDS A LANDMINE-FREE WORLD

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# Robotics Operating System

ROS



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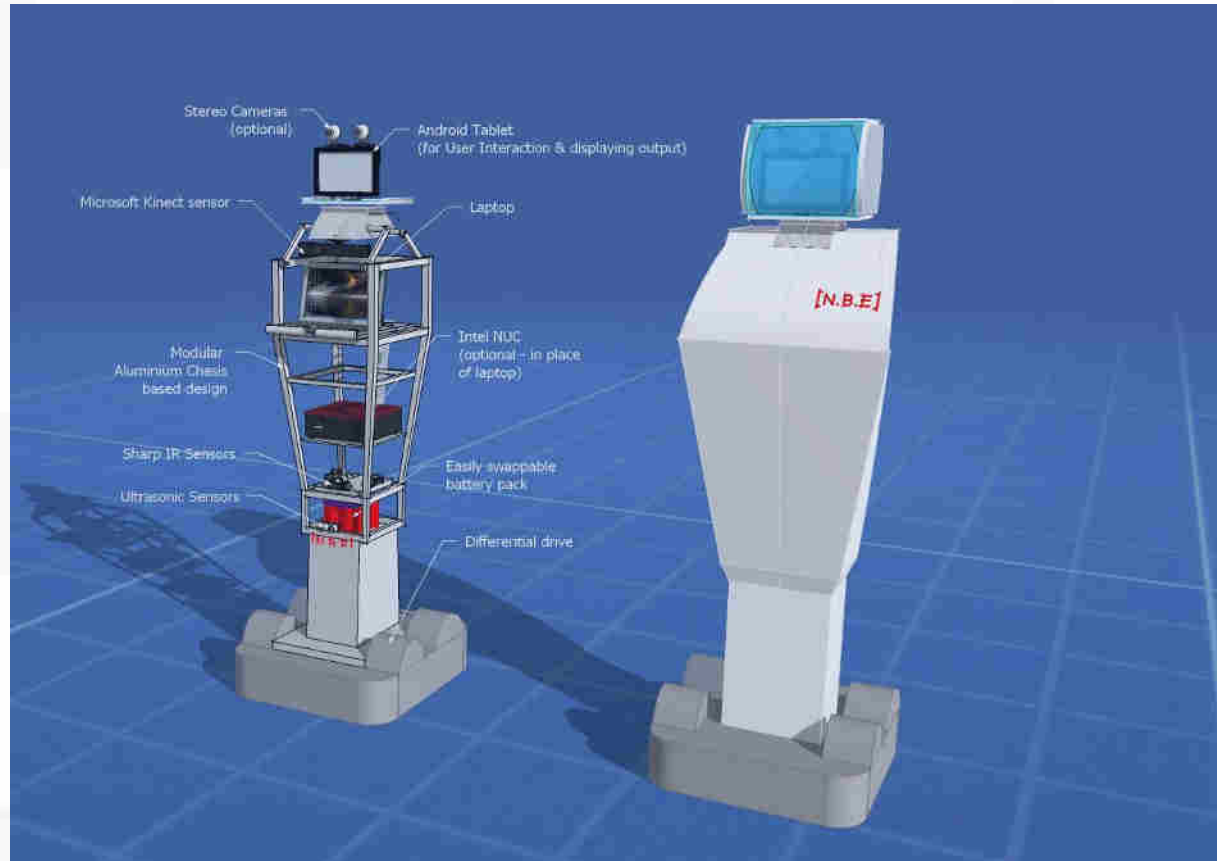


# Agenda

- 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 ?

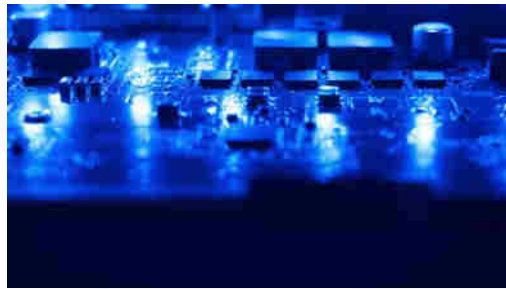


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# What is ROS ? (cont.)

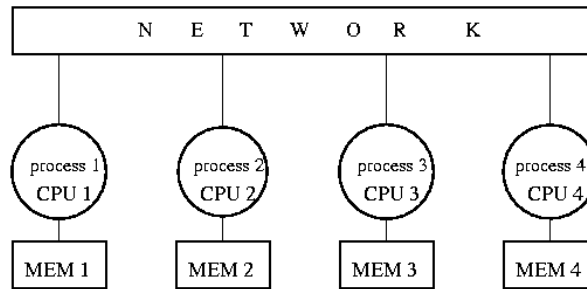
## Hardware Abstraction



## Device Drivers



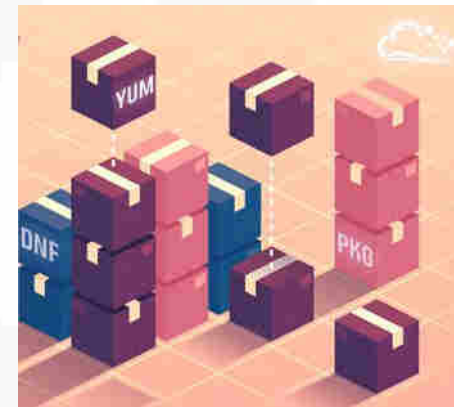
## Message – Passing



## Visualizing



## Package Management



# Why should we go for ROS ?

## Research work



## Industry



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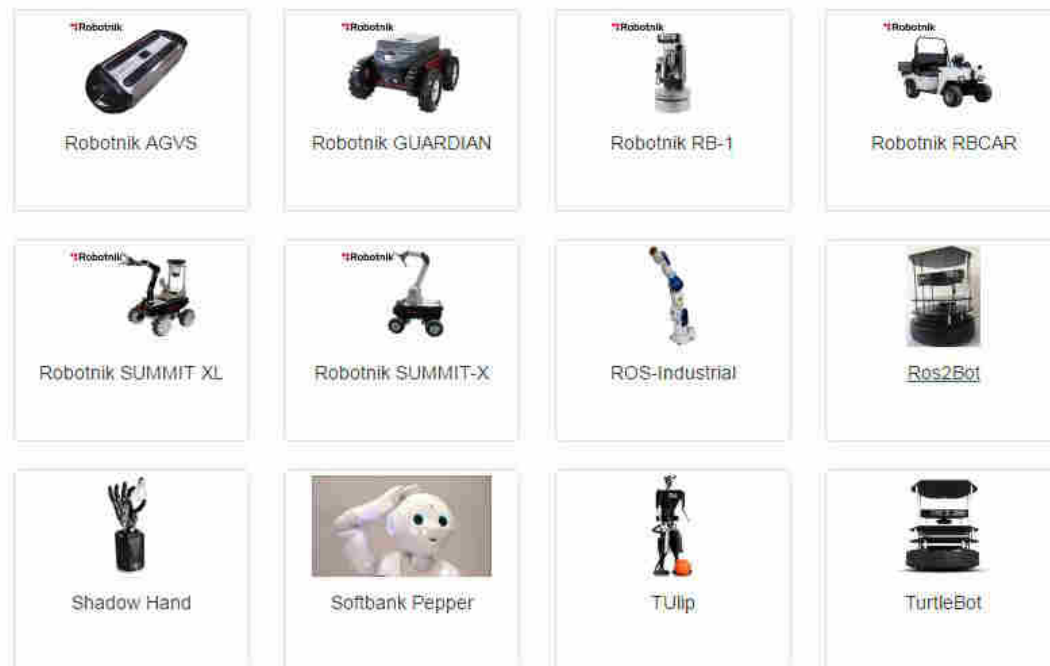
# Why should we go for ROS ?



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



<http://wiki.ros.org/Robots>



<http://wiki.ros.org/Sensors>























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# ROS Distributions

ROS Kinetic Kame	May, 2016			May, 2021
ROS Jade Turtle (Recommended for Latest)	May 23rd, 2015			May, 2017
ROS Indigo Igloo (Recommended for Stability)	July 22nd, 2014			April, 2019 (Trusty EOL)
ROS Hydro Medusa	September 4th, 2013			May, 2015
ROS Groovy Galapagos	December 31, 2012			July, 2014

<a href="#">ROS Fuerte Turtle</a>	April 23, 2012			...
<a href="#">ROS Electric Elys</a>	August 30, 2011			...
<a href="#">ROS Diamondback</a>	March 2, 2011			...
<a href="#">ROS C Turtle</a>	August 2, 2010			...
<a href="#">ROS Box Turtle</a>	March 2, 2010			...

☐ Box Turtle



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# ROS Distributions

- ROS Indigo
- Ubuntu 14.04



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# 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**

**roscd**

**rosls**

**catkin**

**roscd**

**roscd**



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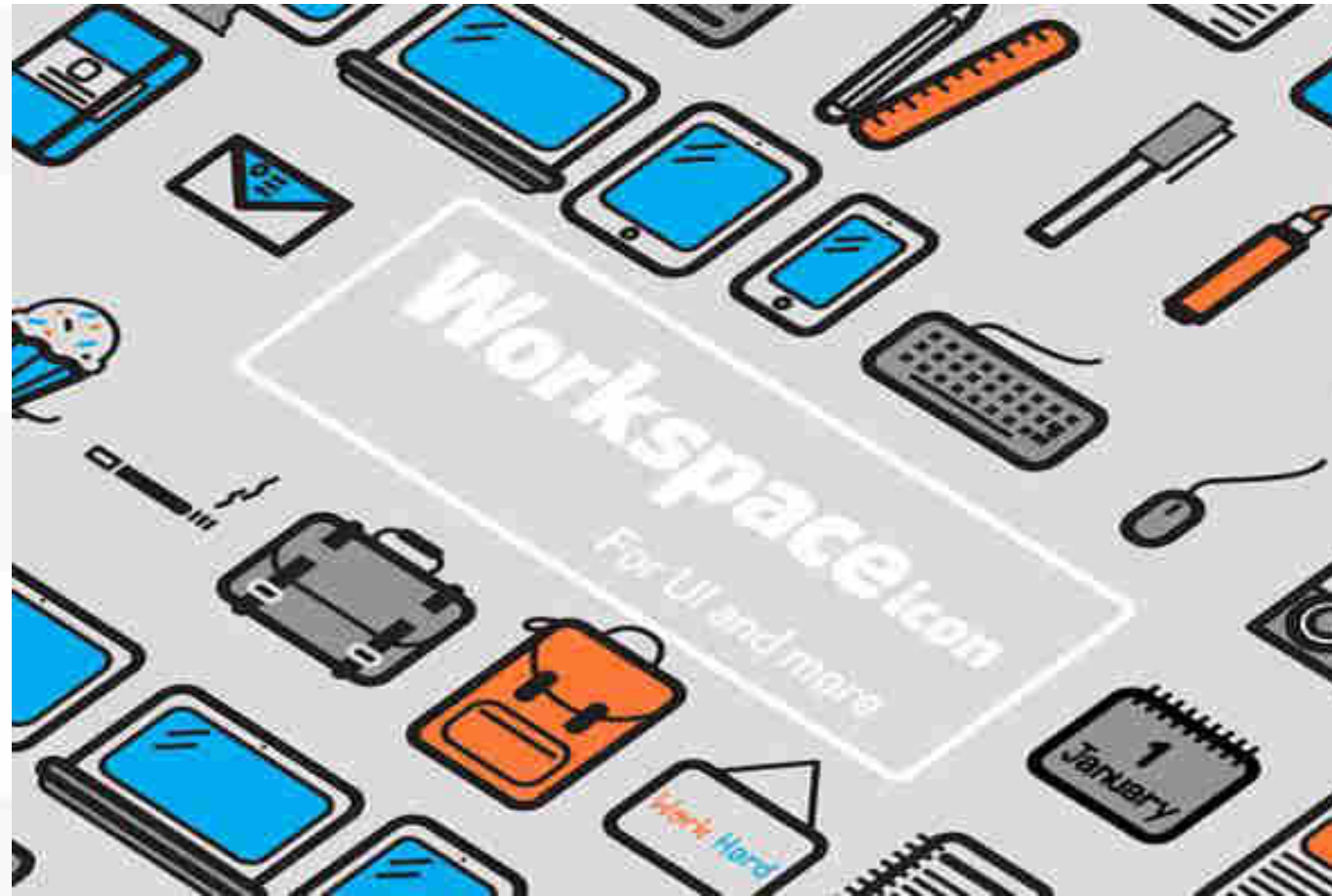
# ROS Concepts



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# Work-space



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# Catkin

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



# Example

- Creating ROS workspace , [here](#)



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# Package

- Each package folder must contain
  - package.xml
  - CMakeLists.txt
- Create package using
  - catkin\_create\_pkg
- Build package using catkin
  - catkin\_make

```
my_package/  
CMakeLists.txt  
package.xml
```



# Example

- Creating ROS Package , [here](#)
- Building ROS package , [here](#)



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# ROS Tools for Packages

- rospack
- rospack find [package\_name]
- roscd [locationname[/subdir]]
- rosls [locationname[/subdir]]

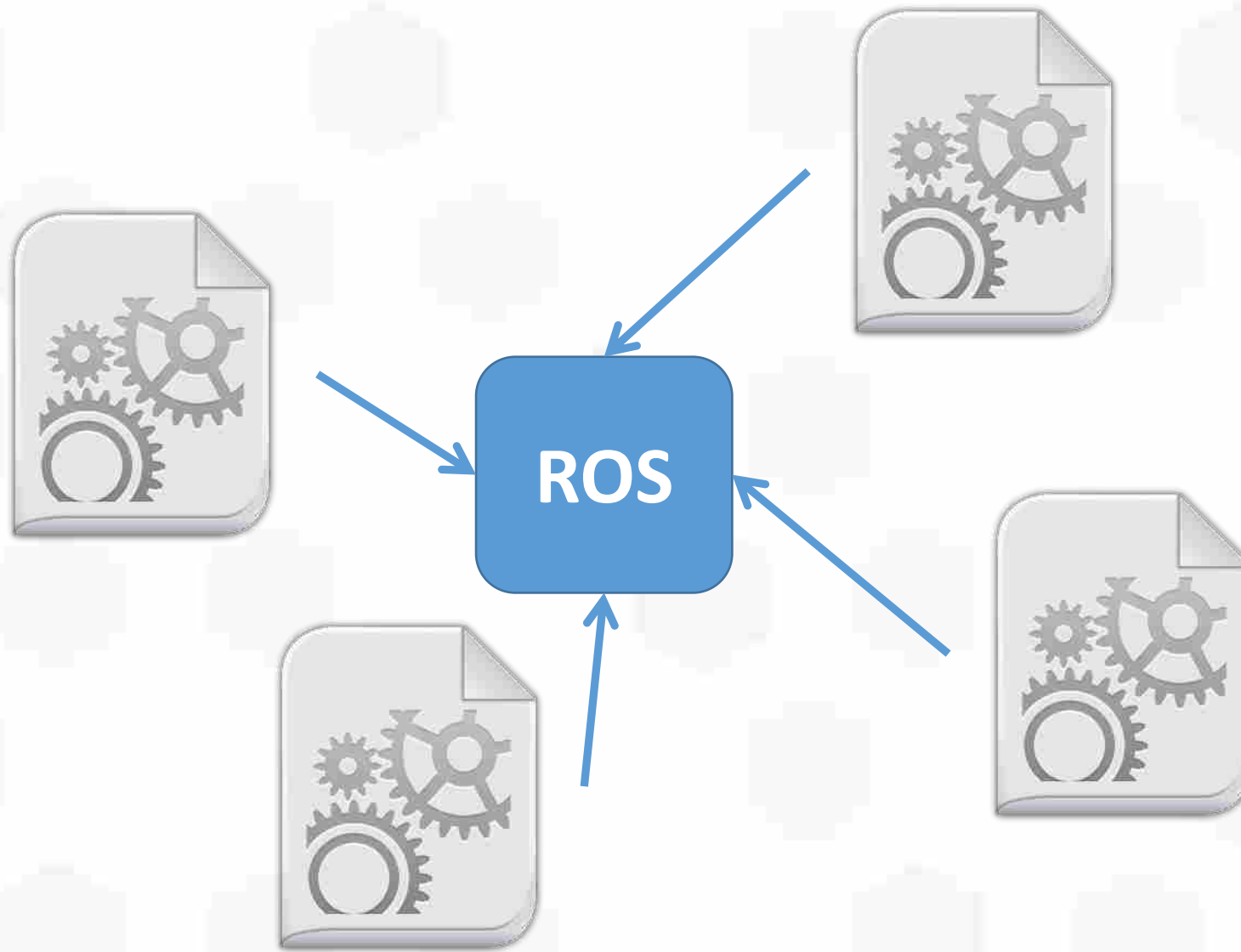


# More details

- About package package.xml file , find [here](#)
- About package CMakeLists.txt file , find [here](#)



# Node



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# Node



ROS Package



Nodes



# Node



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# roscore

```
... 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
* /rostdistro

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]
```





# roscnode

roscnode list

roscnode info [node name]



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# roslun

roslun [package name] [node name]

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

Example found [here](#)



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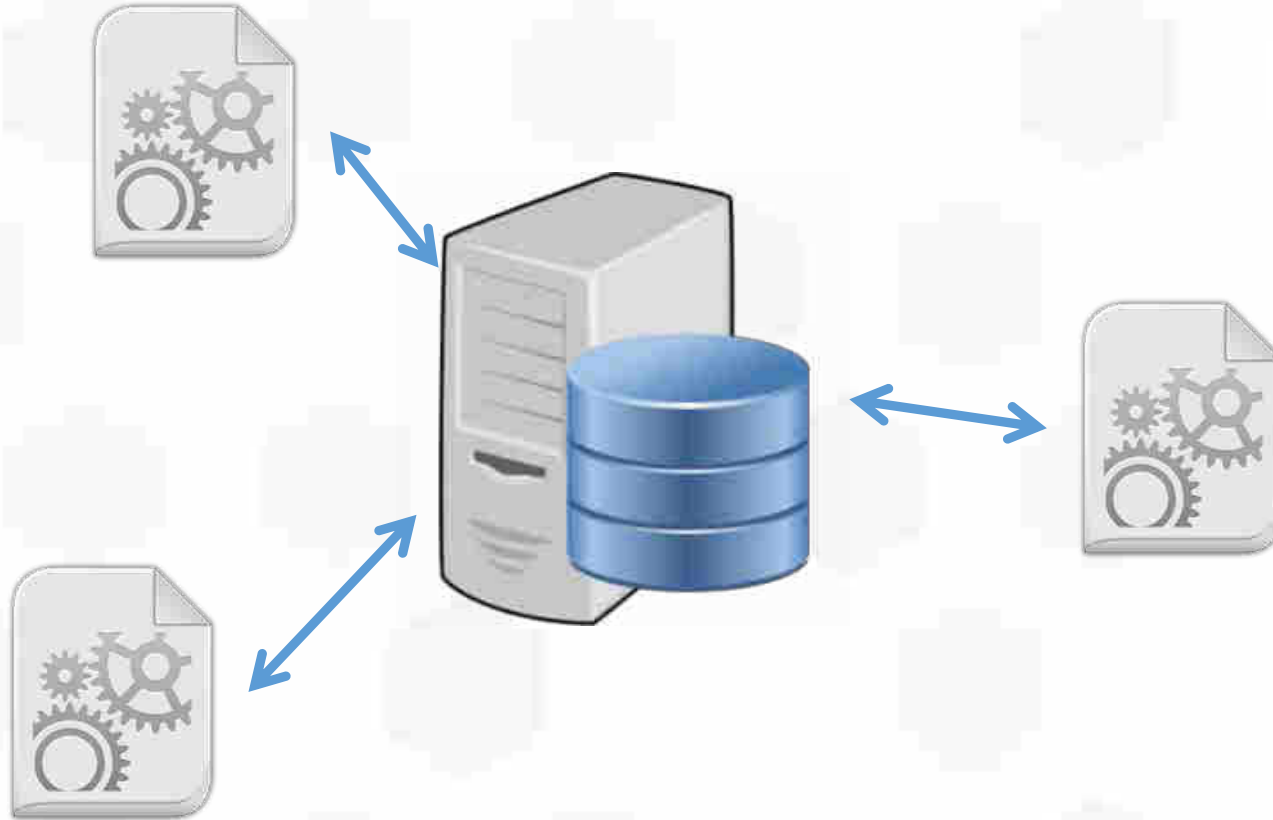
# ROS Master



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# ROS Master



# roscore

```
... 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
=====

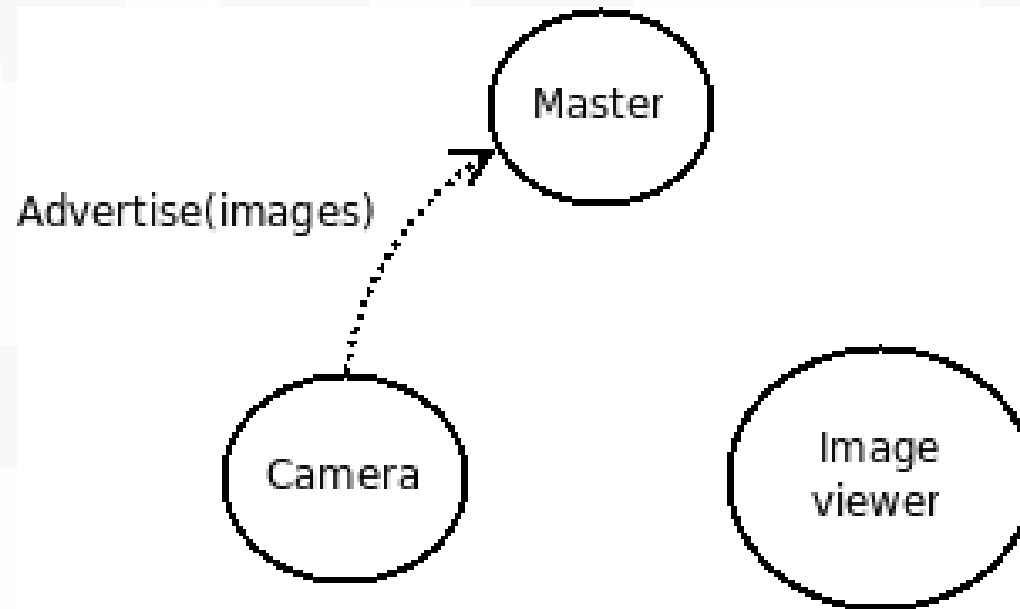
PARAMETERS
* /rosversion
* /rostdistro

NODES

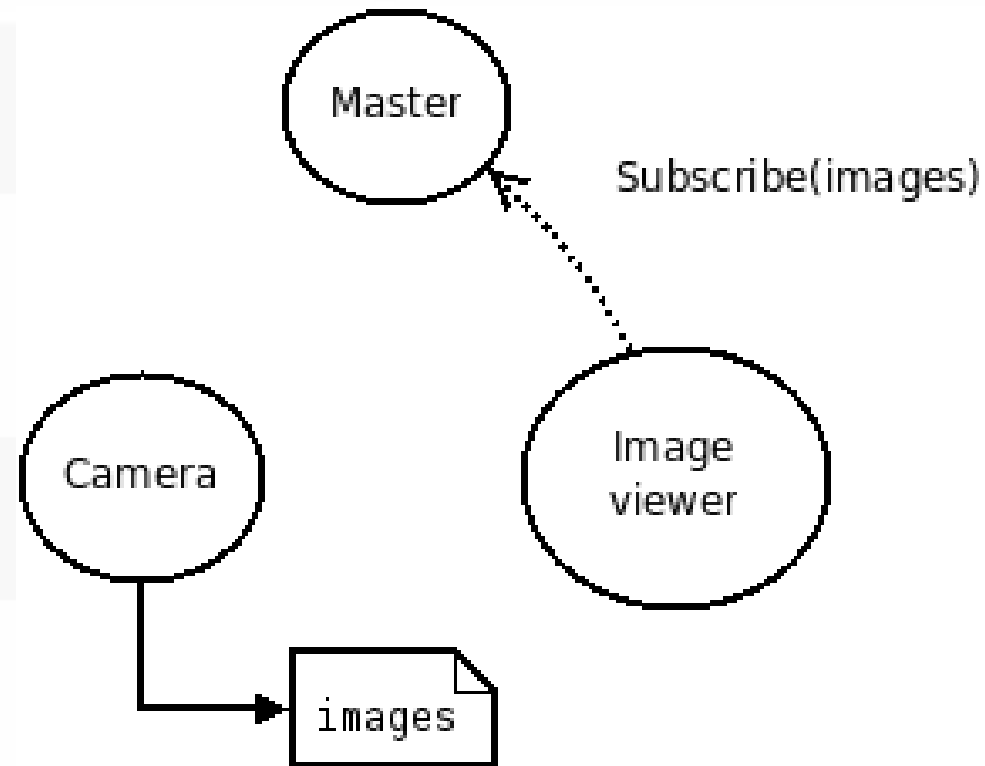
auto-starting new master
process[rosmaster]: started with pid [13054]
ROS_MASTER_URI=http://machine_name:11311/

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

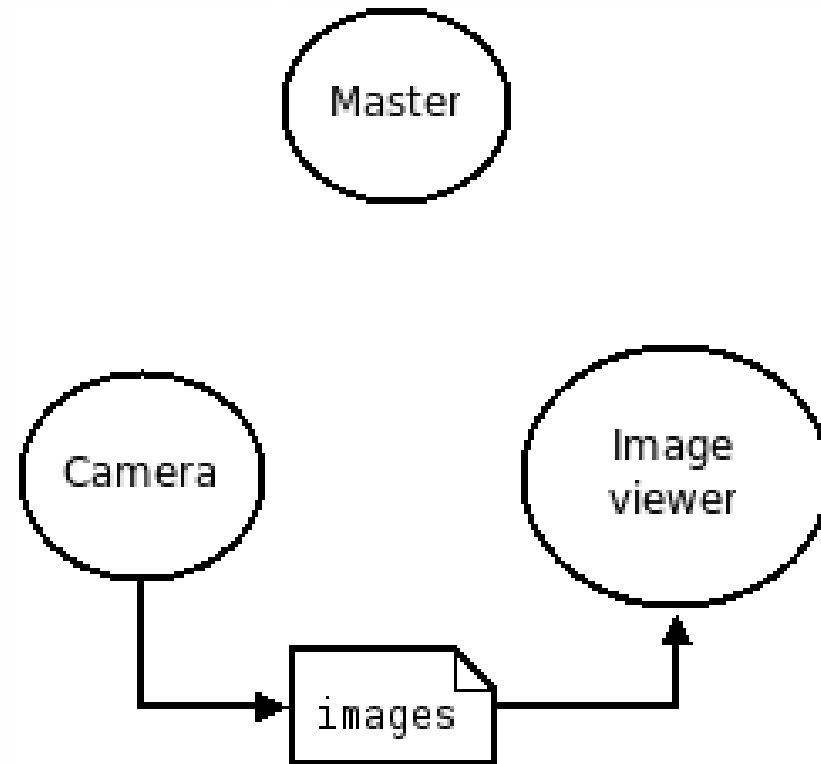
# Example



# Example



# Example





# ROS Master Details

- Read about XMLRPC API [here](#)
- Implementation for rosmaster package , [here](#)



# Topics

**ROS Node**



**ROS Topic**



**ROS Node**



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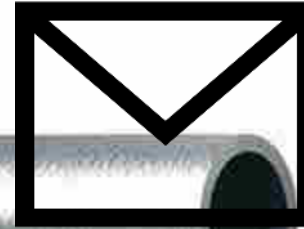
# Publishing



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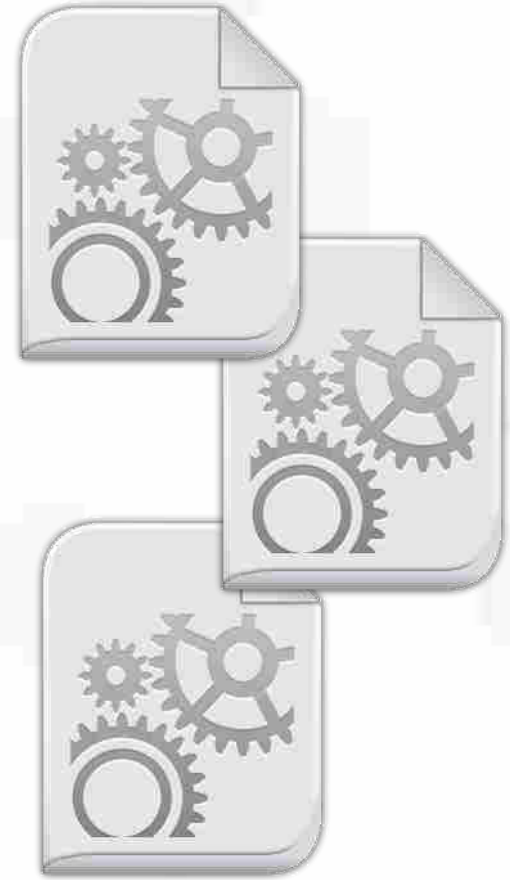
# Subscribing



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# Topics



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# rqt\_graph



```
roslaunch rqt_graph rqt_graph
```



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# rostopic

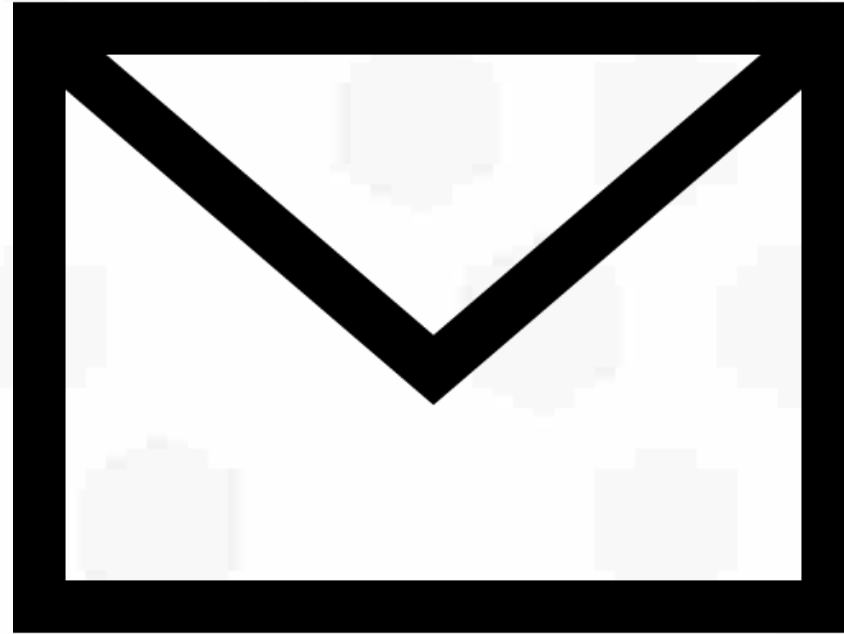
- rostopic echo [topic name]
- rostopic list
- rostopic -h



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# Messages



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# Publisher



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# Subscriber



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# rostopic

- rostopic type to determine the type of the topic
- View details of the message using rosmmsg show [message name]



# Publishing a message on topic

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

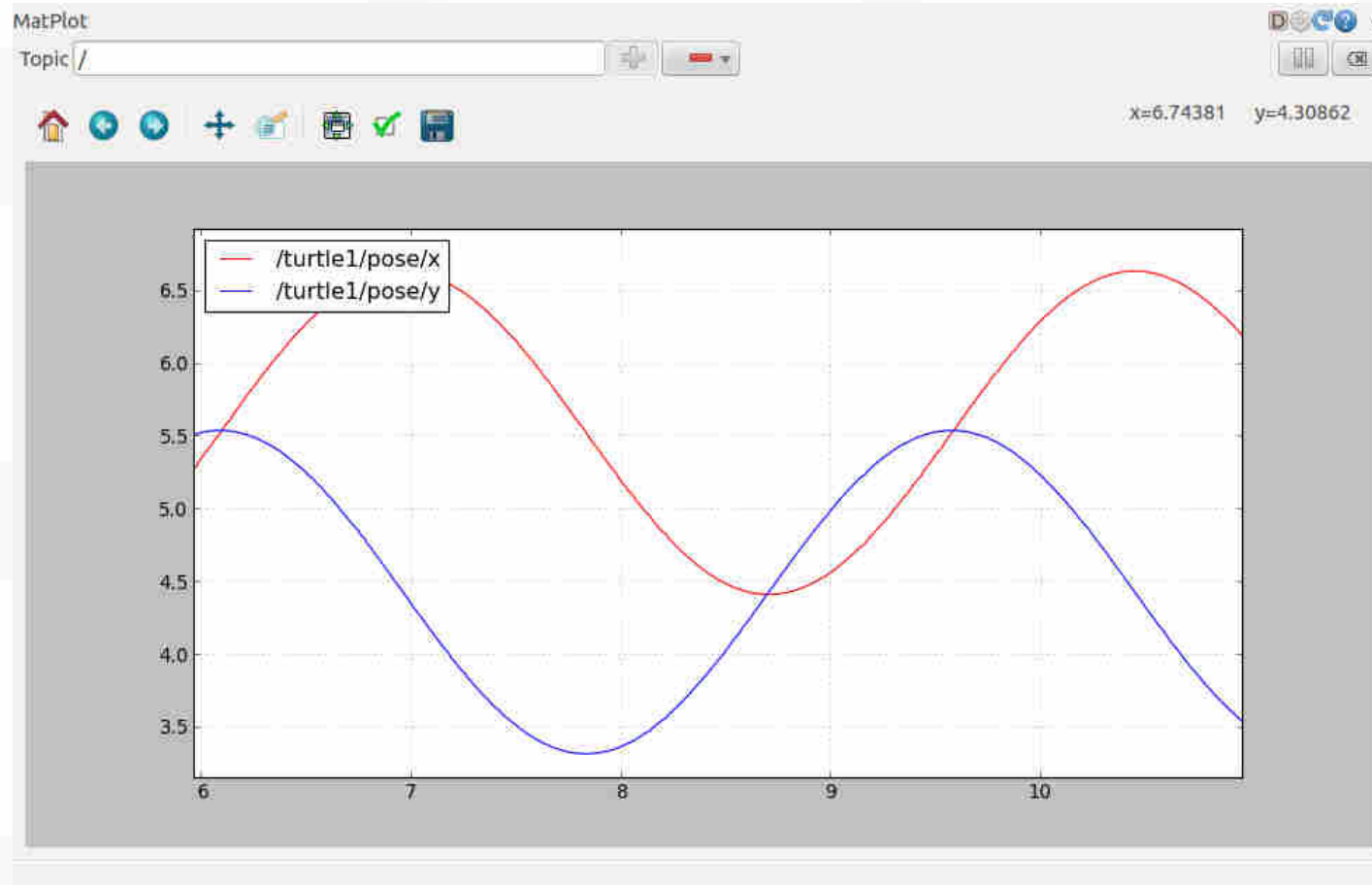


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# Rqt\_plot

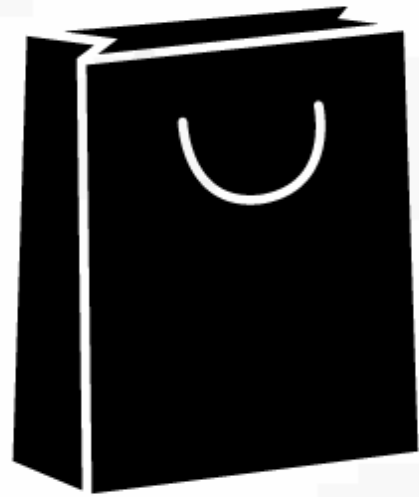
`roslaunch rqt_plot rqt_plot`



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# ROS Bag



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# ROS Bag

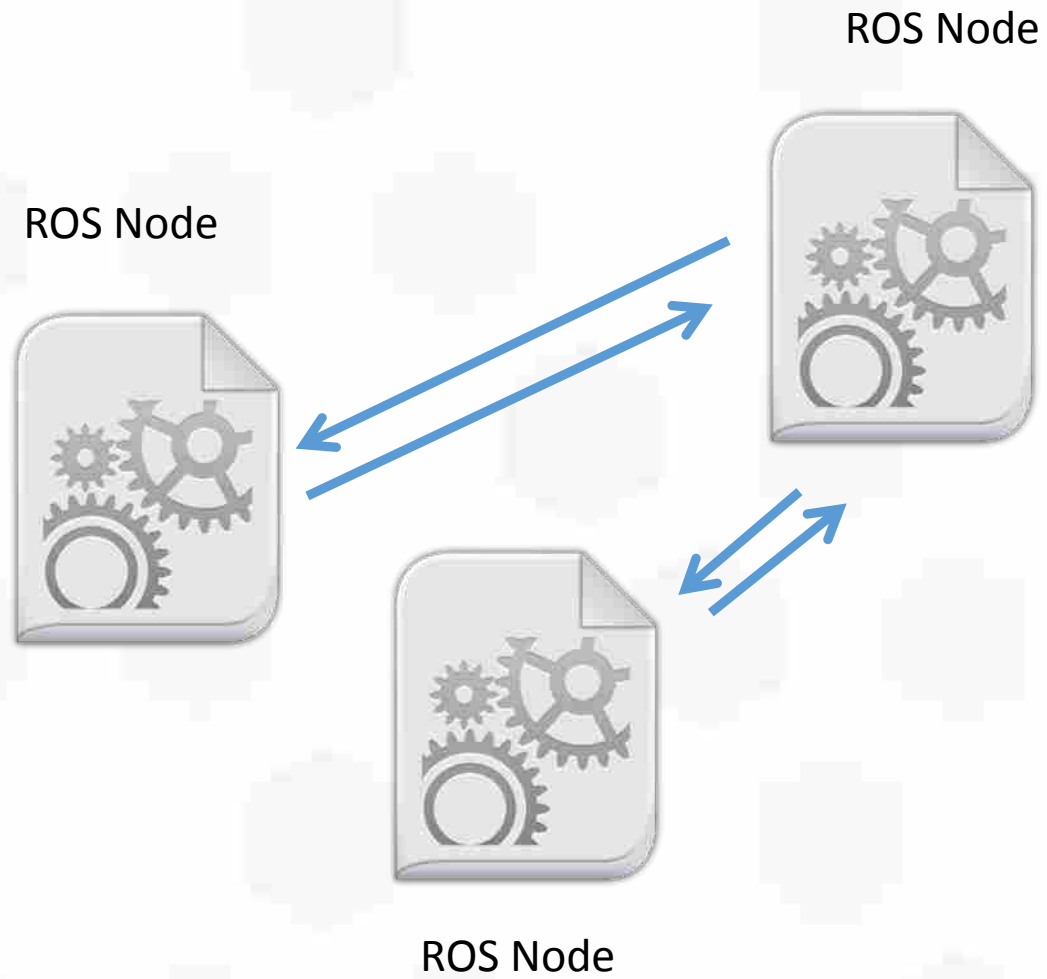
- rosbag
- rqt\_bag



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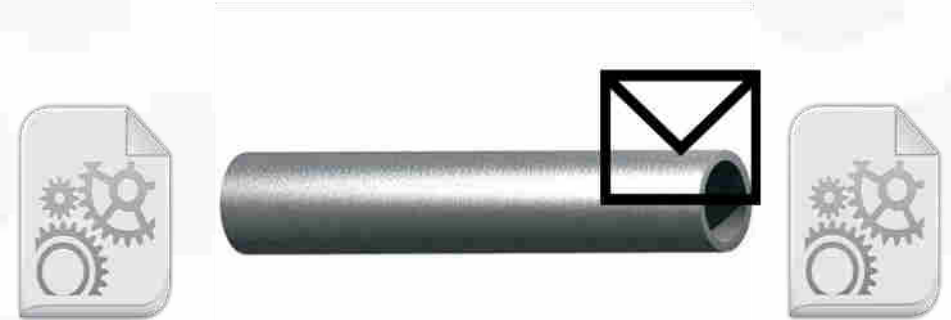
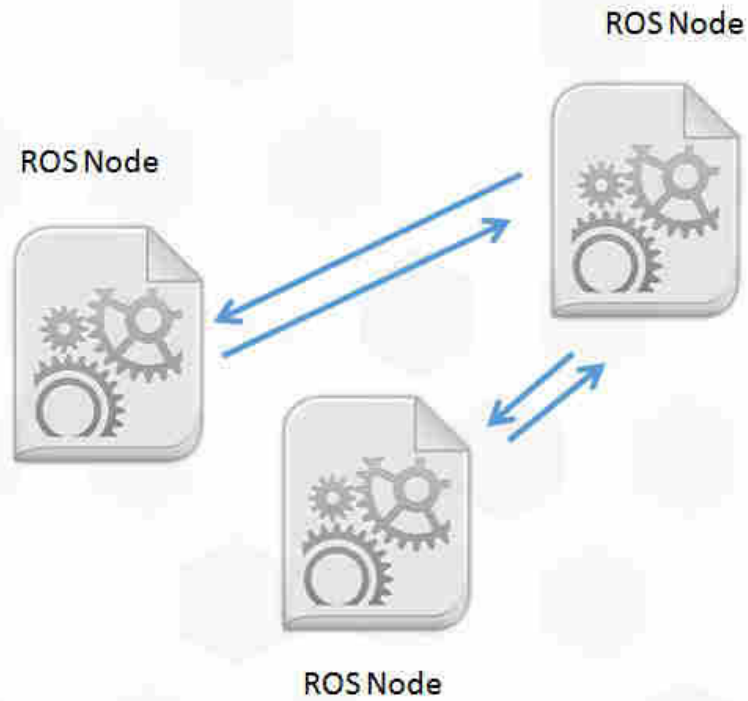


# Services





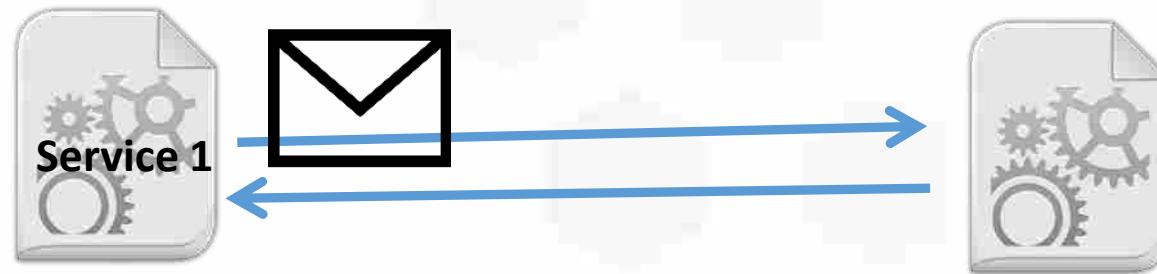
# Services vs Topics



# Services

ROS Node  
Provider

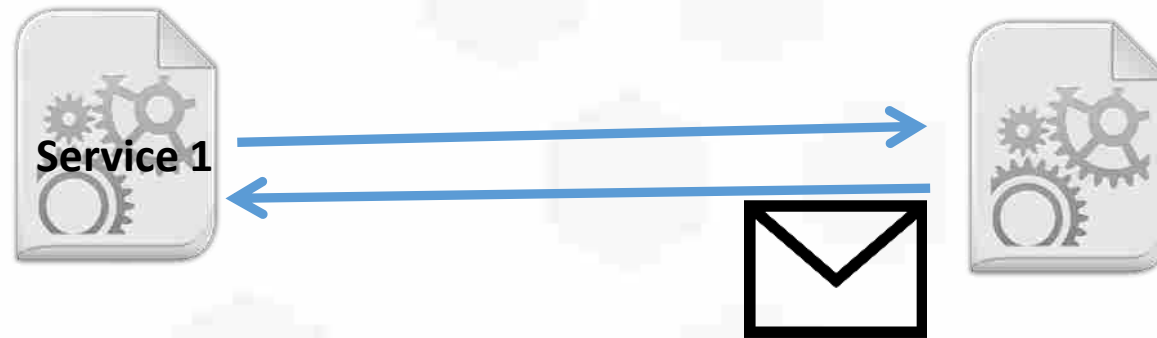
ROS Node  
Client



# Services

ROS Node  
Provider

ROS Node  
Client



# Services Type

my\_package/srv/PolledImage.srv -> my\_package/PolledImage



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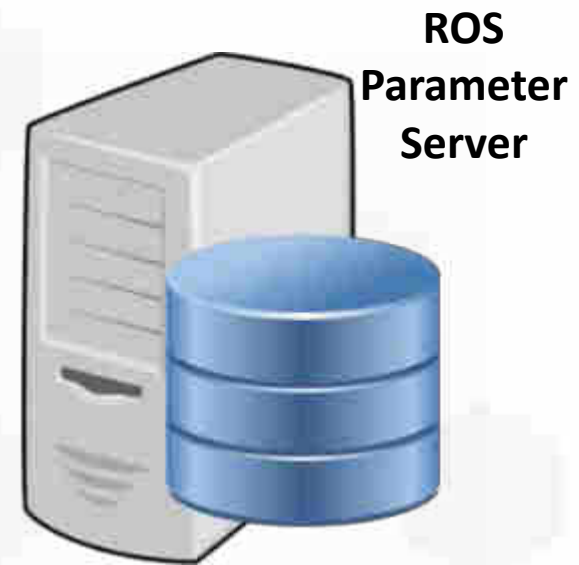


# rosservice

- rosservice list
- rosservice call [service name]
- rosservice type [service name]



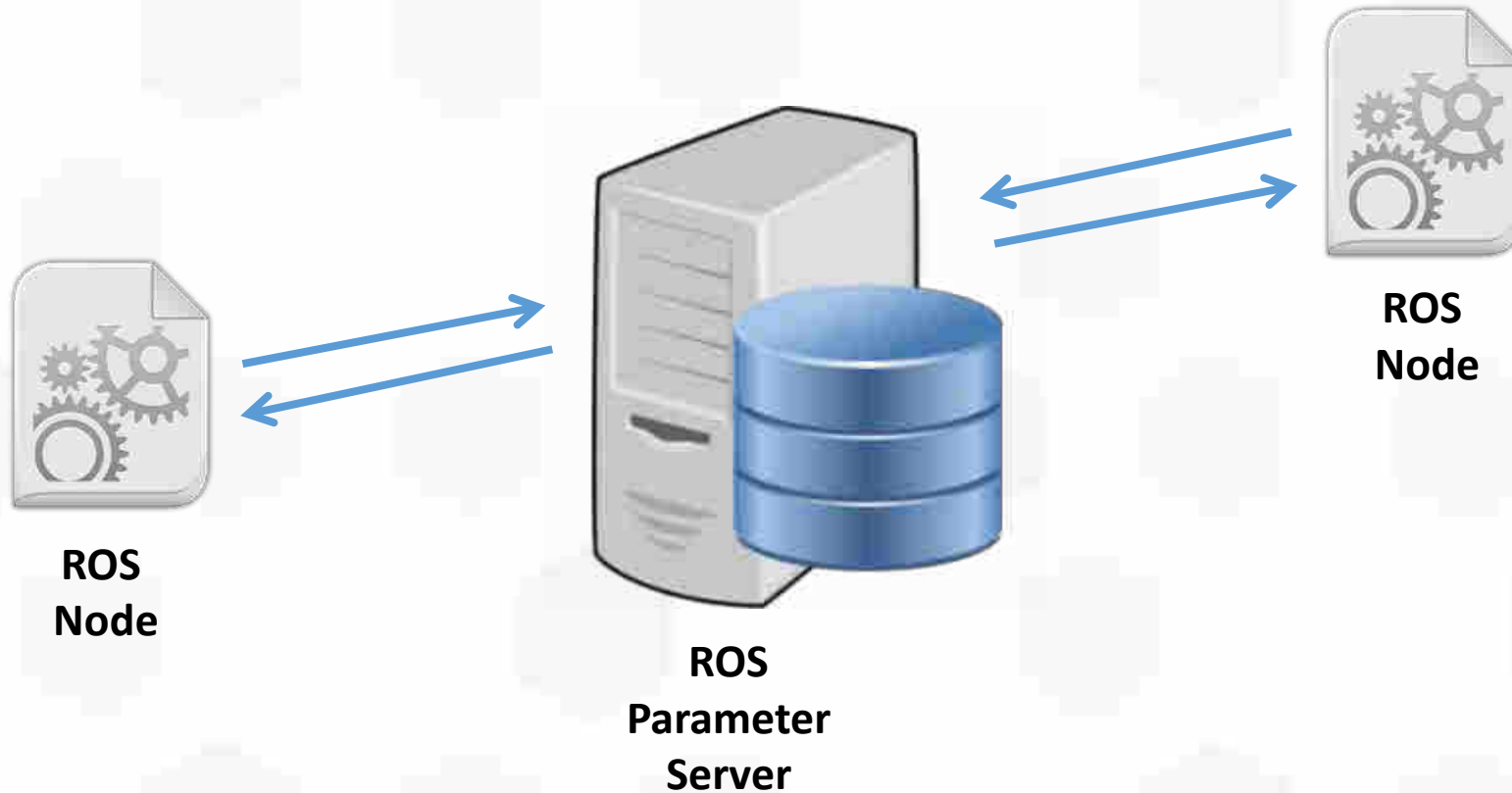
# Parameter Server



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# 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



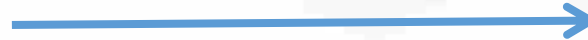
leftcamera



# 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

```
roslaunch rospy_tutorials talker _param:=1.0
```



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# rotparam

- rotparam list
- rotparam set [parameter name] [value]
- rotparam 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*** 

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