ROS Support from MATLAB

ROSCon Chicago
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Ren Sang Nah
Yanliang Zhang
Remo Pillat

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Agenda

- Introduction
- Motivations
- Key features
- Demonstrations

MATLAB ROS I/O Package

A Downloadable MATLAB Add-On

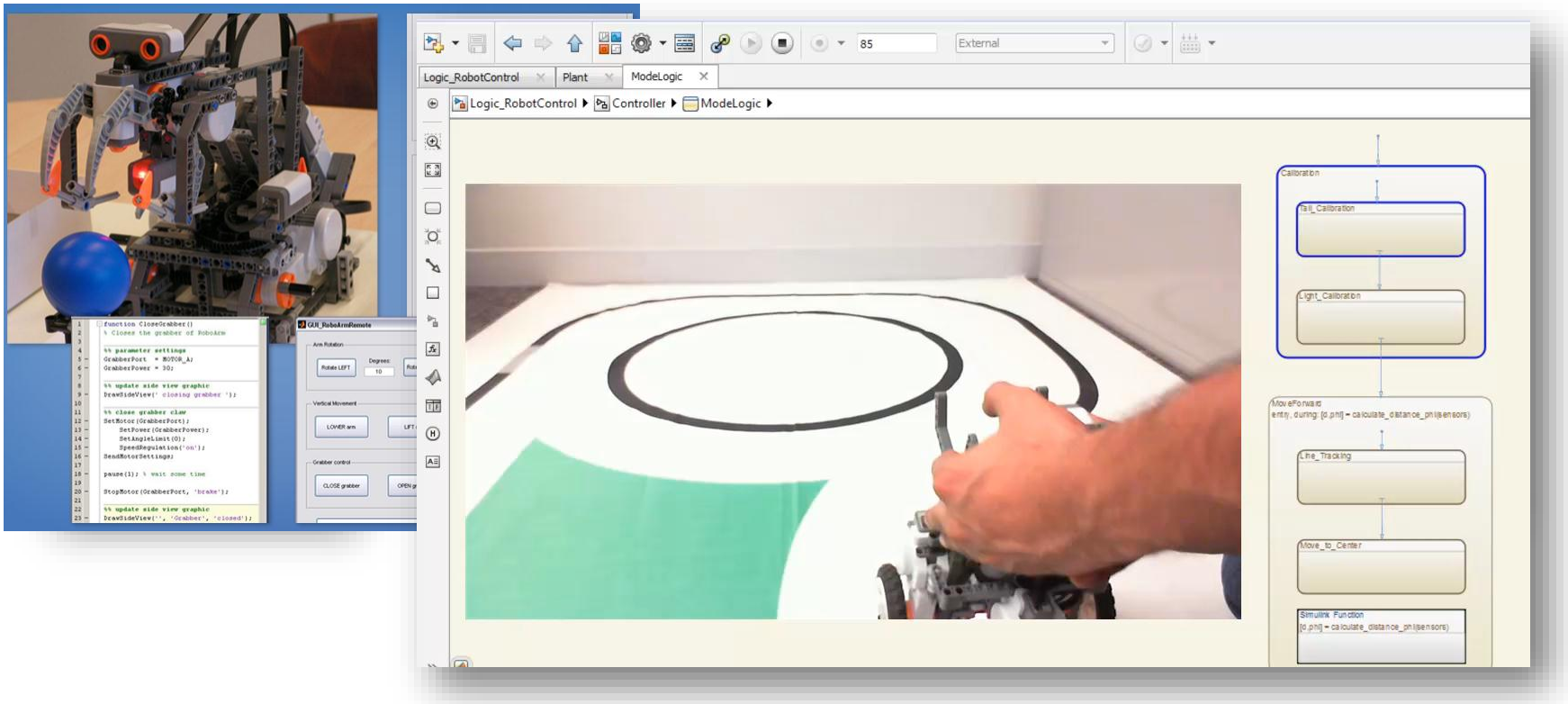
- MATLAB based API for interacting with ROS
- Create ROS nodes directly in MATLAB
- Exchange data via publishers and subscribers
- Capable of launching ROS core to create a standalone ROS network within MATLAB
- Examples for working with TurtleBot and Gazebo
- Available for **R**2012**b**, **R**2013**a**, **R**2013**b**, and **R**2014**a**
- Supports Windows, Linux, and Mac OS X

MATLAB in Robotics

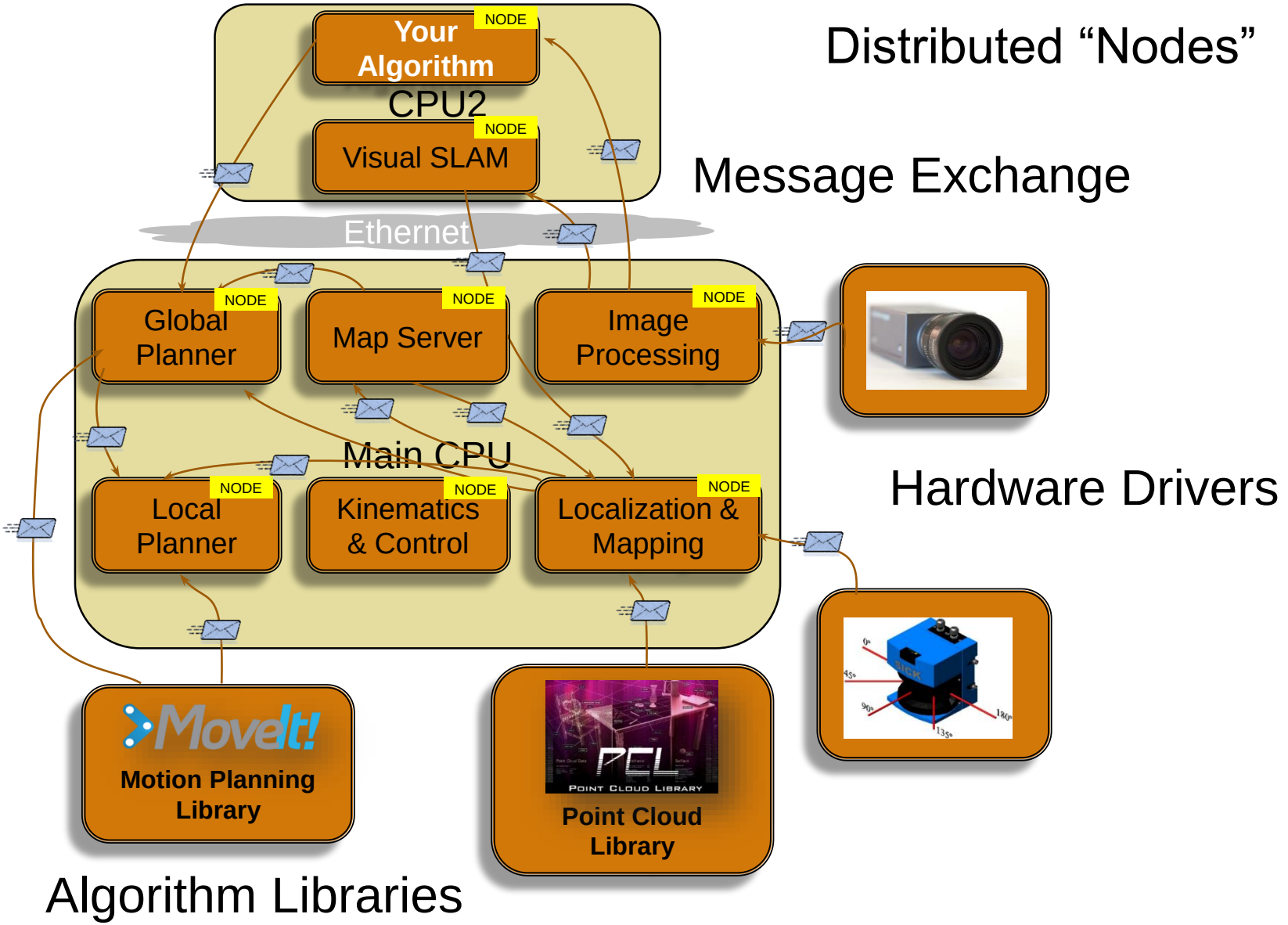
Commercial and Academia

A powerful tool for:

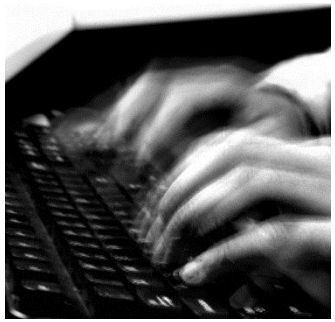
- Data processing & visualization
- Algorithm design & prototyping



ROS a State of the Art Robotics Developer Tools



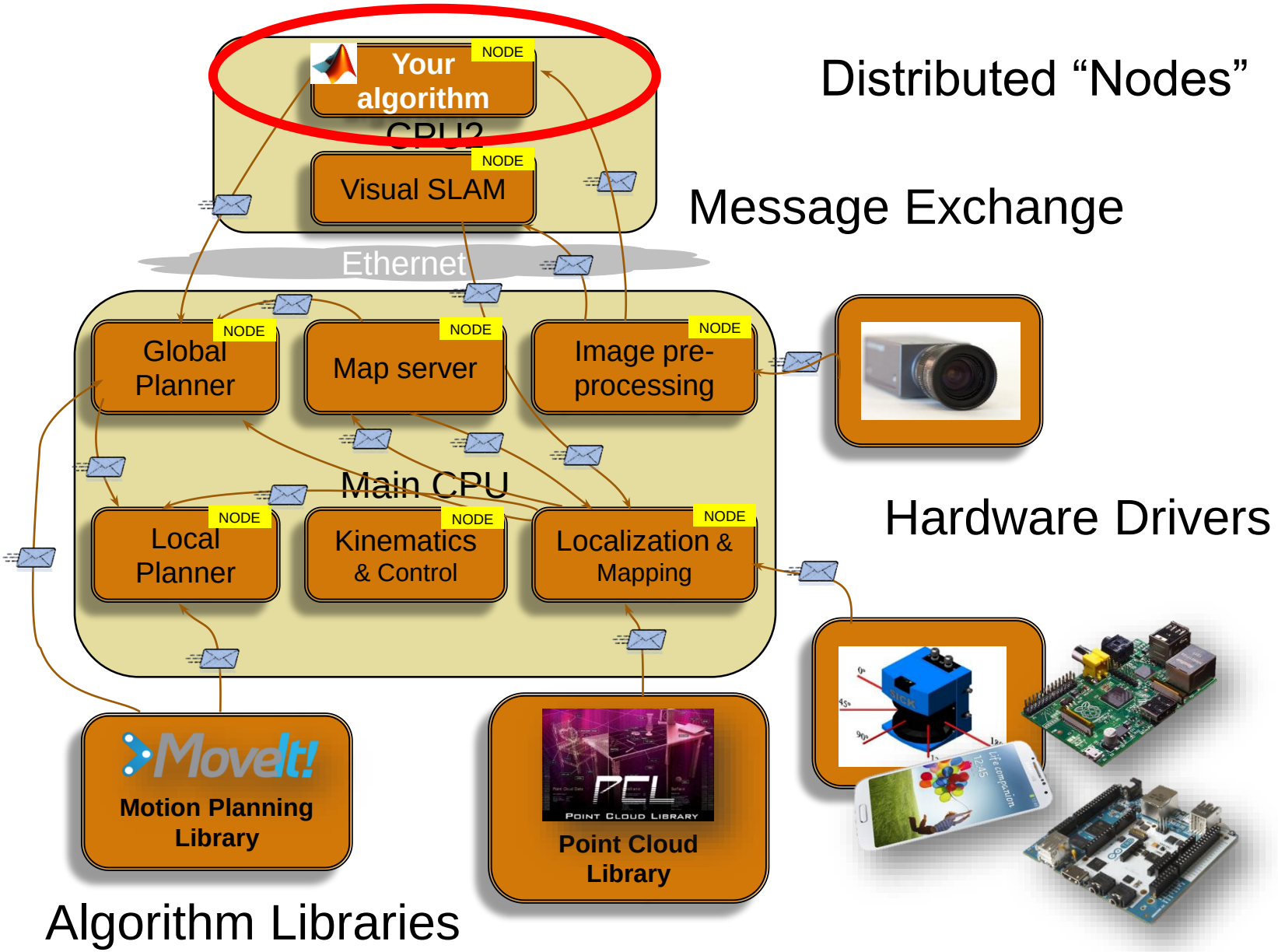
The MATLAB ROS Gap



Hand convert
to ROS node

ROS

With MATLAB ROS I/O Package



MATLAB ROS I/O Package

Interact with Simulator

Interact with Real Robot

MATLAB ROS I/O Package

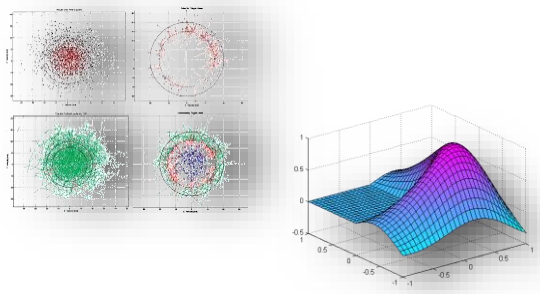
MATLAB

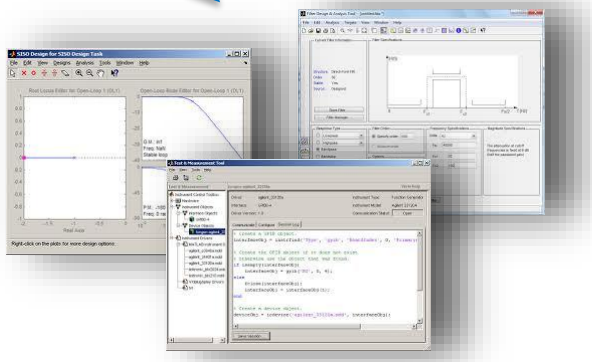
Data Files

Process Data

Visualize and Analyze

Design and Test





Key Capabilities

- Accelerate creation of ROS-based applications
- Allow developers to
  - Focus on developing the algorithm
  - Prove concepts against ROS-enabled robots effortlessly

- Useful for:
  - Interactive exploration of ROS messages
  - Interfacing with ROS-based simulators
  - Interfacing with ROS-based robots

Interactive Exploration of Robot Data

ROS Node
VICON Camera

ROS Node
Kinect

ROS Node
Motors/Sensors

ROS Node

Explore ROS messages from the MATLAB command line

Command Window

```
>> Node
>> VelPu
>> VelMs
>> vLin

vLin =

MessageI
```

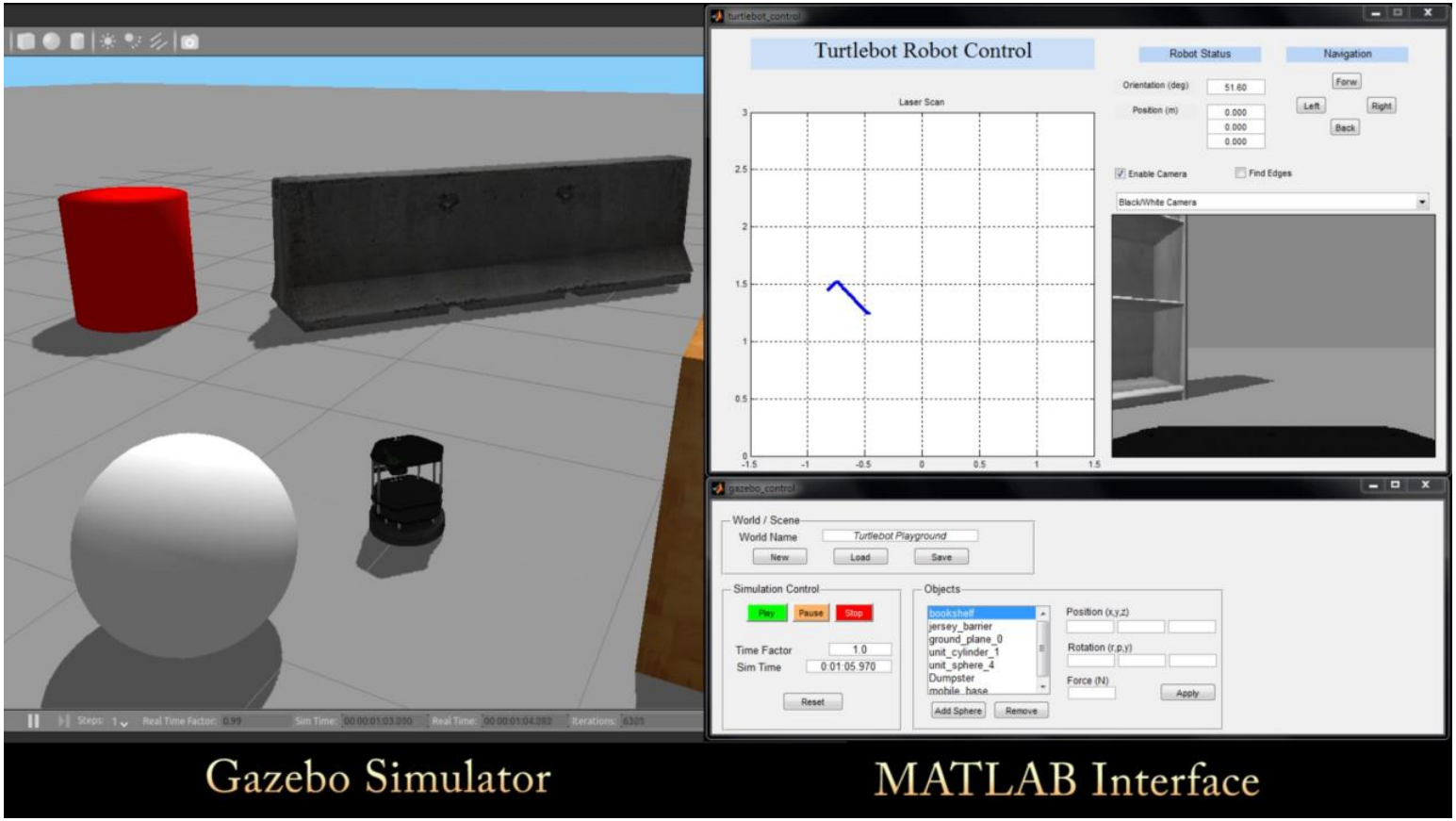
```
equals
getClass
getInstance
getInvocationHandler
getProxyClass
getX
getY
getZ
```

```
NIIOR',rosMasterIp,rosMasterPort,'rosIP',localhostIp);
mobile_base/commands/velocity','geometry_msgs/Twist');
eometry_msgs/Twist',Node);
3>
```

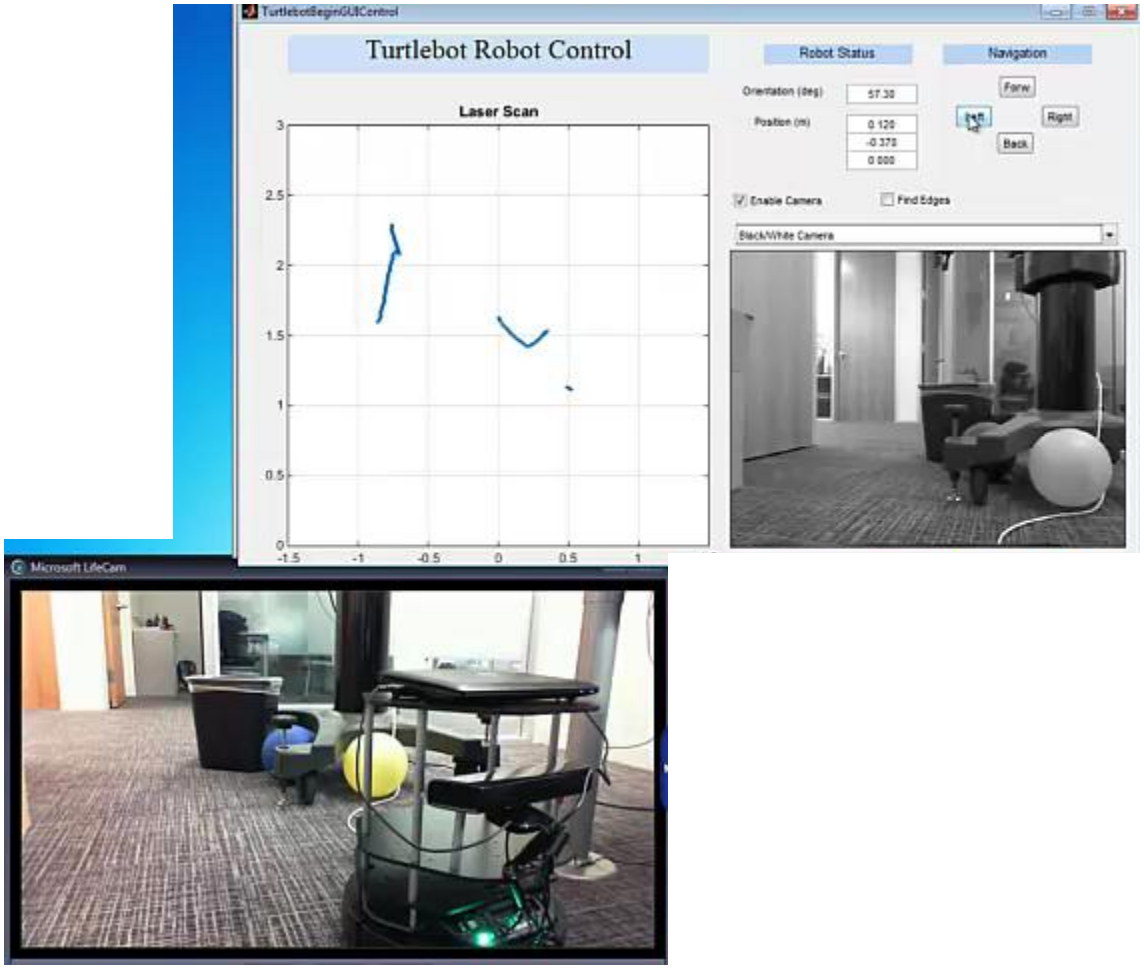
```
>> vLin.
```

Interfacing with Simulator

Gazebo is a 3D robot simulator commonly used with ROS

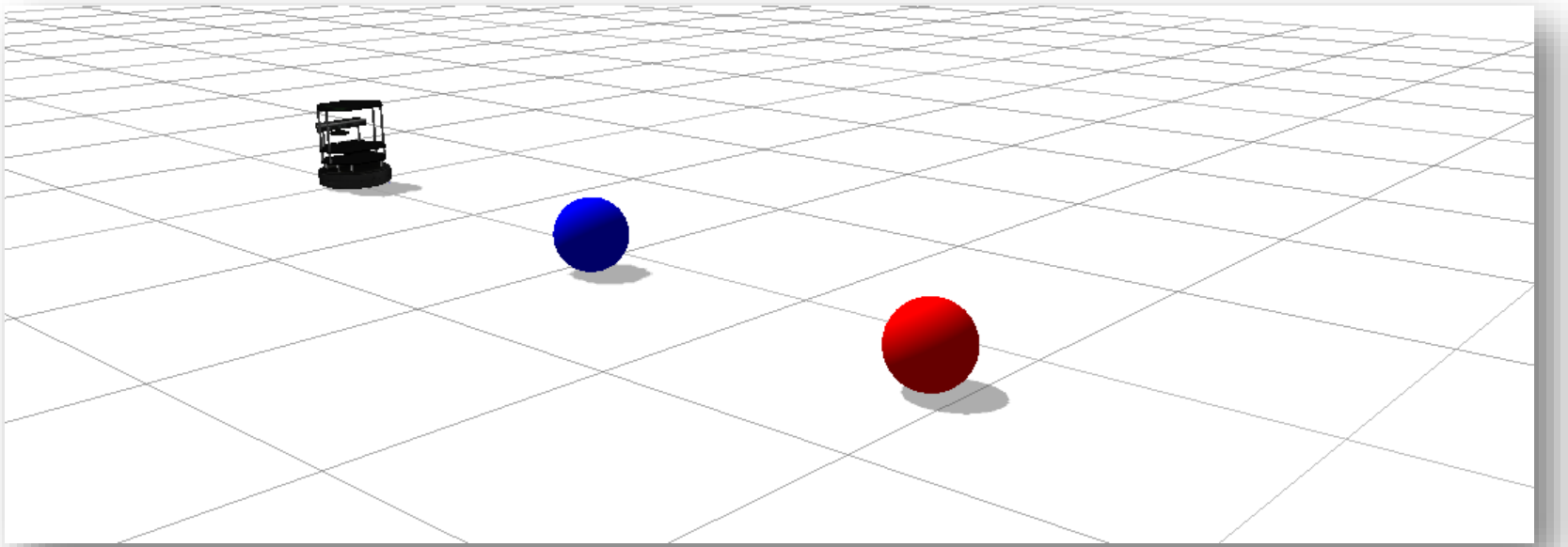


Interfacing with Real Robot

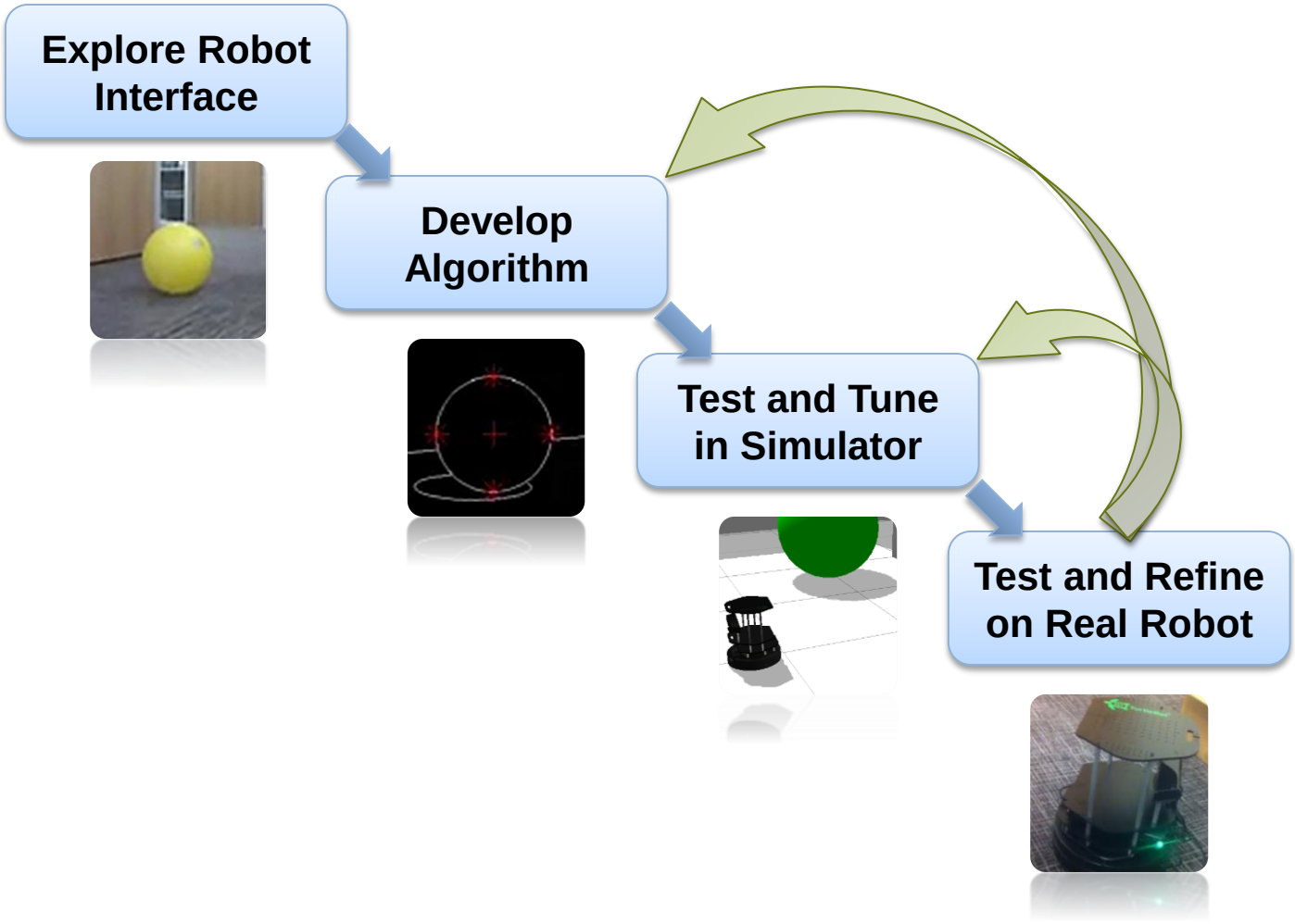


Demonstration

- Algorithm must detect a ball within robot camera view
- Robot must maintain a constant distance from the ball
- Image processing and motion control are all performed in MATLAB



Workflow Overview



Tuning a Ball Tracking Algorithm

Demo Setup

ROS Network for the Teleoperated Robot

ROS Android Sensor Driver

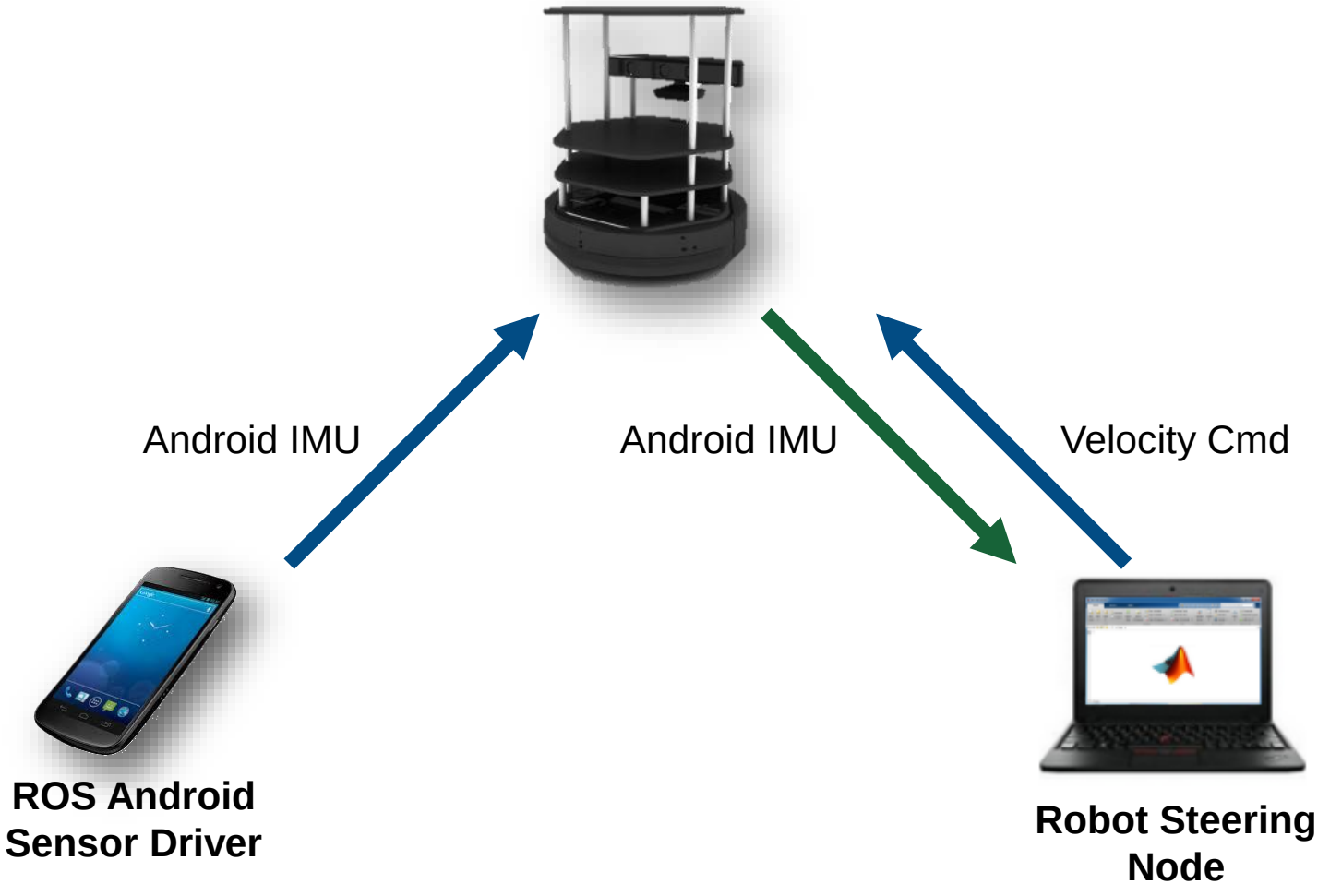
Robot Steering Node

ROS Network for the Ball Tracking Robot

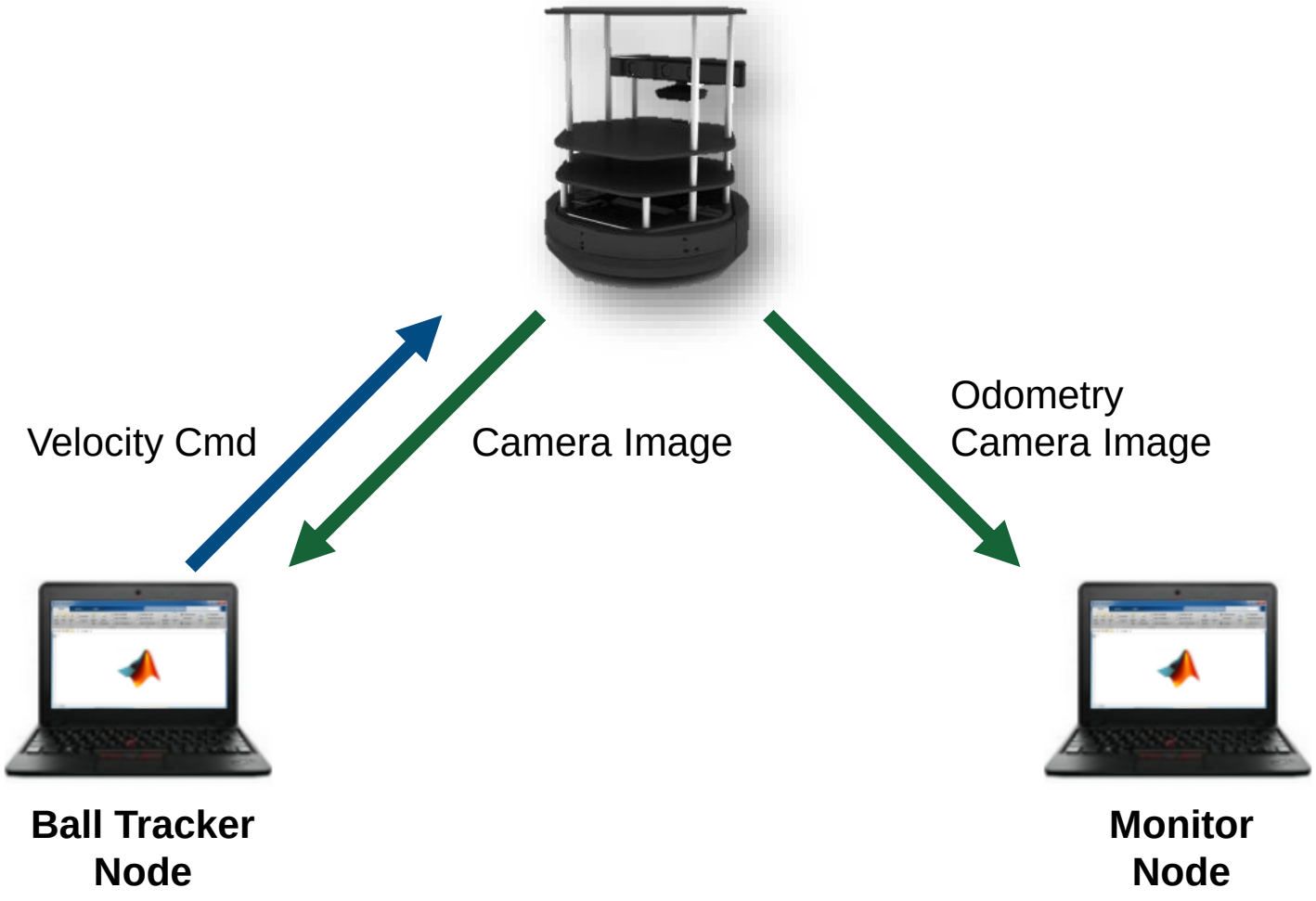
Ball Tracker Node

Monitor Node

ROS Network for the Teleoperated Robot



ROS Network for the Ball Tracking Robot



Closing Remarks

- Allow MATLAB/ROS users to take advantage of both
  - Power of MATLAB in data analysis and algorithm design
  - Flexibility of ROS in handling a network of applications
- Enable multi-platform access to ROS from MATLAB
- Available for download at official MathWorks website
  - http://www.mathworks.com/ros
  - Search for “MATLAB ROS”
- Hands-on IROS Workshop
  - How to Use MATLAB-ROS Interface to Prototype Robotics Algorithms for ROS-Powered Robots
  - Demonstrations by Clearpath Robotics & Rethink Robotics
  - Sunday Sep 14, 1:30 pm to 5:00 pm