

# Introduction to the iRobot Create3 and ROS2 Interfaces

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# Outline

Introduction  
to the iRobot  
Create3 and  
ROS2  
Interfaces

Garrett Wells

iRobot  
Create3  
Hardware

Sensors

ROS2 Stack

Example ROS2  
Architecture

ROS2 Concepts

ROS2 Client Libraries

Python Resources  
and Packages

## 1 iRobot Create3 Hardware

- Sensors

## 2 ROS2 Stack

- Example ROS2 Architecture
- ROS2 Concepts
- ROS2 Client Libraries
- Python Resources and Packages

# iRobot Create3 Hardware Summary

Introduction  
to the iRobot  
Create3 and  
ROS2  
Interfaces

Garrett Wells

iRobot  
Create3  
Hardware

Sensors

ROS2 Stack

Example ROS2  
Architecture

ROS2 Concepts

ROS2 Client Libraries

Python Resources  
and Packages

## ► iRobot Create3 Hardware

### 1 Sensors

- IR sensors
- Buttons
- Odometry and Cliff sensors

### 2 Cover and Cargo Bay

### 3 Interfaces

- USB
- BLE
- Battery

# Front

Introduction  
to the iRobot  
Create3 and  
ROS2  
Interfaces

Garrett Wells

iRobot  
Create3  
Hardware

Sensors

ROS2 Stack

Example ROS2  
Architecture  
ROS2 Concepts  
ROS2 Client Libraries  
Python Resources  
and Packages



# IR Sensors

Introduction  
to the iRobot  
Create3 and  
ROS2  
Interfaces

Garrett Wells

iRobot  
Create3  
Hardware

Sensors

ROS2 Stack

Example ROS2  
Architecture

ROS2 Concepts

ROS2 Client Libraries

Python Resources  
and Packages

| IR Opcodes |                                      |
|------------|--------------------------------------|
| 160        | Reserved                             |
| 161        | Force Field                          |
| 164        | Green Buoy                           |
| 165        | Green Buoy and Force Field           |
| 168        | Red Buoy                             |
| 169        | Red Buoy and Force Field             |
| 172        | Red Buoy and Green Buoy              |
| 173        | Red Buoy, Green Buoy and Force Field |

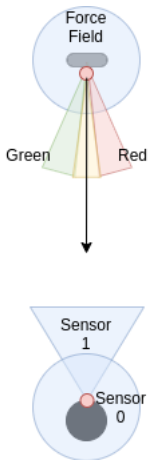


Figure: Dock and Robot Buoy Sensors Diagram

# Rear

Introduction  
to the iRobot  
Create3 and  
ROS2  
Interfaces

Garrett Wells

iRobot  
Create3  
Hardware

Sensors

ROS2 Stack

Example ROS2  
Architecture

ROS2 Concepts

ROS2 Client Libraries

Python Resources  
and Packages



# Bottom

Introduction  
to the iRobot  
Create3 and  
ROS2  
Interfaces

Garrett Wells

iRobot  
Create3  
Hardware

Sensors

ROS2 Stack

Example ROS2  
Architecture  
ROS2 Concepts  
ROS2 Client Libraries  
Python Resources  
and Packages



# Foundational Principles

John's rules for robots... mostly.

Introduction  
to the iRobot  
Create3 and  
ROS2  
Interfaces

Garrett Wells

iRobot  
Create3  
Hardware  
Sensors

ROS2 Stack

Example ROS2  
Architecture  
ROS2 Concepts  
ROS2 Client Libraries  
Python Resources  
and Packages

## 1 Robots are dumb.

- they generate data instead of consuming data to produce decisions(intelligence)

## 2 Processing power is a finite resource.

- actuator control
- signal processing
- calculations from inputs

## 3 ROS2 allows intelligent control through abstraction.

- Interfaces
  - Topics
  - Actions
  - Services
- Nodes



# Example ROS2 Architecture

Based on the iRobot Create3 generic use case.

Introduction  
to the iRobot  
Create3 and  
ROS2  
Interfaces

Garrett Wells

iRobot  
Create3  
Hardware

Sensors

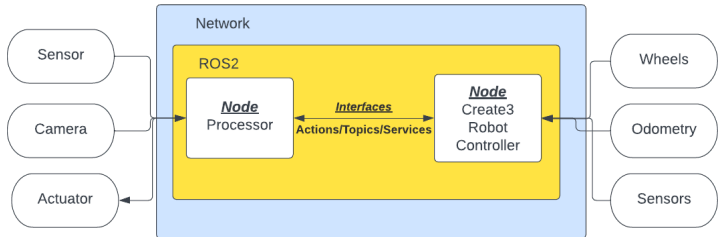
ROS2 Stack

Example ROS2  
Architecture

ROS2 Concepts

ROS2 Client Libraries

Python Resources  
and Packages



# ROS2 Interfaces

Hardware abstraction for the masses.

Interfaces define implementation independent standards for communicating between ROS2 Nodes.

- 1 define packet(data) structure
  - how many fields?
- 2 define data types and labels
  - int, float, string, etc

Definition

*Node an entity that uses ROS to communicate with other nodes*

Useful ROS2 Commands

```
ros2 interface list
show
```

Introduction  
to the iRobot  
Create3 and  
ROS2  
Interfaces

Garrett Wells

iRobot  
Create3  
Hardware  
Sensors

ROS2 Stack

Example ROS2  
Architecture

ROS2 Concepts

ROS2 Client Libraries

Python Resources  
and Packages

# ROS2 Interfaces Continued

Introduction  
to the iRobot  
Create3 and  
ROS2  
Interfaces

Garrett Wells

iRobot  
Create3  
Hardware

Sensors

ROS2 Stack

Example ROS2  
Architecture

**ROS2 Concepts**

ROS2 Client Libraries

Python Resources  
and Packages

► iRobot Create3 Interface Definition

► ROS2 Interfaces Documentation

► Topics vs Services vs Actions

*ROS2 CLI Demo*

# Topics/Messages

A publish subscribe system.

## ► ROS2: Understanding Topics

- 1 Should be used for continuous data streams(sensors, robot state)
- 2 Publisher decides when data is sent
- 3 Exposed to subscribers through the network

## Useful ROS2 Commands

```
ros2 topic list -t  
echo  
hz  
pub
```

Introduction  
to the iRobot  
Create3 and  
ROS2  
Interfaces  
Garrett Wells

iRobot  
Create3  
Hardware  
Sensors

ROS2 Stack

Example ROS2  
Architecture

ROS2 Concepts

ROS2 Client Libraries

Python Resources  
and Packages

# Services

Request for a discrete unit of work.

Introduction  
to the iRobot  
Create3 and  
ROS2  
Interfaces

Garrett Wells

iRobot  
Create3  
Hardware  
Sensors

ROS2 Stack

Example ROS2  
Architecture

ROS2 Concepts

ROS2 Client Libraries

Python Resources  
and Packages

## ► ROS2: Understanding Services

- 1 Should be used for remote procedure calls that terminate quickly
- 2 Simple blocking call, good for requesting specific data

## Useful ROS2 Commands

```
ros2 service list  
call  
find
```

# Actions

Facilitate initiation of behavior and monitor robot progress.

Introduction  
to the iRobot  
Create3 and  
ROS2  
Interfaces

Garrett Wells

iRobot  
Create3  
Hardware  
Sensors

ROS2 Stack

Example ROS2  
Architecture

ROS2 Concepts

ROS2 Client Libraries

Python Resources  
and Packages

## ► ROS2: Understanding Actions

- 1 Should be used for any discrete behavior that moves a robot or that runs for a longer time but provides feedback during execution
- 2 Preemptable
- 3 May be used as blocking or non-blocking operation

## Useful ROS2 Commands

```
ros2 action list  
send_goal
```

# Q&A

Introduction  
to the iRobot  
Create3 and  
ROS2  
Interfaces

Garrett Wells

iRobot  
Create3  
Hardware

Sensors

ROS2 Stack

Example ROS2  
Architecture

**ROS2 Concepts**

ROS2 Client Libraries

Python Resources  
and Packages

# ROS Client Libraries

Programming language access to interfaces.

Introduction  
to the iRobot  
Create3 and  
ROS2  
Interfaces

Garrett Wells

iRobot  
Create3  
Hardware  
Sensors

ROS2 Stack

Example ROS2  
Architecture  
ROS2 Concepts

**ROS2 Client Libraries**

Python Resources  
and Packages

ROS2 interfaces can be used through the ROS Client Library API.

▸ `rclpy`

▸ `rclcpp`



# Minimalist ROS2 Node Code Example

Introduction  
to the iRobot  
Create3 and  
ROS2  
Interfaces

Garrett Wells

iRobot  
Create3  
Hardware

Sensors

ROS2 Stack

Example ROS2  
Architecture

ROS2 Concepts

**ROS2 Client Libraries**

Python Resources  
and Packages

# Useful Resources for Python

Introduction  
to the iRobot  
Create3 and  
ROS2  
Interfaces

Garrett Wells

iRobot  
Create3  
Hardware  
Sensors

ROS2 Stack  
Example ROS2  
Architecture  
ROS2 Concepts  
ROS2 Client Libraries  
Python Resources  
and Packages

- *PynPut*: allows non-blocking input from the keyboard and the ability to call functions when a key is pressed
- *argparse*: allows passing command line arguments to python scripts, helpful for namespaces, operating parameters

# ROS2 Oddities and Bugs

Introduction  
to the iRobot  
Create3 and  
ROS2  
Interfaces

Garrett Wells

iRobot  
Create3  
Hardware  
Sensors

ROS2 Stack

Example ROS2  
Architecture  
ROS2 Concepts  
ROS2 Client Libraries  
Python Resources  
and Packages

- changing networks while using ROS2 may cause connections to break, requiring a system reset
- a workspace **MUST** be sourced before running source code
- Always run colcon build in a different terminal than the one you execute your code in