Zebra DevCon 2023

ZEBRA

F100 for OEM Applications

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Presentation Overview

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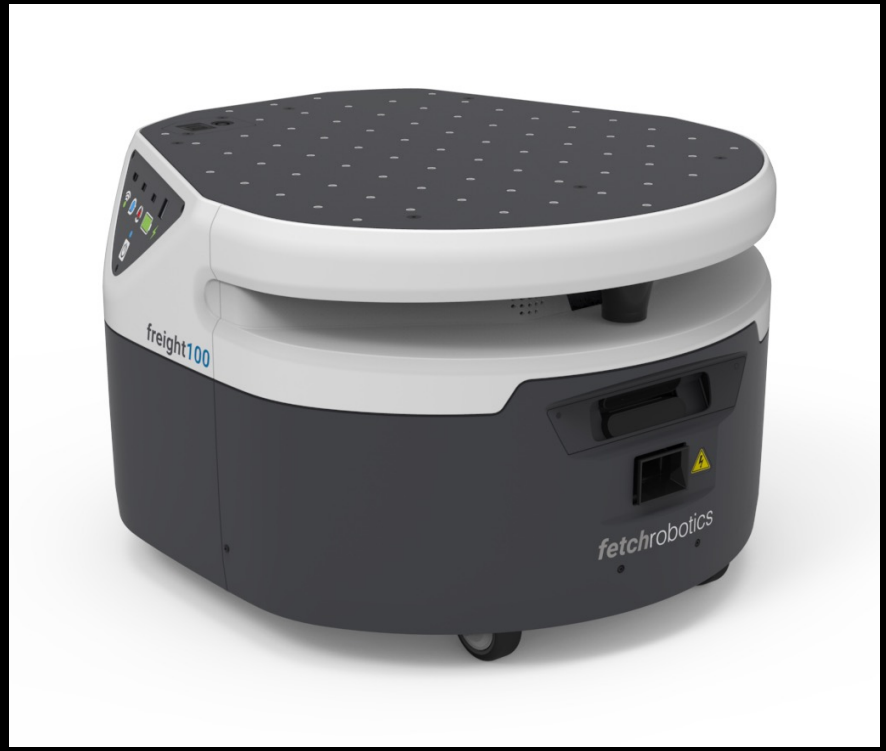
- Background
- Introduction to Zebra Automation & FetchCore
- Introduction to the Robot Operating System
- F100 OEM APIs
- Demos
- Questions



Background

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Introduction To Zebra Automation & FetchCore

Introduction to Zebra Automation

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Manufacturing Solutions

Distribution Solutions

Fulfillment Solutions

OEM Solutions

Fetchcore

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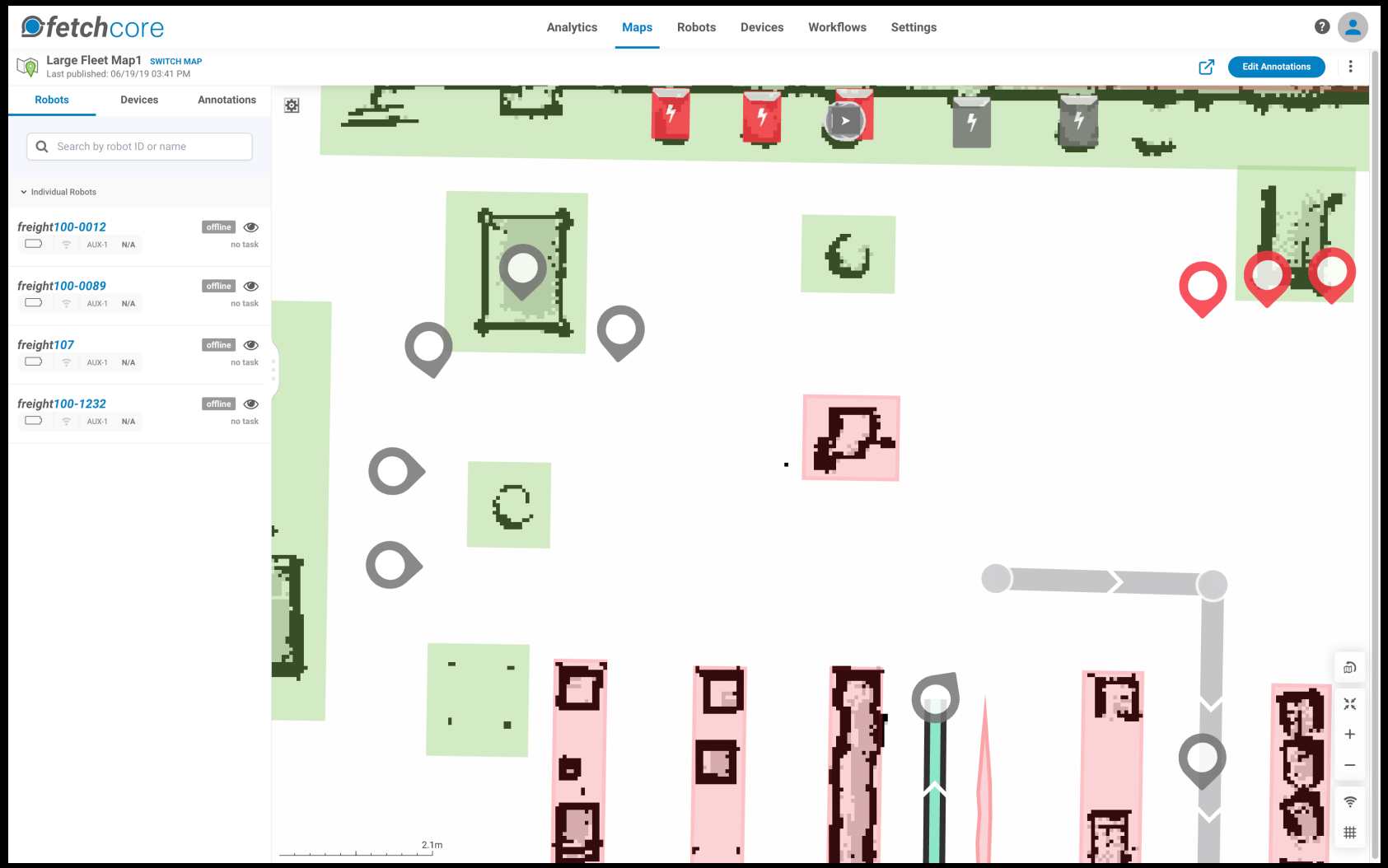

FetchCore Integration Options

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Standalone

fetchcore

AMRs

Equipment

fetchcore

AMRs & TDC

Device/System

Devices & Apps

WMS / MES

fetchcore

AMRs

OEM

OEM SW

fetchcore

AMR & OEM Accessory

OEM - ROS

OEM SW

fetchcore

AMR & OEM Accessory

No Code

REST APIs

REST APIs & HW

ROS APIs & HW

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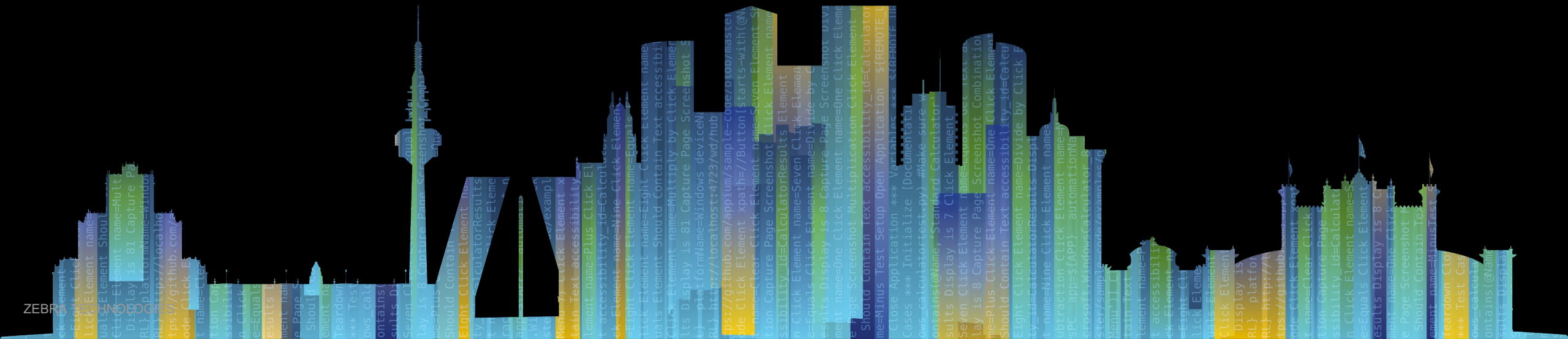
Introduction the Robot Operating System



Introduction To The Robot Operating System (ROS)

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- What is ROS?
- ROS 1 vs ROS 2
- ROS Core Concepts
  - Nodes
  - ROS Master
  - Messages and Topics
  - Actions
  - Packages and Stacks

What is ROS?

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- The Robot Operating System (ROS) is an open source Framework not an Operating System
- Originally developed at Stanford (2007) to provide a plug and play based robotics framework
- Now maintained by the Open Source Robotics Foundation (since 2013)
- Addressed the issues in robotics at the time
  - Lack of standards
  - Little code reuse
  - Recoding common algorithms
  - Continually reinventing or rewriting device drivers
- Runs on Ubuntu Linux Operating System
- Used by over 125 robots models

ROS1 vs ROS2

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- There are two supported versions of ROS
- ROS 2 is newer and is being developed as the replacement for ROS 1
- Both are used quite actively throughout robotics
- We will be discussing ROS 1 for the rest of this presentation

ROS Nodes

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- A Node is a process that performs some work or computation
- Nodes communicate with each other by either publishing or subscribing to topics
- An example of a Node could be a driver for a sensor which publishes data
- Other nodes can subscribe to, filter, and act on that data

ROS Master

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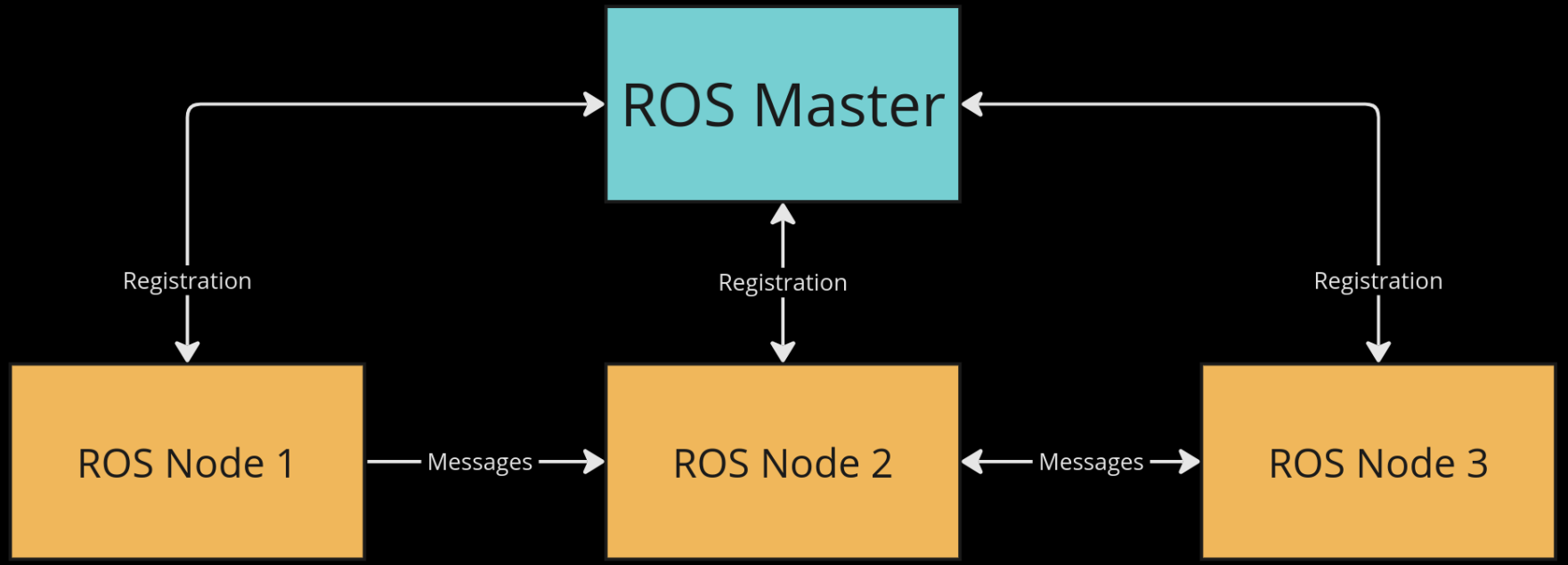
- ROS starts with the ROS Master
- The ROS Master allows all ROS Nodes to find each other and allows communication between the various nodes to be established



Remote ROS Master

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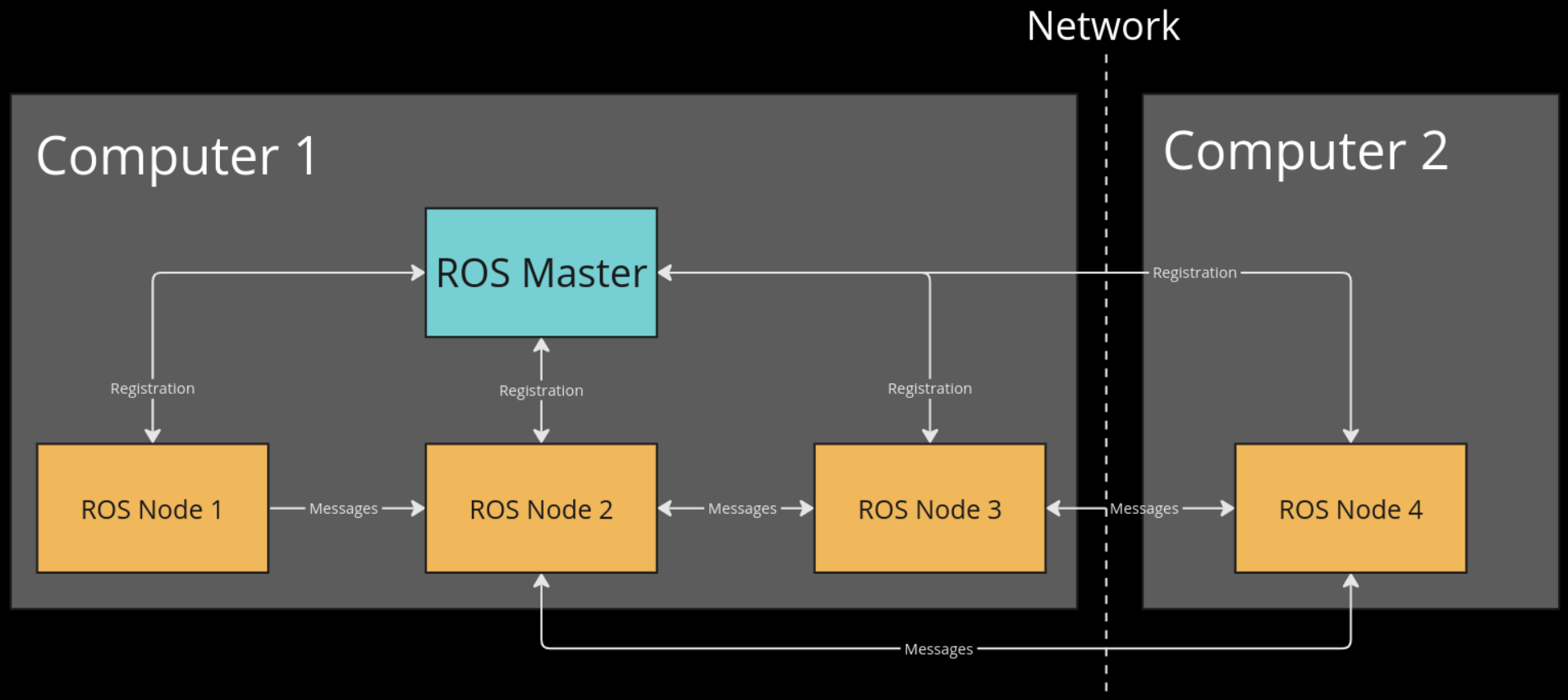
- Multiple Computers can communicate with a single ROS Master
- Allows Nodes run on a second computer to act as if they are on the same computer



ROS Topics and ROS Messages

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- Topic: Named stream of messages with a defined type
  - Data from a camera might be on topic /camera_image and be of type Image
- There is a standard set of messages, but custom ones can be defined
- Nodes can publish messages (no limit to the number of published topics)
- Nodes will Subscribe to Topics (no limit to the number of subscribed topics)
- The communication model for a topic is 1-to-N
  - One topic can be subscribed to by many other subscribers at once
- On receiving data from a Topic the node will run a Callback
  - Could save the data
  - Trigger an event
  - Etc.

ROS Action

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- A standard Interface for requesting work.
- Server Client Model
- There are three parts of a ROS Action Message
  - Goal
    - Published from the client to the server to do some work.
    - Example: could be requesting the robot drives from it's current location to another
  - Feedback
    - Feedback is published from the server as the action executes and subscribed to by the client
    - Example: could be how far from the requested location the robot is
  - Result
    - Result is published by the server to the client at the end of the action
    - Example: could be if the robot succeeded or failed to get to the goal location

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F100 OEM Integration

F100 OEM Integrations

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- Hypothetical Hardware Setup
  - Power
  - Network
  - Compute
- Software APIs
  - ROS Data Topics
  - ROS Actions

Hypothetical Hardware Setup

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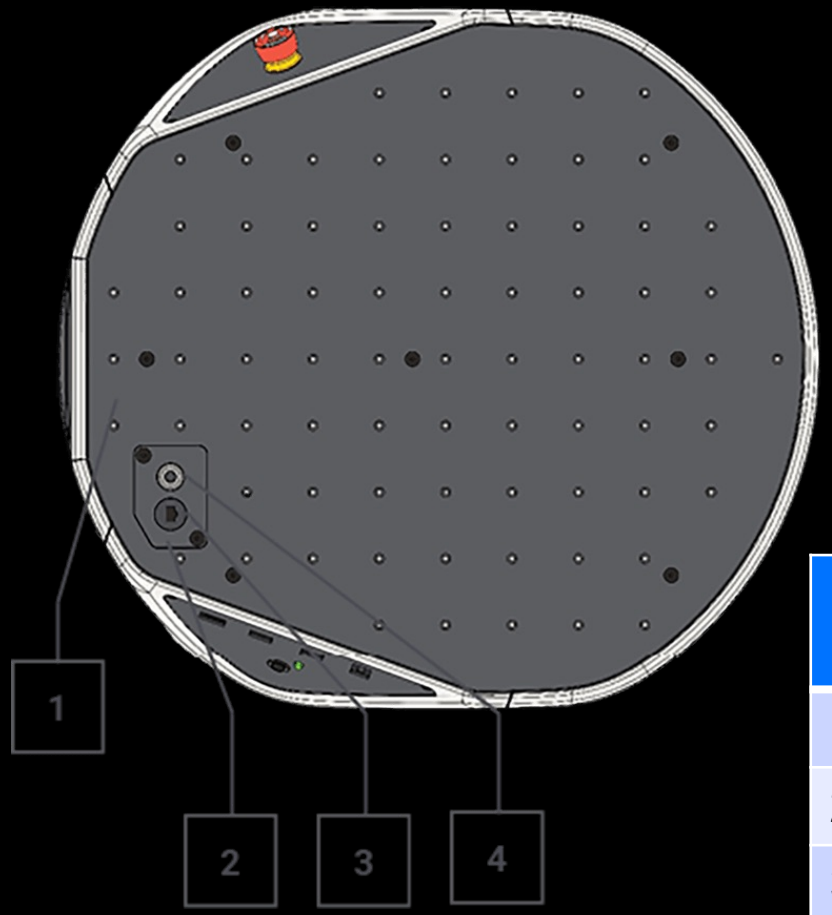
- Power
  - 24V 10A (240W)
- Network
  - Connection provided to robot network.
  - Internet access not provided on the internal network.
- Compute
  - Bring your own compute



Number	Description
1	Top Platform
2	Connector Faceplate
3	Ethernet, USB 2.0 or Blank
4	AUX Power (24v)

Hypothetical Network Setup

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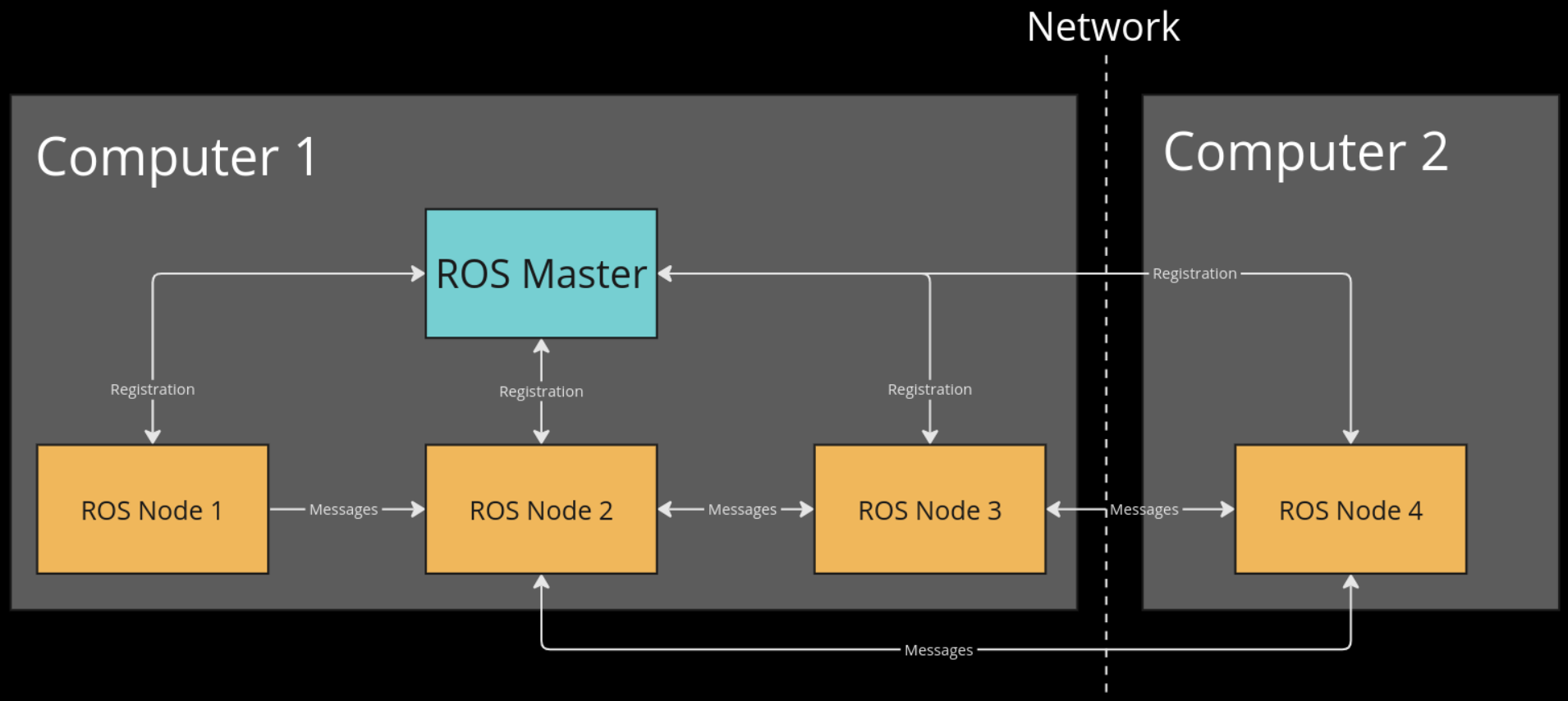
- Computer 1 onboard F100 Compute
- Computer 2 OEM computer and integration with onboard robot stack



Software APIs (Non exhaustive list)

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- Data Topics
  - Battery Information
    - Current state and charge of the battery
  - Runstop Information
    - State of the Runstop (Safety stop button that will either enable or disable the robot)
- Actions
  - Navigate
    - Tell a robot to navigate to a position
  - Localize
    - Localize a robot in a map
  - Charge Dock
    - Go to a charge dock
  - Undock Charger
    - Undock from a charge dock

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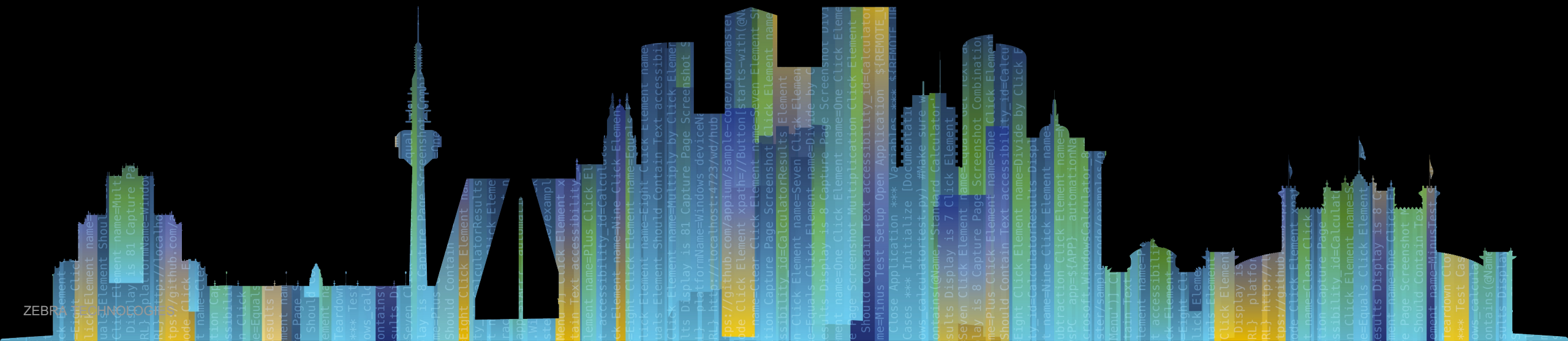
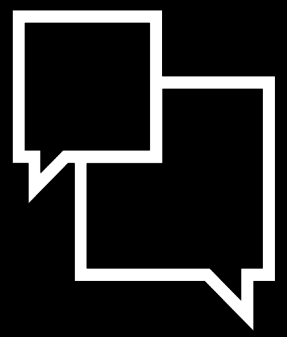
Demos!





Questions

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Thank You