

# ROS / ROS 2 with Kubernetes (ROSCon Recap)

Tomoya Fujita

Sony R&D US Laboratory

Slides are available

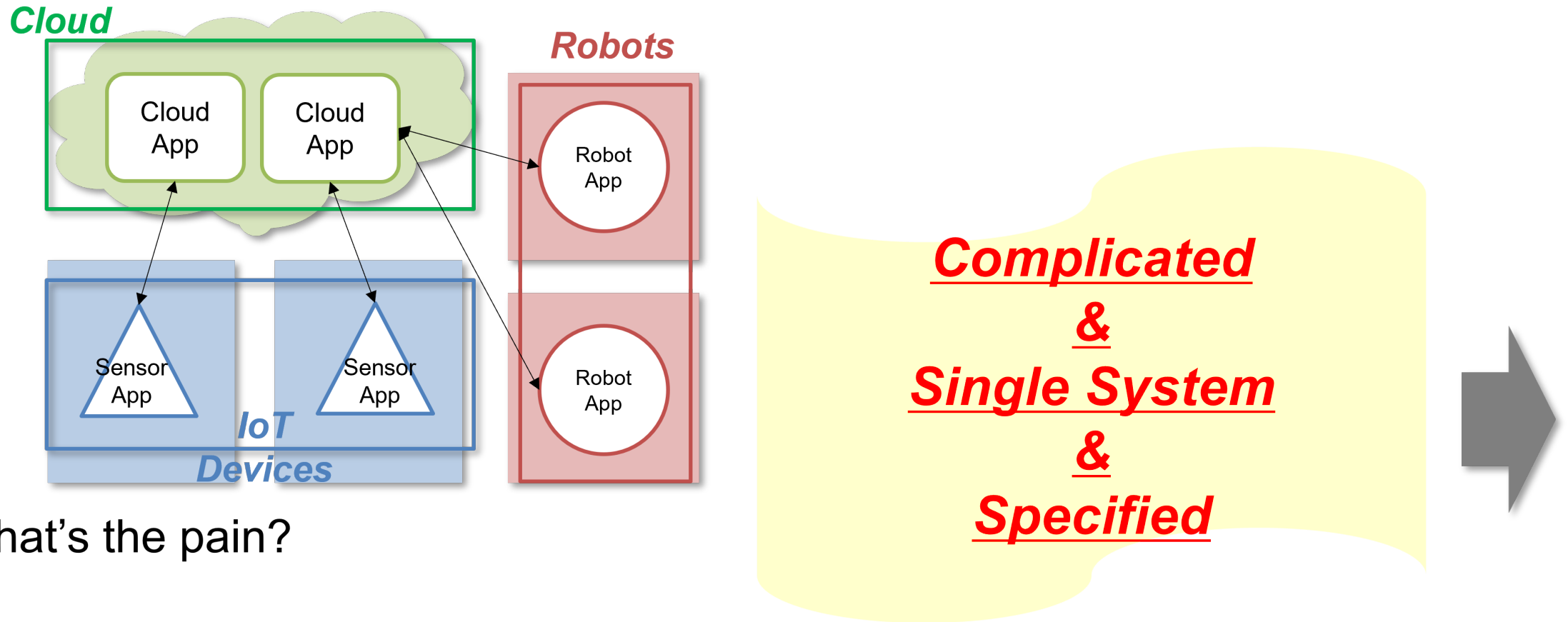


# References

- ROSCon 2023 ROS with Kubernetes [Talk](#) / [Slides](#)
- Community Meeting
  - [ROS Deployment Meeting](#)
  - [Cian Donovan : ROS Deployment Podman / Systemd](#)
  - Stay tuned for next meeting?

# Background / Problems

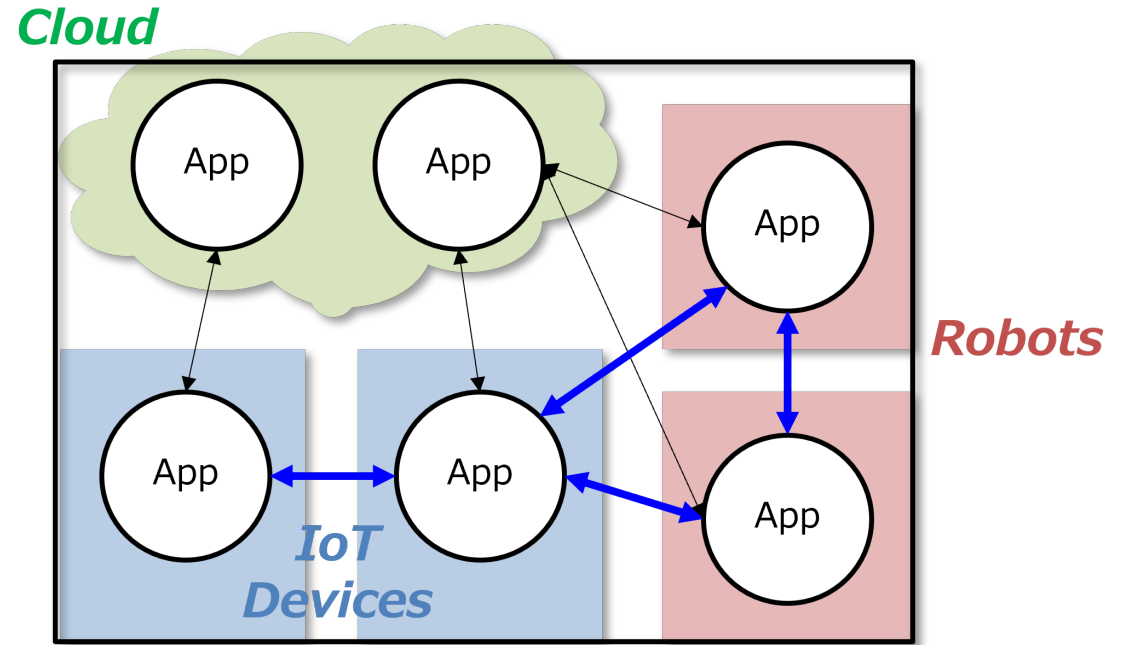
- Broad use cases (factory, logistics, entertainment, rescue, car, done...)
- ROS and ROS 2 Distributed and Connected System.
- Collaborative and Orchestrated Application.
- AI/ML Ops Application lifecycle
- Hardware Acceleration / Platform Dependencies.



What's the pain?

- Different architecture for cloud and edge device.
- Take time and effort to setup environment and run application.
- IoT Device is really statistic implementation.

**Simple/Common**  
**&**  
**Distributed System**  
**&**  
**Platform Agnostic**



What we want is...

- Common base architecture for everyone and everywhere.
- Application can be deployed on anywhere.
- Eco-system for Application.

# Goal / Requirements

- Flexible Application Deployment.
- Network, Device and Storage Abstraction.
- Application Modularity / Platform Agnostic.
- Sustainability / Efficiency
- Observability / Network Policy

# Kubernetes

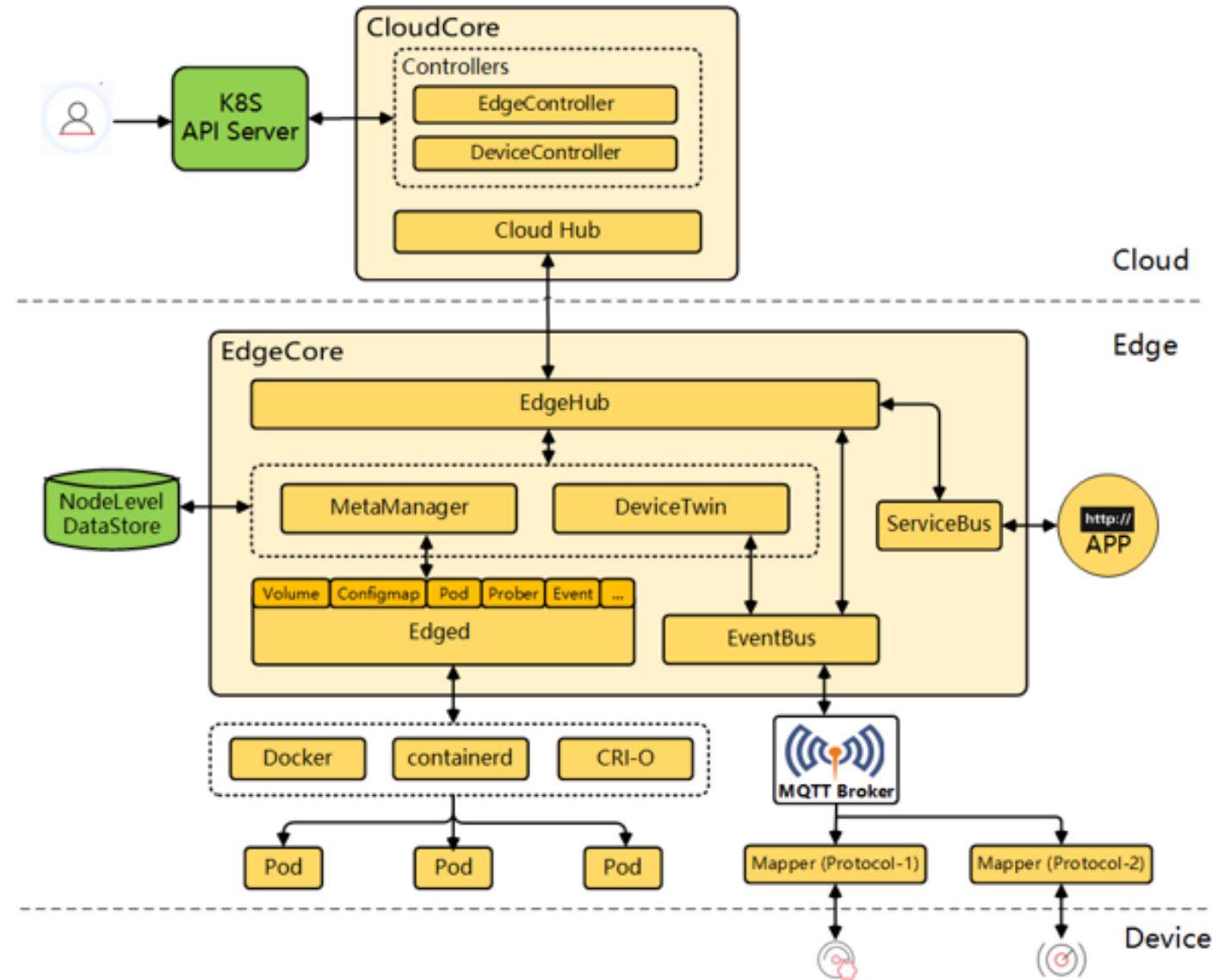
- Application Deployment and Orchestration.
- Device Capability and Label Control.
- Auto- Scaling and Healing.
- Roll Up/Down, Canary Test.
- Role Based Access Control.
- Device-Plugin / Container Device Interfaces.
- Container Network Interfaces.
- Observability / Network Policy.





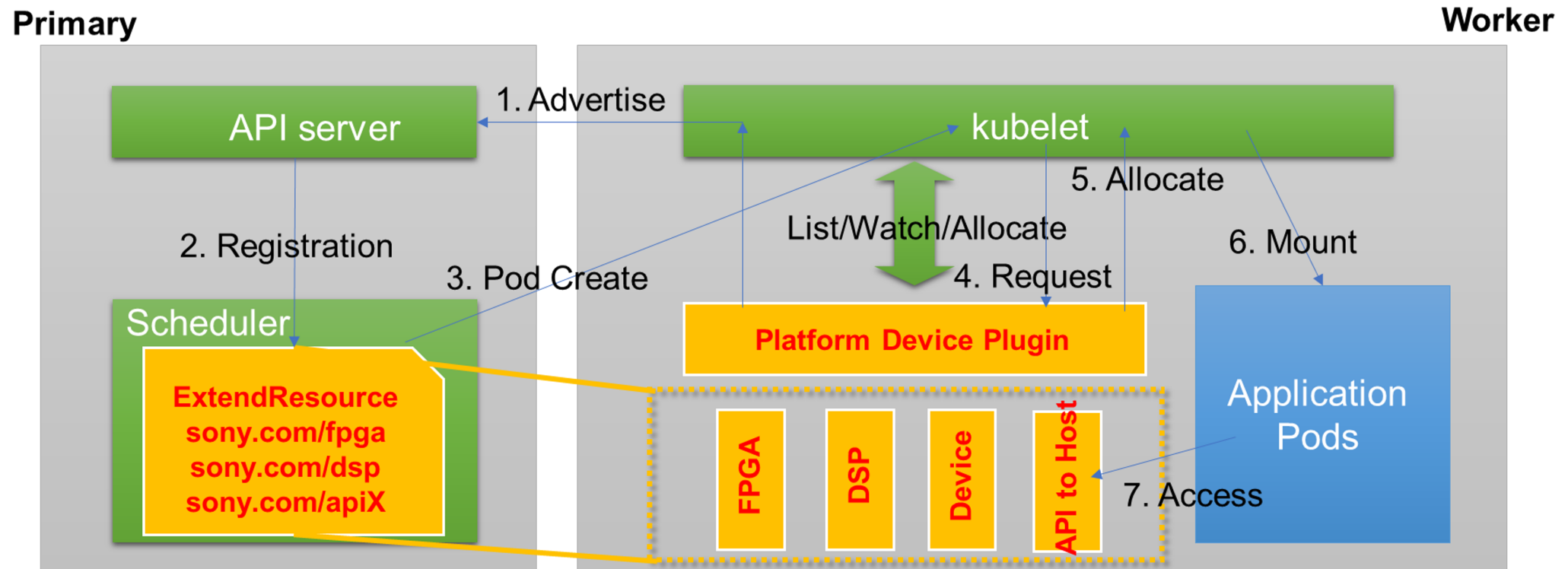
# KubeEdge

- Cloud-Edge Coordination
- Edge Autonomy
- Kubernetes-native Support
- Resource Efficient



## Device-Abstraction (Device-Plugin, Container Device Interface)

- Kubernetes Custom Resource Definition, that allows us to plugin vendor specific hardware and device to the containers.
- After advertising the custom resource to Kubernetes, Kubernetes controls those resources with workload based on application requirements.



# What's missing?

- Missing CNI supports multicast ([Cilium](#))
- KubeEdge CNI support ([Cilium](#))
- Edge Optimization / Configuration
- KubeEdge Cloud-Native Digital Twin RobotDevOps
- Far Edge Devices? [WasmEdge](#)?

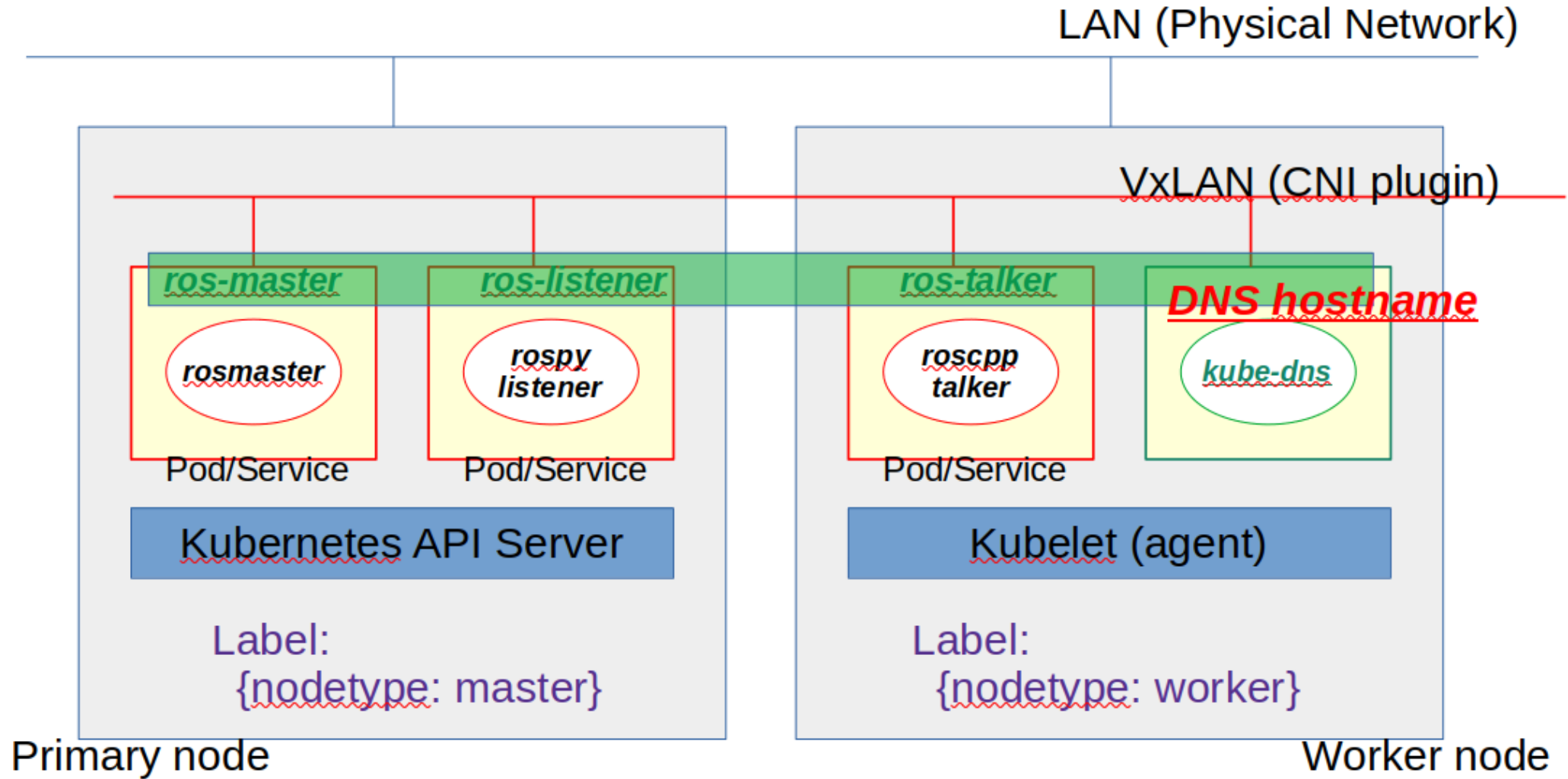
# Open Issues

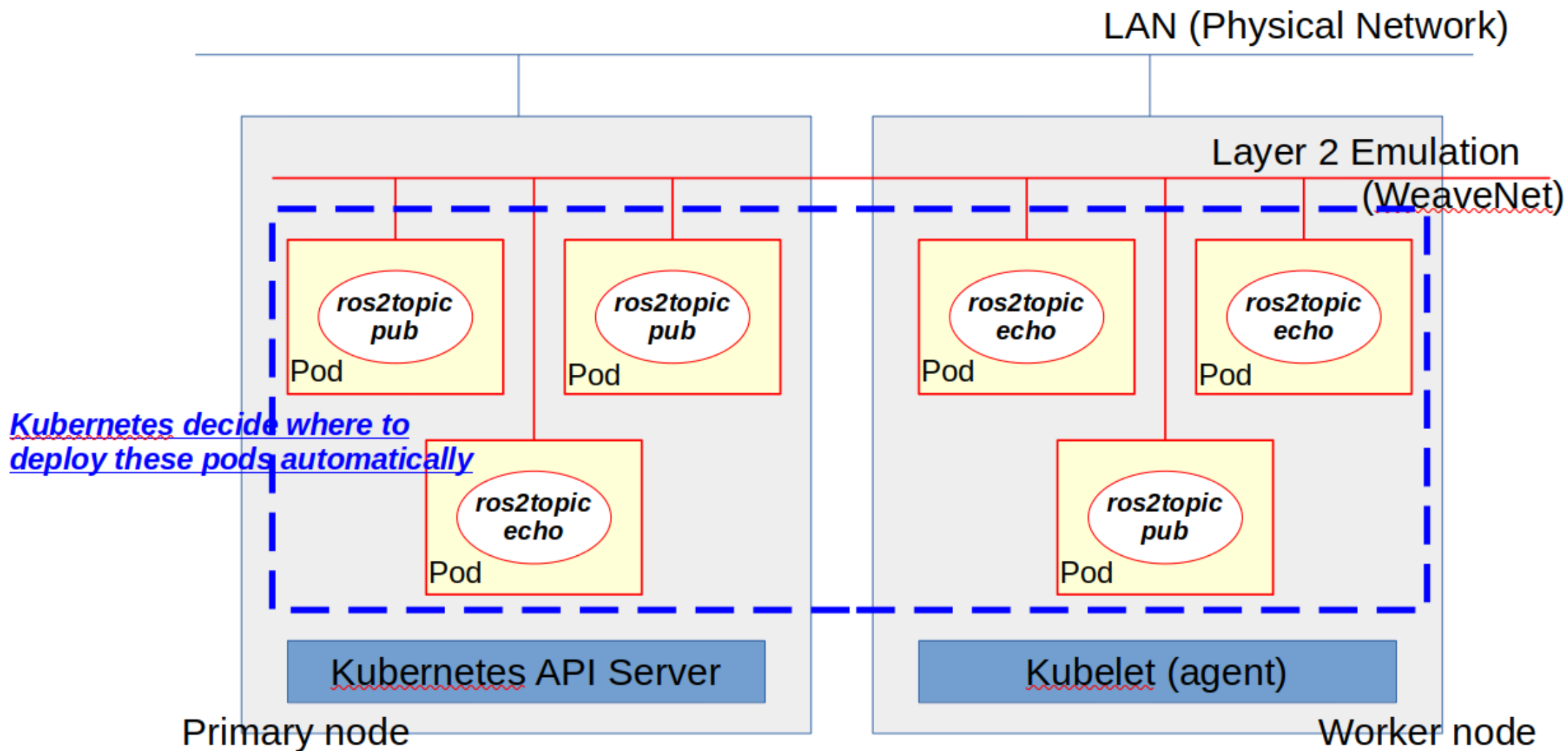
- Add example deployment with Data Sharing via LoanedMessage
- support systemd kubelet to start the cluster automatically
- Edge worker device offers limited resource to be managed by Kubernetes
- Support SROS2 security enclaves via ConfigMap
- Support Nvidia Device-Plugin
- Support KubeEdge tutorial with far edge micro-ROS

# Demo

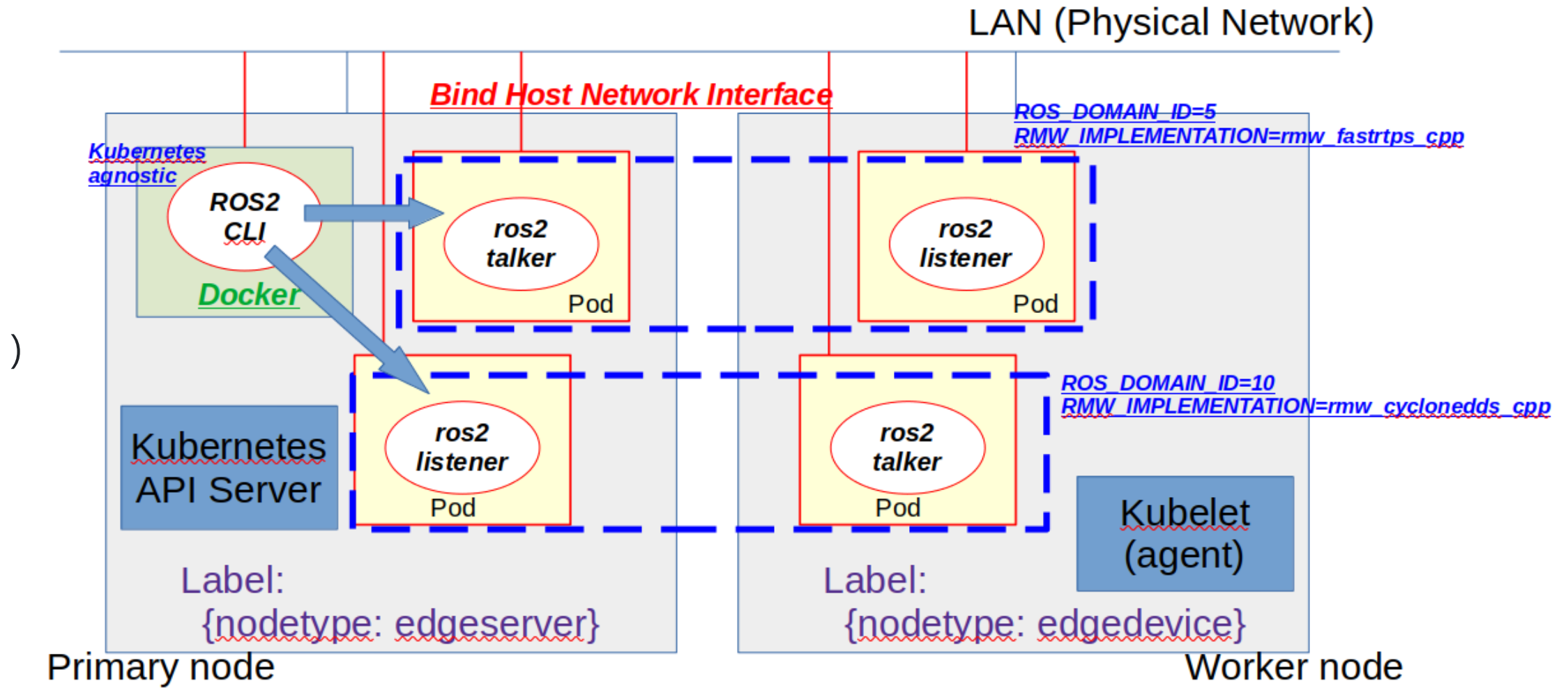
- ROS 1 Multiple Node Deployment
- ROS 2 Simple Distributed System
- ROS 2 Domain ID / RMW Configuration

# Check Kuberntes Cluster











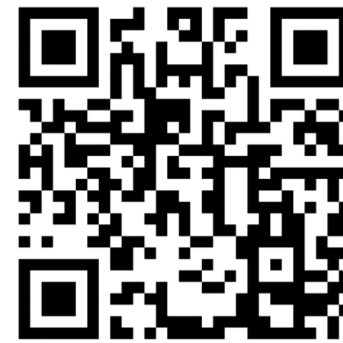
 ROS



*[Kubernetes  
IoT Edge WG](#)*



*[KubeEdge  
SIG Robotics](#)*



*[ROS Kubernetes  
Tutorials](#)*

# Questions?