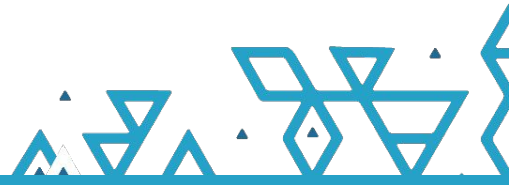
Orchestrating Edge<>Cloud Infra and Applications using Nephio + Red Hat OpenShift

KubeCon/CloudNativeCon - Paris
March, 2024

Agenda

- Nephio overview – 5 minutes
- Key Nephio Principles – 15 minutes
- AMCOP/Nephio using OpenShift – 10 minutes
- AMCOP/Nephio Demo of Infra Orchestration using OpenShift – 10 minutes
- Q&A/Discussion – 5 minutes



Introducing Nephio

- New Linux Foundation open source project; seeded by **Google**
- Nephio's goal is to **deliver simple, open, Kubernetes-based cloud-native intent-driven automation**, via automation templates
- Materially simplify the deployment and management of multi-vendor cloud infrastructure and network functions across large scale edge deployments

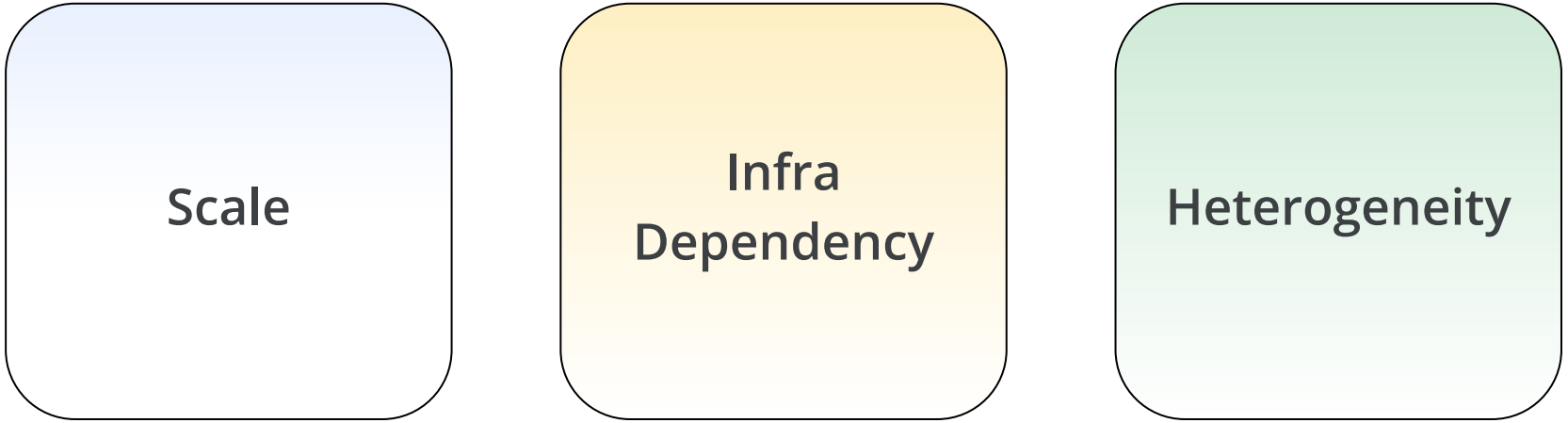
Multi-vendor & multi-domain

Network functions & edge native apps

Configuration management

Challenges at the Edge

Edge workload (e.g. Network Service or Edge Native App) orchestration and management presents new challenges



What if we could use Kubernetes to solve this problem?

Introducing Nephio

- Kubernetes-based intent driven orchestration and management of ***network services, edge computing apps, and the underlying infrastructure***

Multi-vendor cloud & edge infra

Network functions & edge native apps

Configuration management

Why Nephio?

Scale

- Multi-site
- Intent driven = constant reconciliation = Day 1 & 2
- DevOps baked in

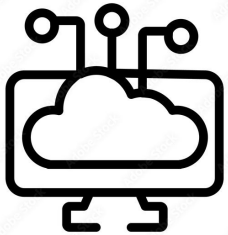
Infra⇒ Workload

- On-demand distributed clouds
- Suitable for infra and workloads

Heterogeneous

- Multi-vendor environments
- Public & private clouds
- 3rd party network functions and edge native apps

Sample Problems Solved by Nephio

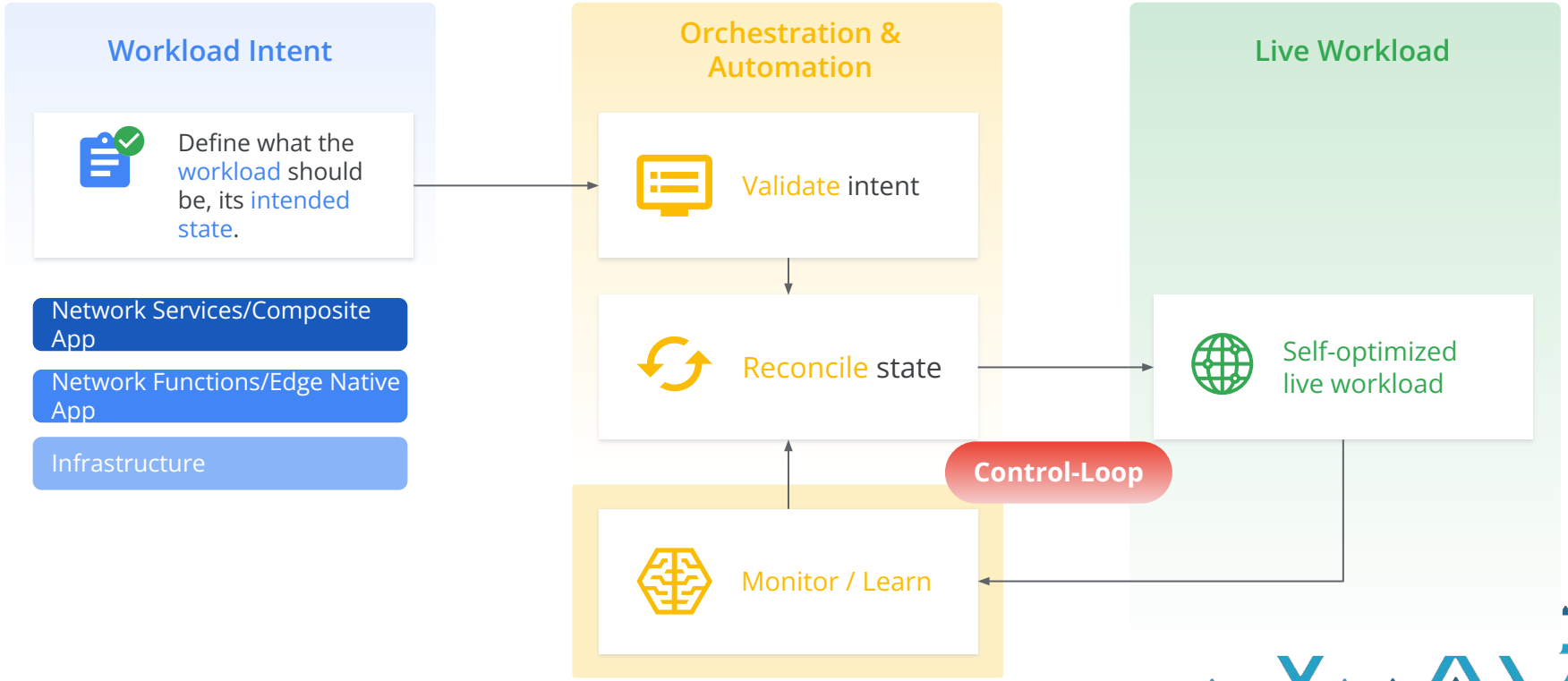


Multi-vendor Edge Services Brokering

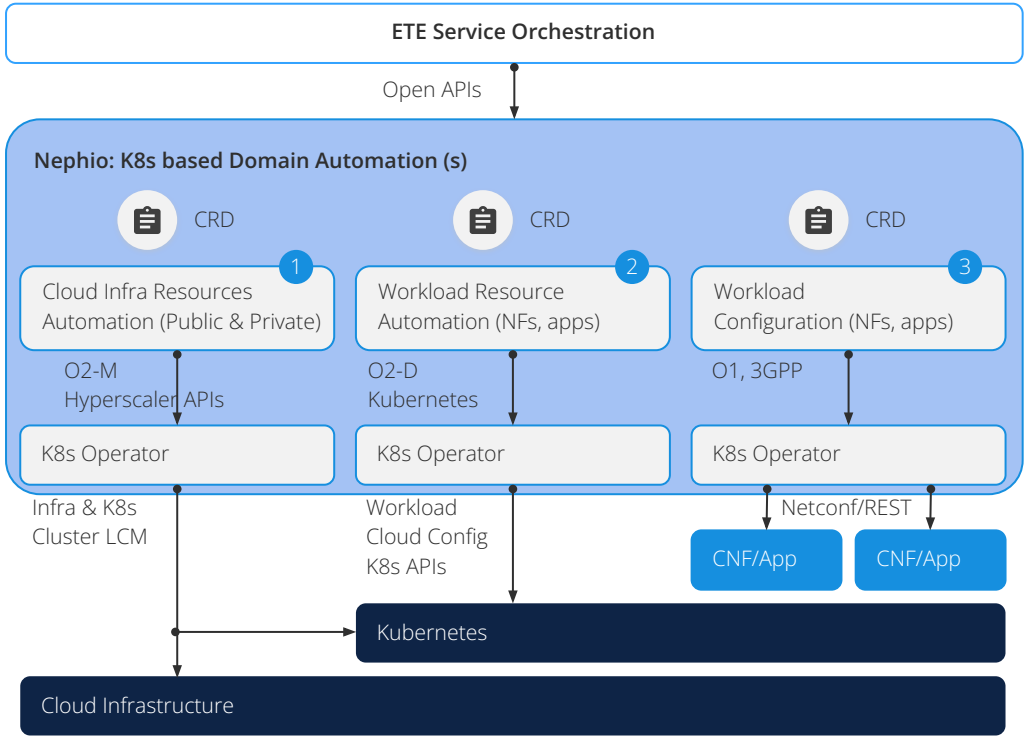
Multi-Access Edge Computing Applications

5G Network Services (e.g. O-RAN)

Nephio Architecture



Nephio Extends Kubernetes



Scope of Nephio community

Nephio focuses on extending K8s to support unified automation with

- K8s based CRDs and operators for each Public and private cloud Infrastructure automation.
- The workload cloud resource automation (i.e CRUD operations of K8 Cluster, Network Functions/App deployment on top of the cloud, and NF/App infrastructure configuration such as SR-IOV)
- Workload configuration (ie. NF/App level configuration)

Key Nephio Principles

Intent-based automation

Simplified configuration to user e.g. Deploy 5G UPF with X capacity at Y location OR deploy a VR application within 5 ms of Plano, TX

Declarative configuration

To address day 0, 1 and 2 configurations, rainy day scenarios, intelligent auto scaling control-loops, and full life-cycle support

Non-complex: Cloud -Native automation

Simplified, unified cloud native management (Kubernetes) in every tier

Extend base Kubernetes with Infrastructure CRDs and Operators

- Declarative expression of ALL infrastructure requirements for NFs/edge native apps

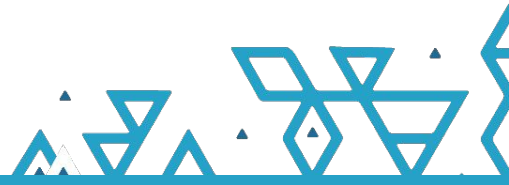
Deploy a workload anywhere

- No out-of-band infrastructure configuration

CI/CD at Scale

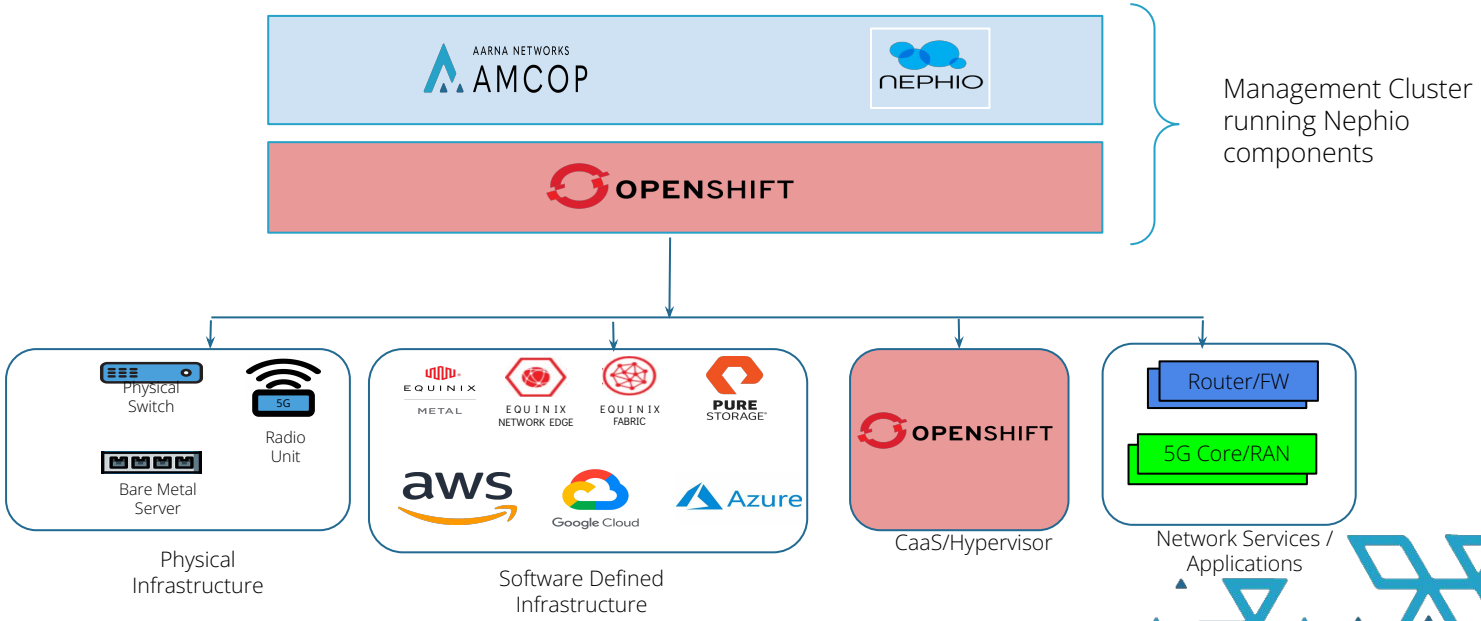
- Open source CI projects **kpt & Porch** used as a wrappers around git
- Intent is stored and successively mutated through this mechanism
- Open source CD project **ConfigSync** is used by the edge to pull the final intent and apply it to the target cluster

Mechanisms handle day 0, 1, 2 in a uniform manner; drift is eliminated; massive scale can be supported

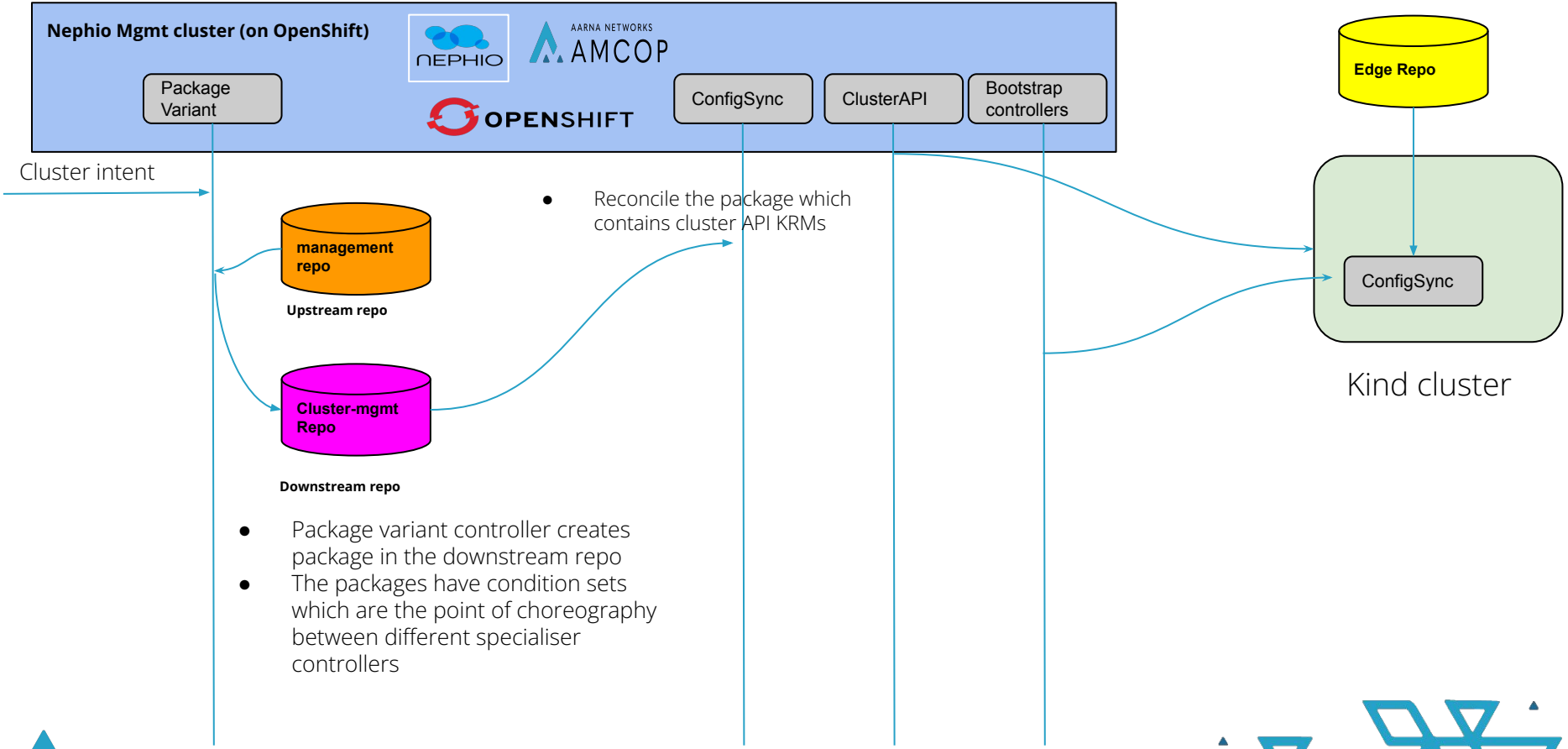


Red Hat OpenShift + AMCOP / LFN Nephio

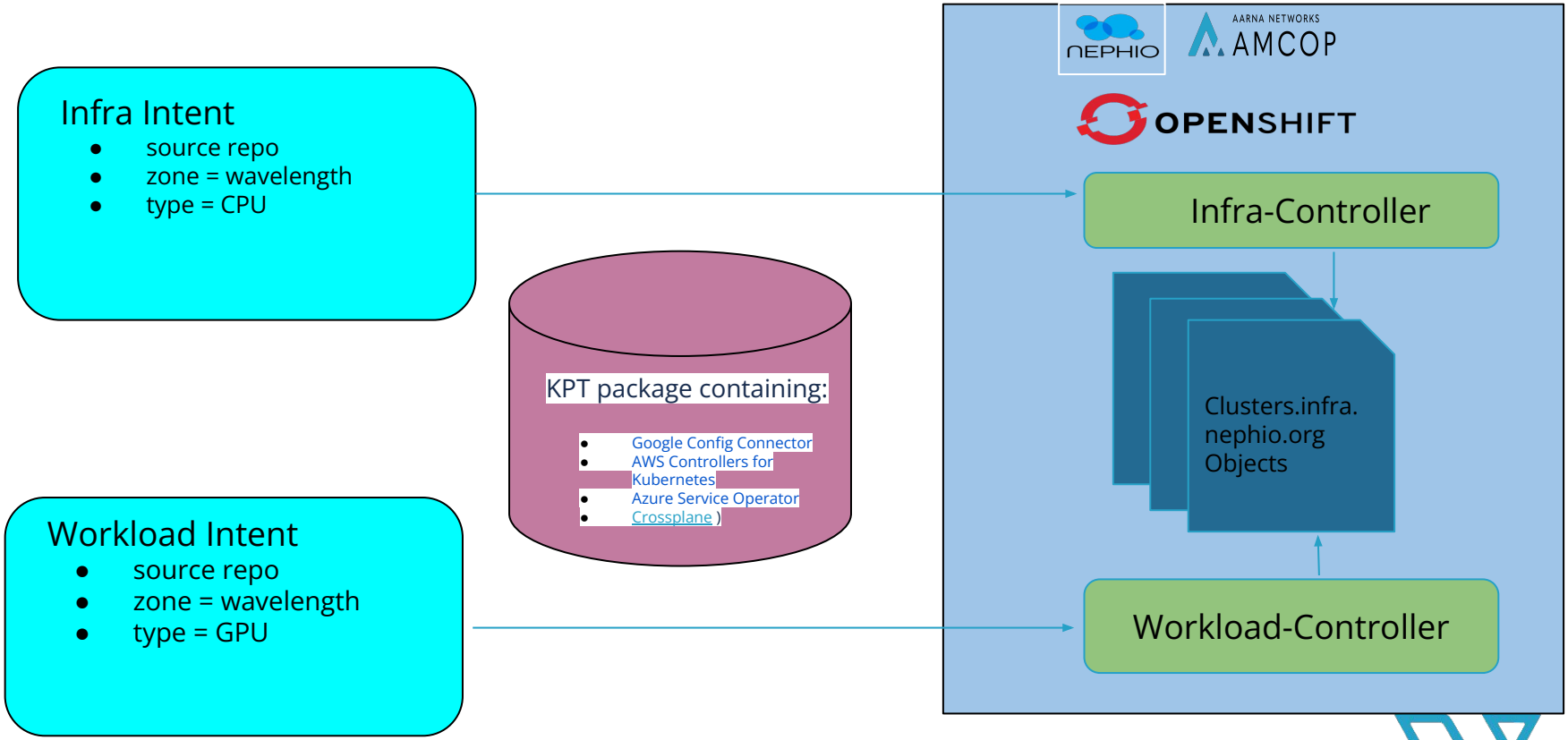
- LFN Nephio can use OpenShift as the Kubernetes control path
- LFN Nephio + OpenShift provides an Enterprise-grade platform for supporting Nephio applications and use cases



Cluster Automation (Example)



Infra & Workload Intents (Example)

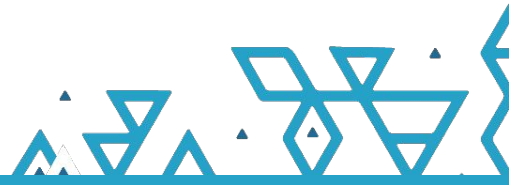


OpenShift + AMCOP/Nephio

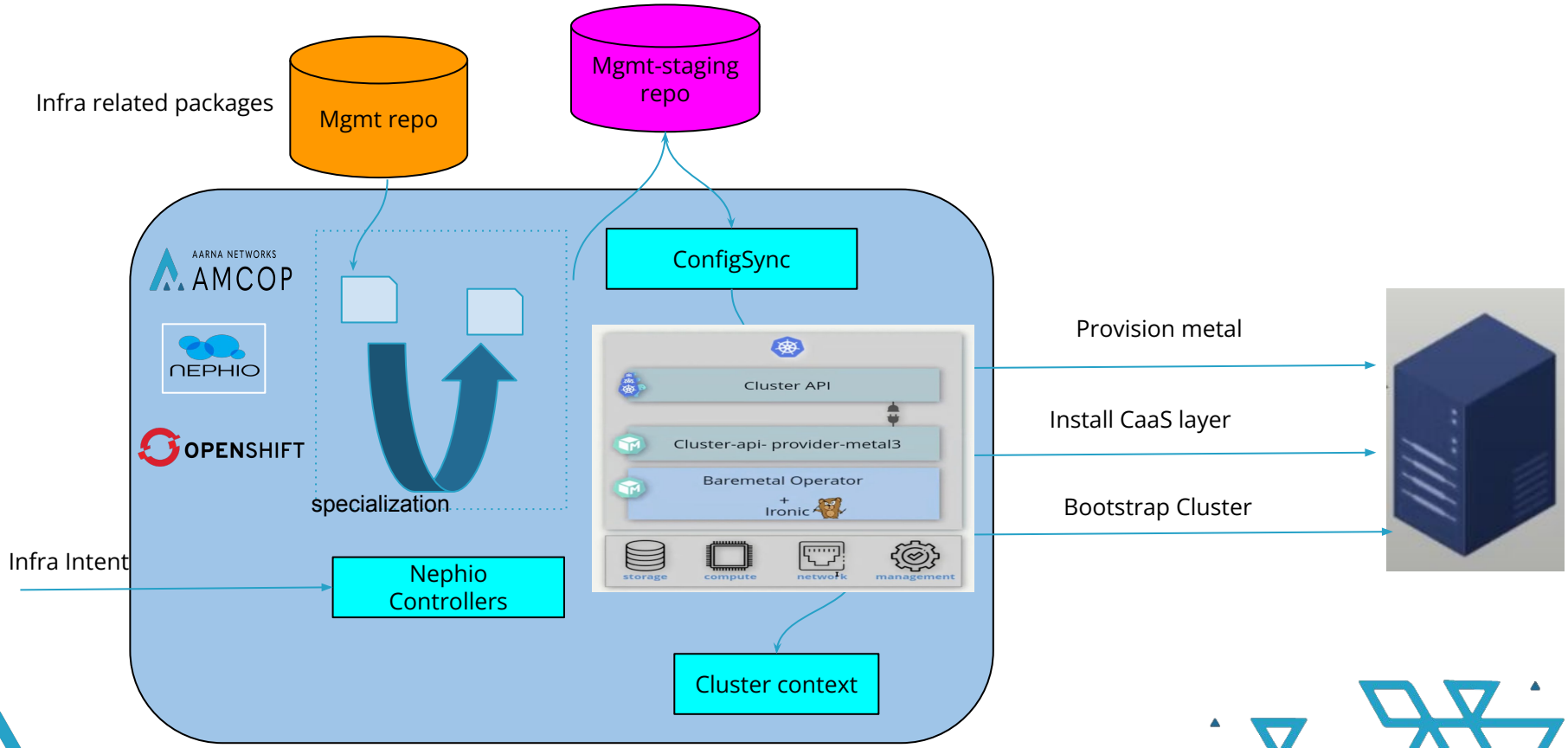
DEMO

Example Use case: Bare Metal provisioning

- Onboard bare-metal servers
  - Discover hardware inventory
  - Configure BIOS and RAID settings on hosts
- Install and boot an operating system image
- Deploy kubernetes
- Manage kubernetes cluster
- Remediate failed hosts

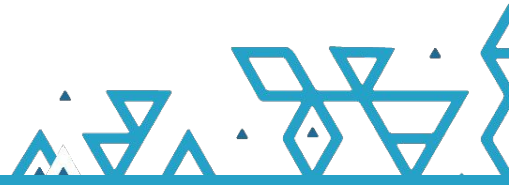


AMCOP Nephio - Bare-metal provisioning



Demo Storyline

- Pre-installed:
  - RH OpenShift on a VM
  - Aarna AMCOP (Nephio) on OpenShift
- Login to AMCOP as admin user
- Submit Infra Intent
- Orchestrate the BM Server



Thank You!