Akraino
Integrated Cloud Native (ICN)

Agenda

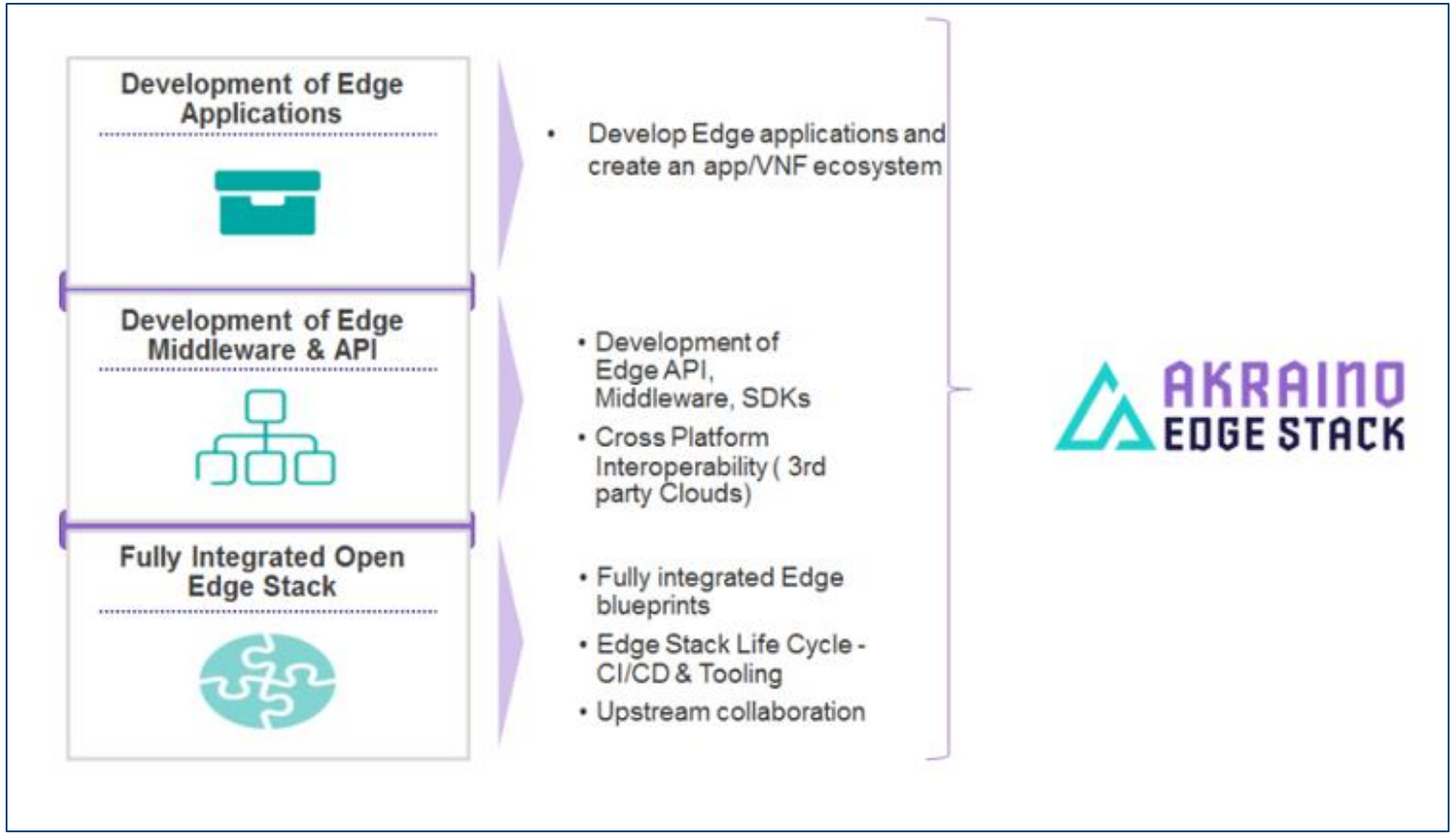
- What is Integrated Cloud Native(ICN)?
- Akraino Edge Stack
- ICN - Edge Stack details

What is ICN?

- A reference architecture/integration initiative targeting edge computing use cases
- Approved (incubation phase) as a ‘blueprint’ family within the Akraino project (LF)
  - Lead ICN use case is SDWAN. Distributed Analytics as a Service; IOT framework - EdgeXFoundry, Video CDN & Streaming to follow
    - Initial partners: Verizon, Intel, MobileEdgeX, Aarna Networks, VMWare, Dell
    - Targeting October for first ICN release (Akraino R2)
- Planned Intel-optimized ingredients include: SRIOV, QAT, CSI/Optane, OpenNESS, Clear Linux, k8s HPA, etc.
- Highly dependent on Intel’s upstream enabling

Akraino Edge Stack

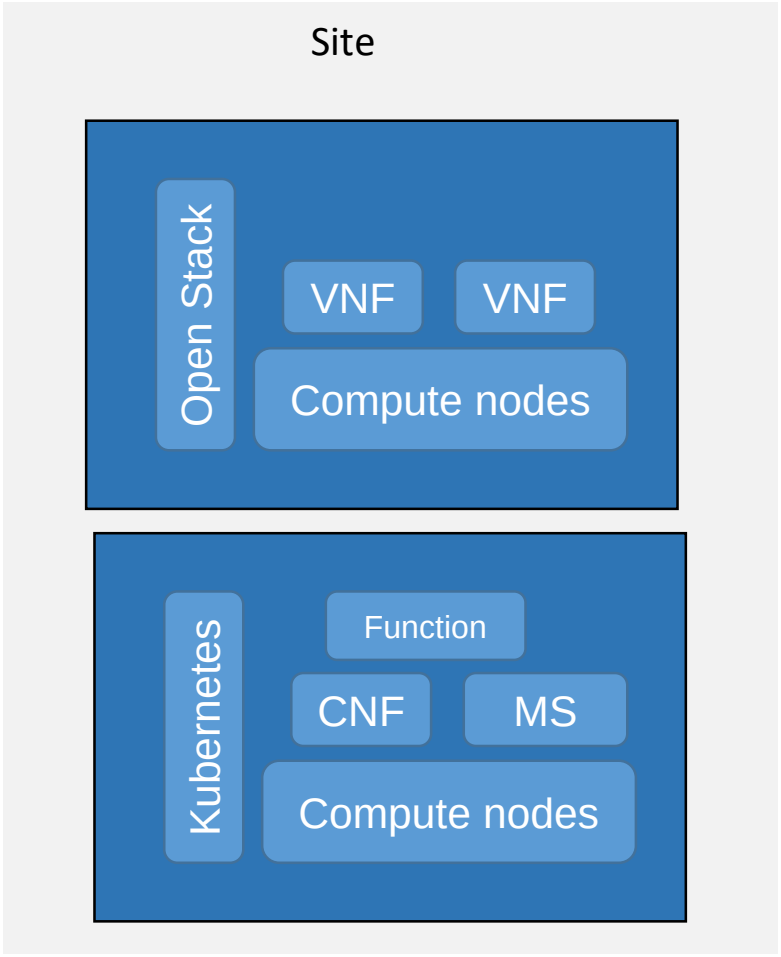
The Akraino Edge Stack Project scope includes the software, documentation, testing, integration and creation of artifacts (aka “blueprints”) that aid the development, deployment, operation or adoption of open source “edge” implementations.

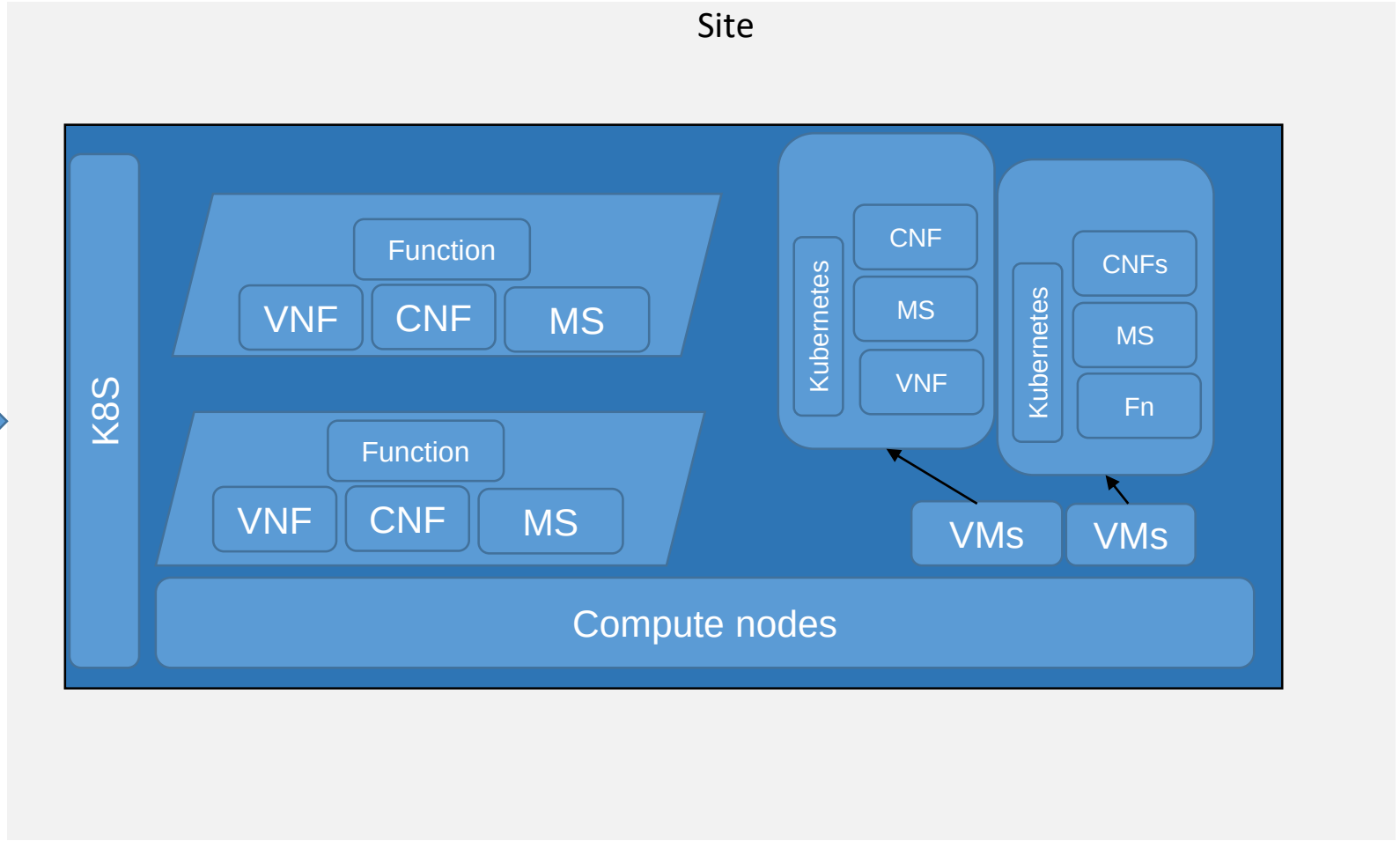


Membership:
AT&T, Ericsson, HPE, Seagate, Nokia, ARM, Dell, Huawei, Intel, Inwinstack, Juniper, NTT, Qualcomm, Radysis, Red Hat, WRS, (IBM, VMware).

- Akraino is a quasi-umbrella nested in the LF Edge umbrella
- Blueprints = Ref Architectures; Feature projects = any development projects

Transformation journey (to Kubernetes)





Two different resource orchestrators
Compute nodes are divided

- K8S for VNFs, CNFs, Micro-Services and functions
- Soft Multitenancy with one K8S
- Strict Multitenancy with K8S clusters from VMs (when required)

Technical Goals of ICN BPs

Co-existence of multiple deployment types
(VNFs, CNFs, VMs, Containers and functions)

Advanced Networking support
(Multiple networks, Provider networks, Dynamic Route/network creation, Service function chaining)

Soft and Strict Multi-tenancy

AI based Predictive placement
(Collection using Prometheus, Training and inferencing framework)

Slicing in each tenant
(QoS On per Slice basis, VLAN networks for slices, VNFs/CNFs/VMs/PODs on per slice basis or slice configuration facility on shared VNFs/CNFs)

Multi Site Scheduler (ONAP4K8S)
(Auto Edge registration, Workload placement, On-demand tenant/slice creation)

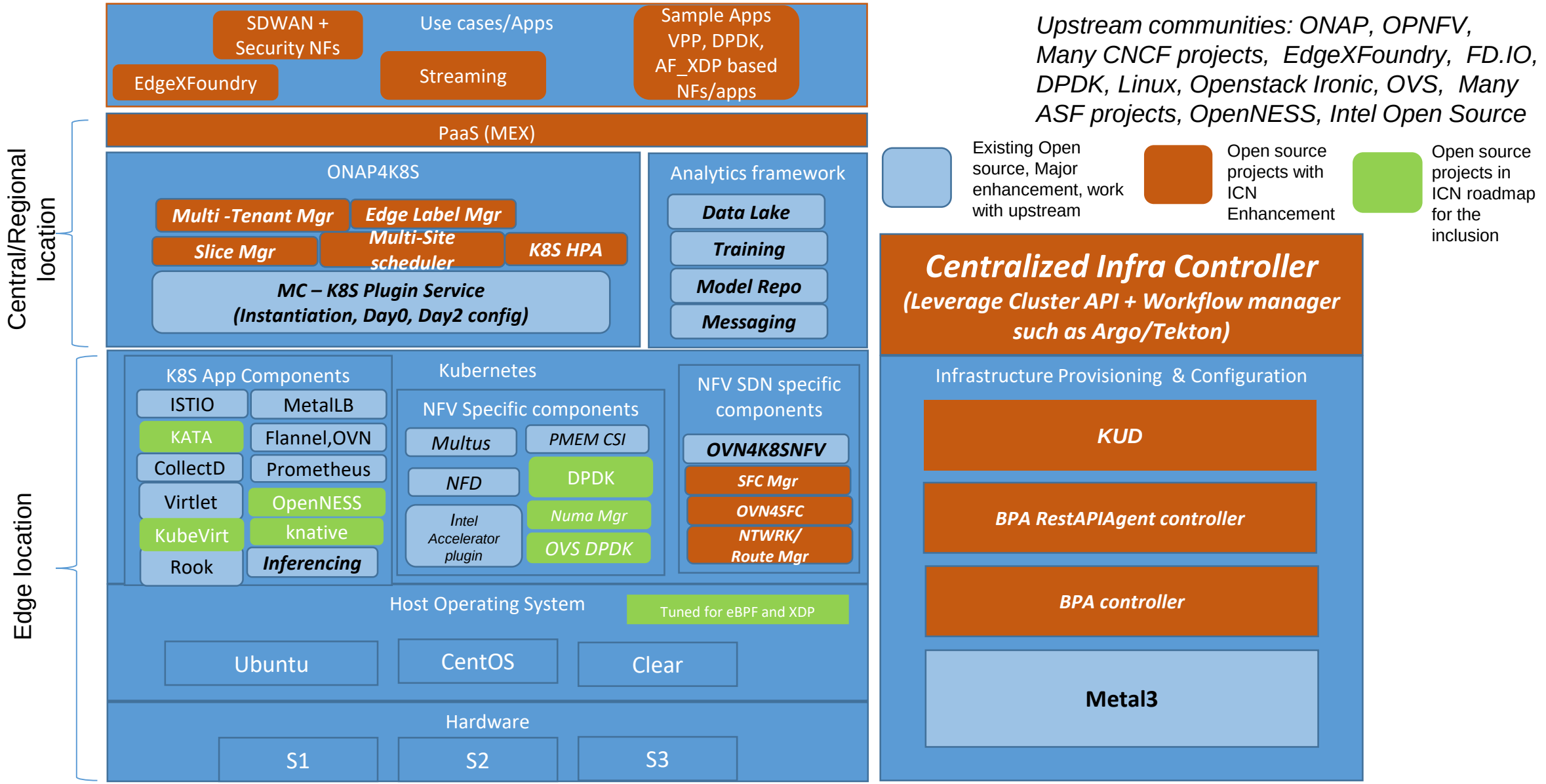
Service Mesh for Micro-services
(Acceleration using Cilium' Kernel bypass among service mesh side cars - e.g. Envoys; and others)

Programmable CNI
(to allow SFC and avoid multiple protocol layers)

Security Orchestration
(Key orchestration for securing private keys of CA and user certificates)

Prove with either test cases or use cases

ICN Stack



Upstream communities: ONAP, OPNFV, Many CNCF projects, EdgeXFoundry, FD.IO, DPDK, Linux, Openstack Ironic, OVS, Many ASF projects, OpenNESS, Intel Open Source

Existing Open source, Major enhancement, work with upstream

Open source projects with ICN Enhancement

Open source projects in ICN roadmap for the inclusion

Centralized Infra Controller

(Leverage Cluster API + Workflow manager such as Argo/Tekton)

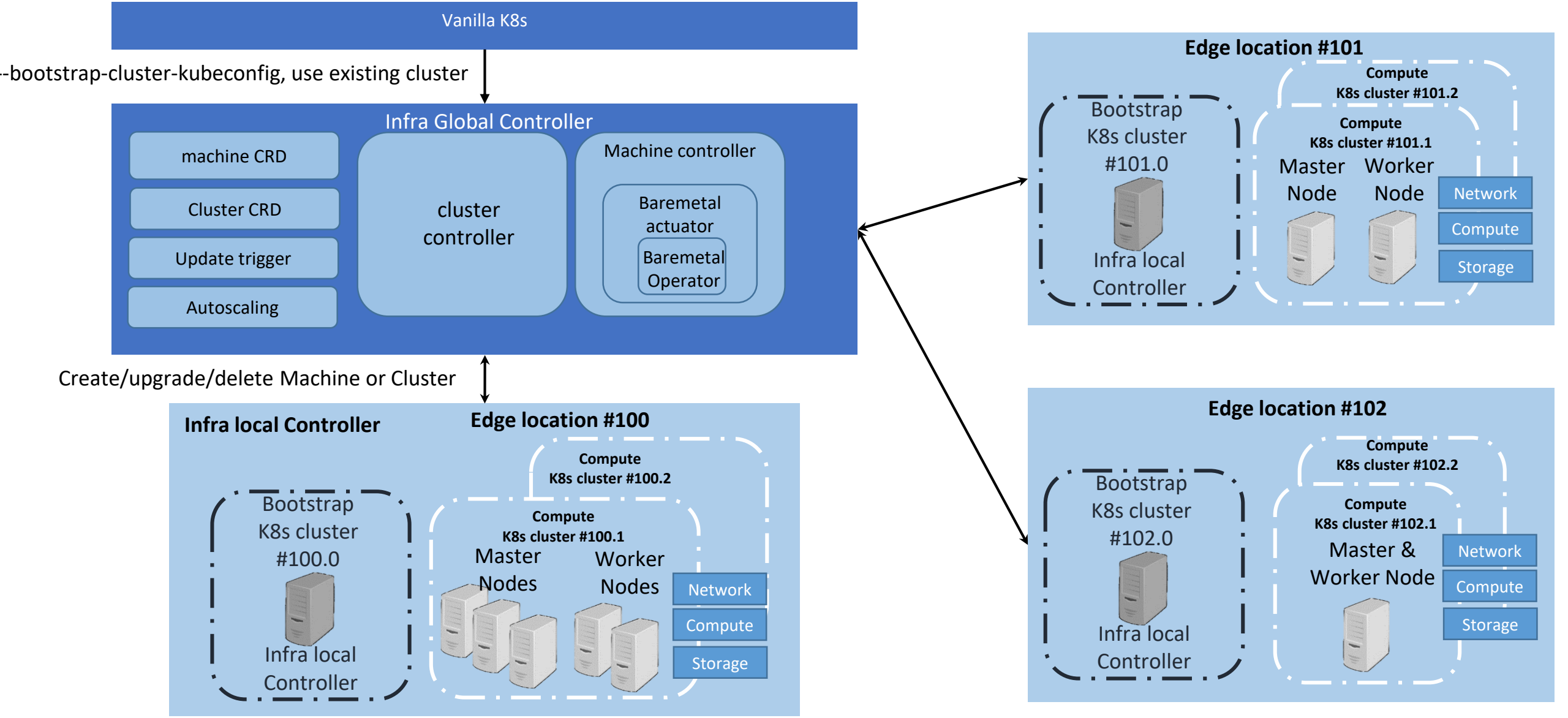
Infrastructure Provisioning & Configuration

- ***KUD***
- ***BPA RestAPIAgent controller***
- ***BPA controller***
- **Metal3**

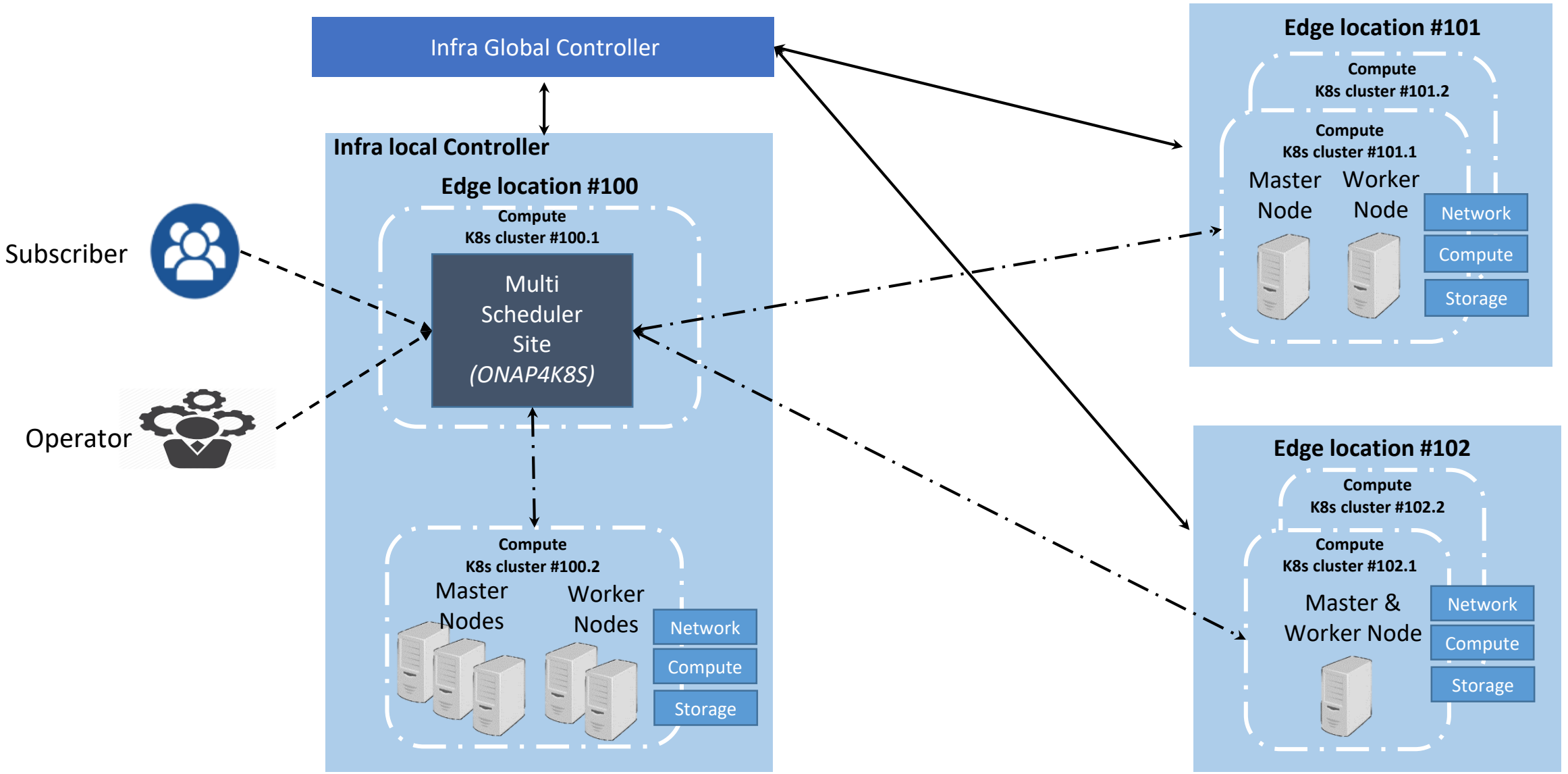
BACKUP

ICN
Infrastructure Orchestration Architecture

ICN Infrastructure

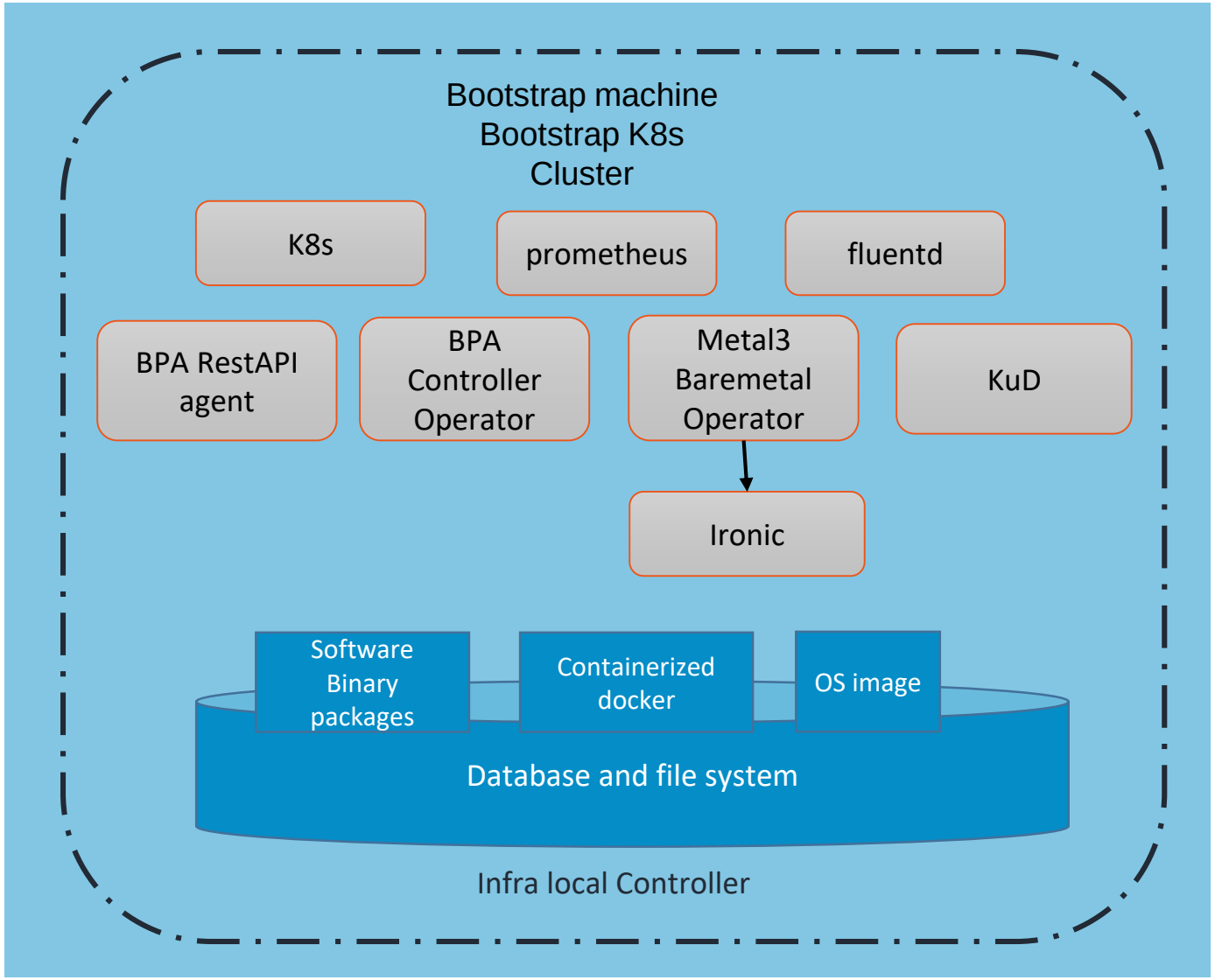


ICN Infrastructure

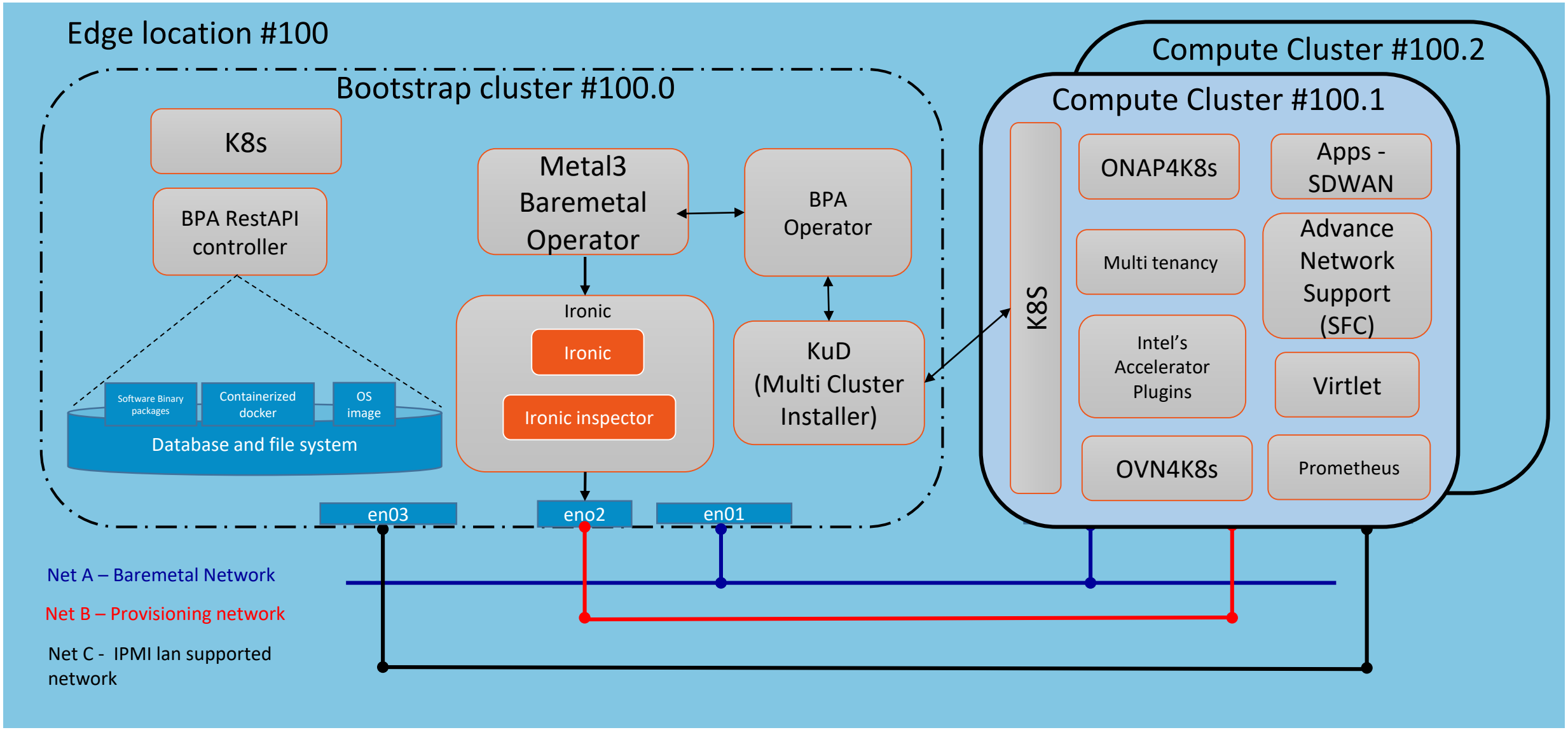


ICN Infrastructure- Infra local controller

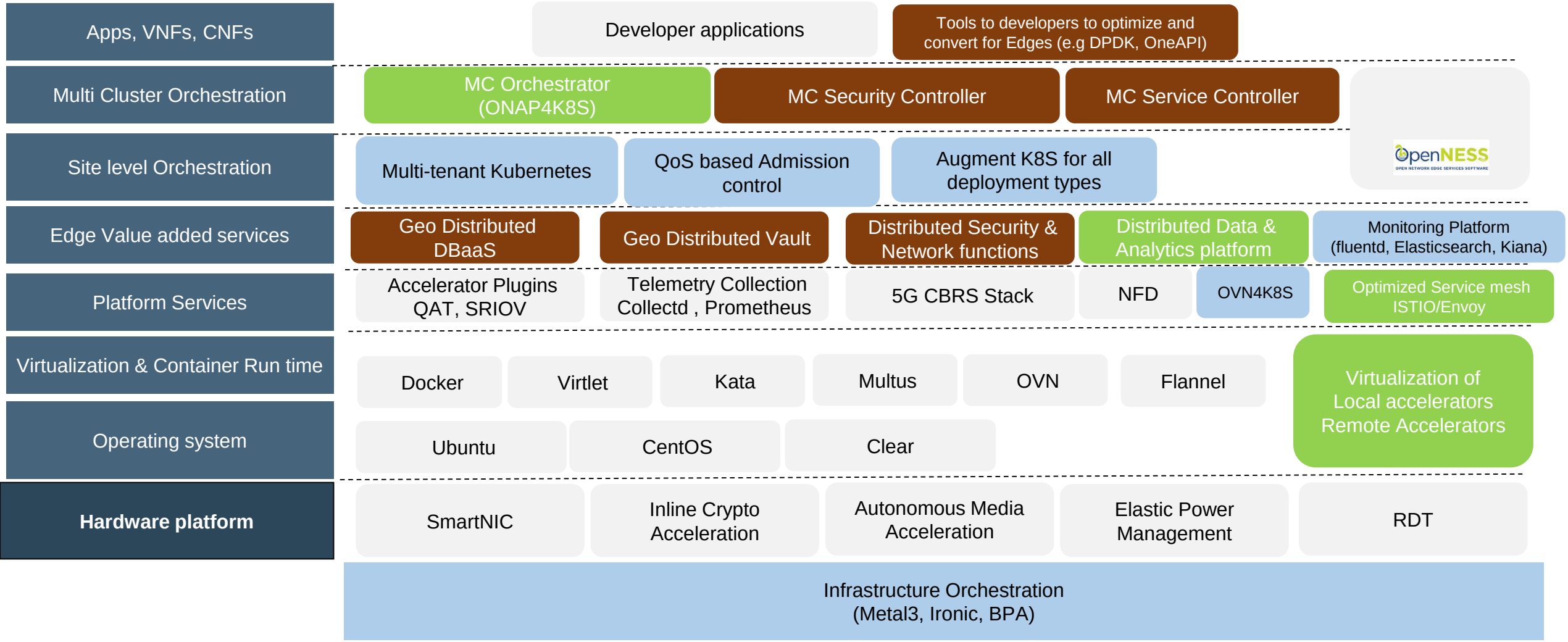
- Infra local controller has the following components
  - Metal3 Baremetal Operator
  - BPA controller
  - BPA RestAPI agent
  - Prometheus
  - fluentd
- Baremetal Operator is for provisioning OS in the compute server and bringing up the compute server
- BPA controller is responsible for cluster creation in the edge location. It follows crd spec for the cluster creation using KuD that internally call k8s installer
- BPARestAPI agent is used to get the software binary package from the user client
- Prometheus and fluentd could also be used to export the data and log to the infra global controller
- Expected output all-in-one installation script and USB bootload disk installation script



ICN Infrastructure– Infra local controller



ICN – Big picture

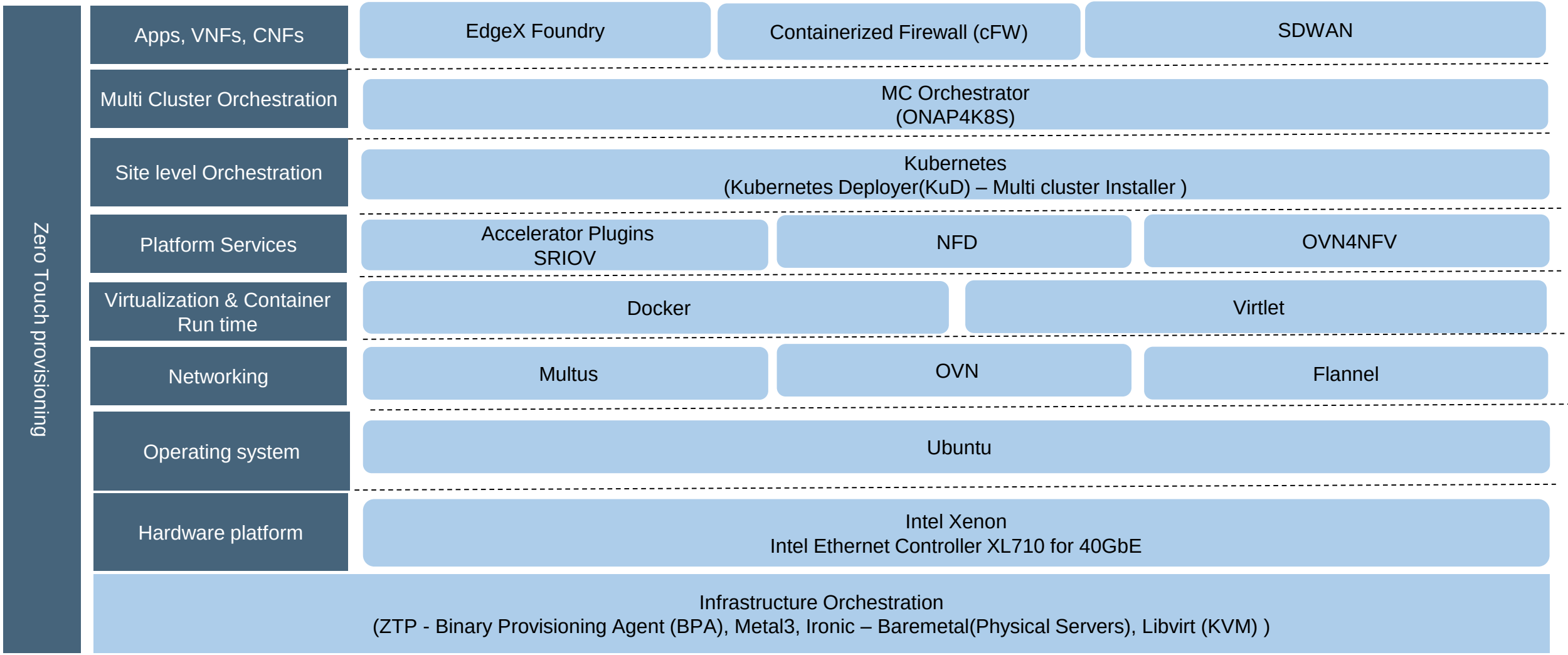


New feature project

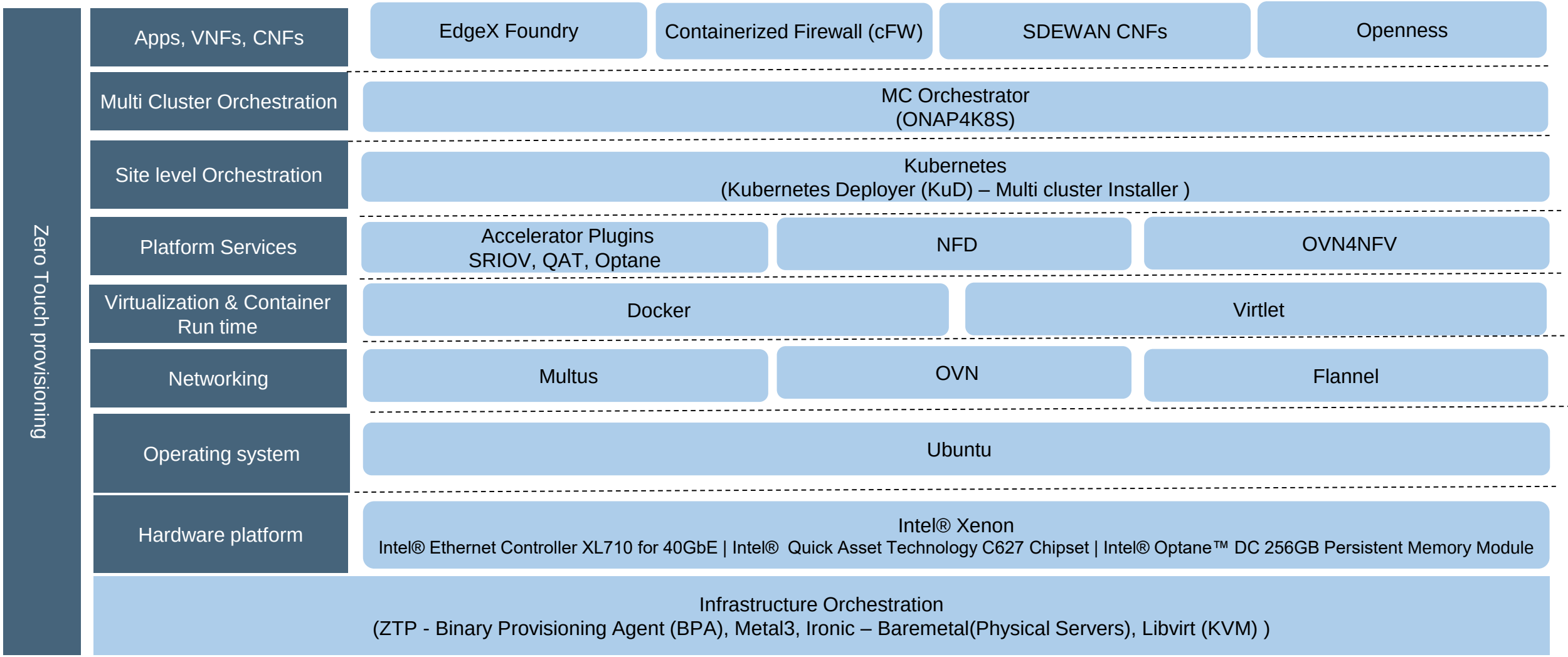
Existing Open source, Major enhancement, work with upstream

Enhancement in ICN project

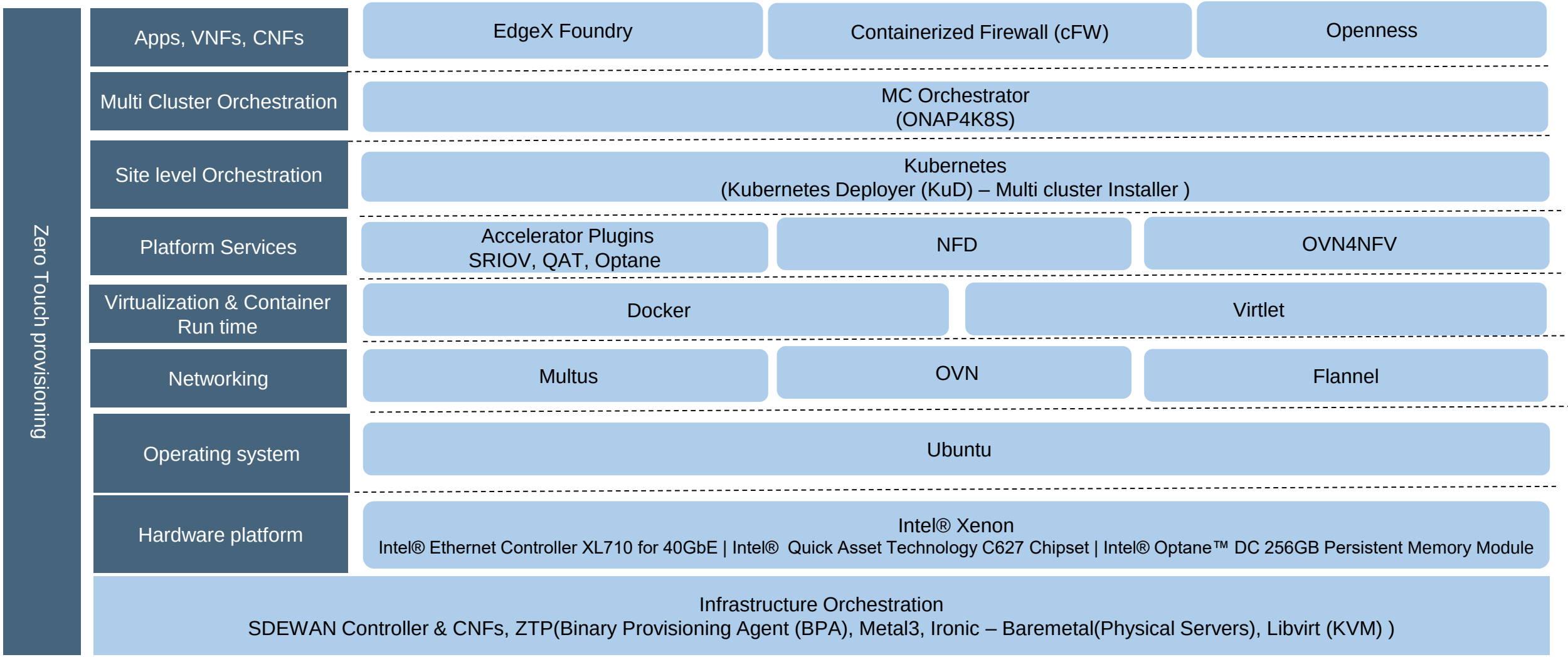
ICN R2 Release



ICN R3 Release - old

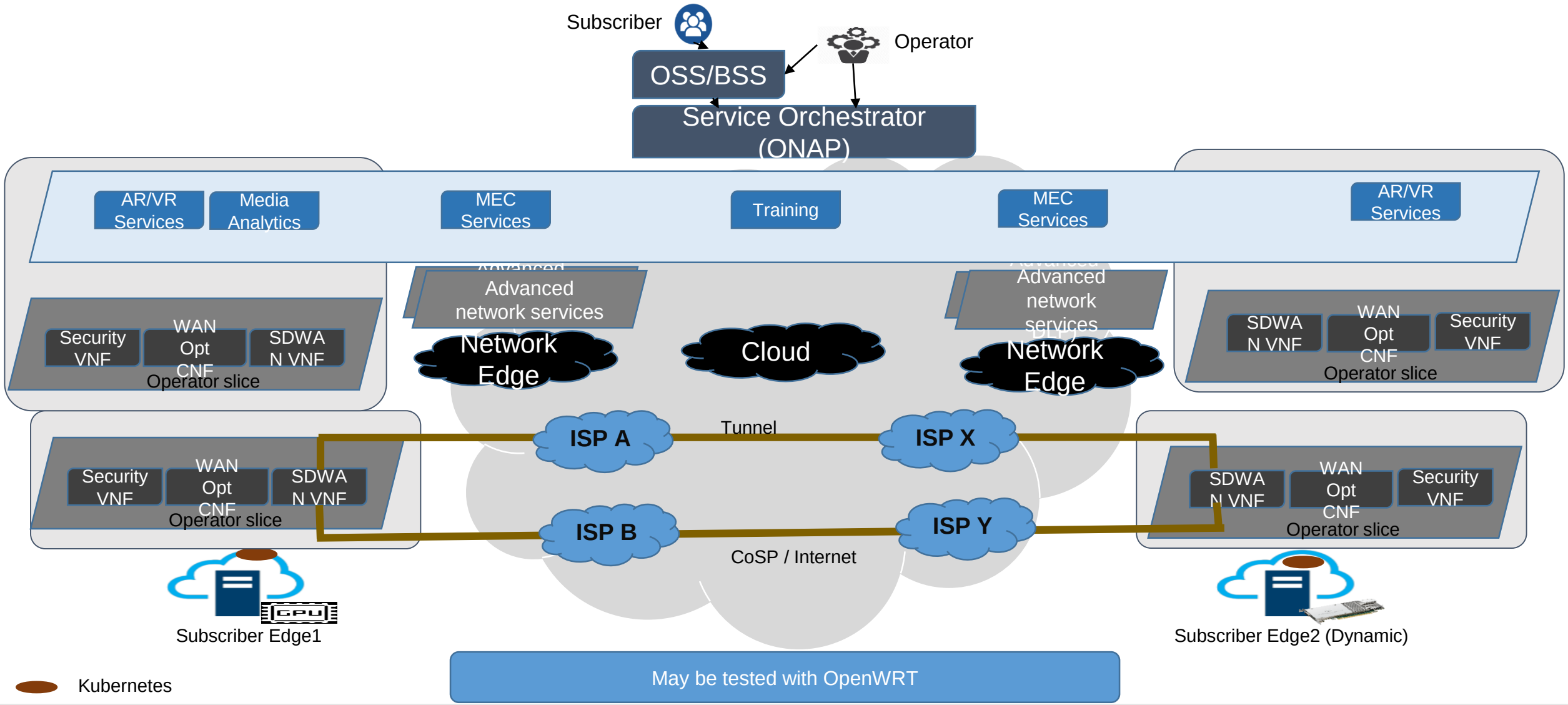


ICN R3 Release

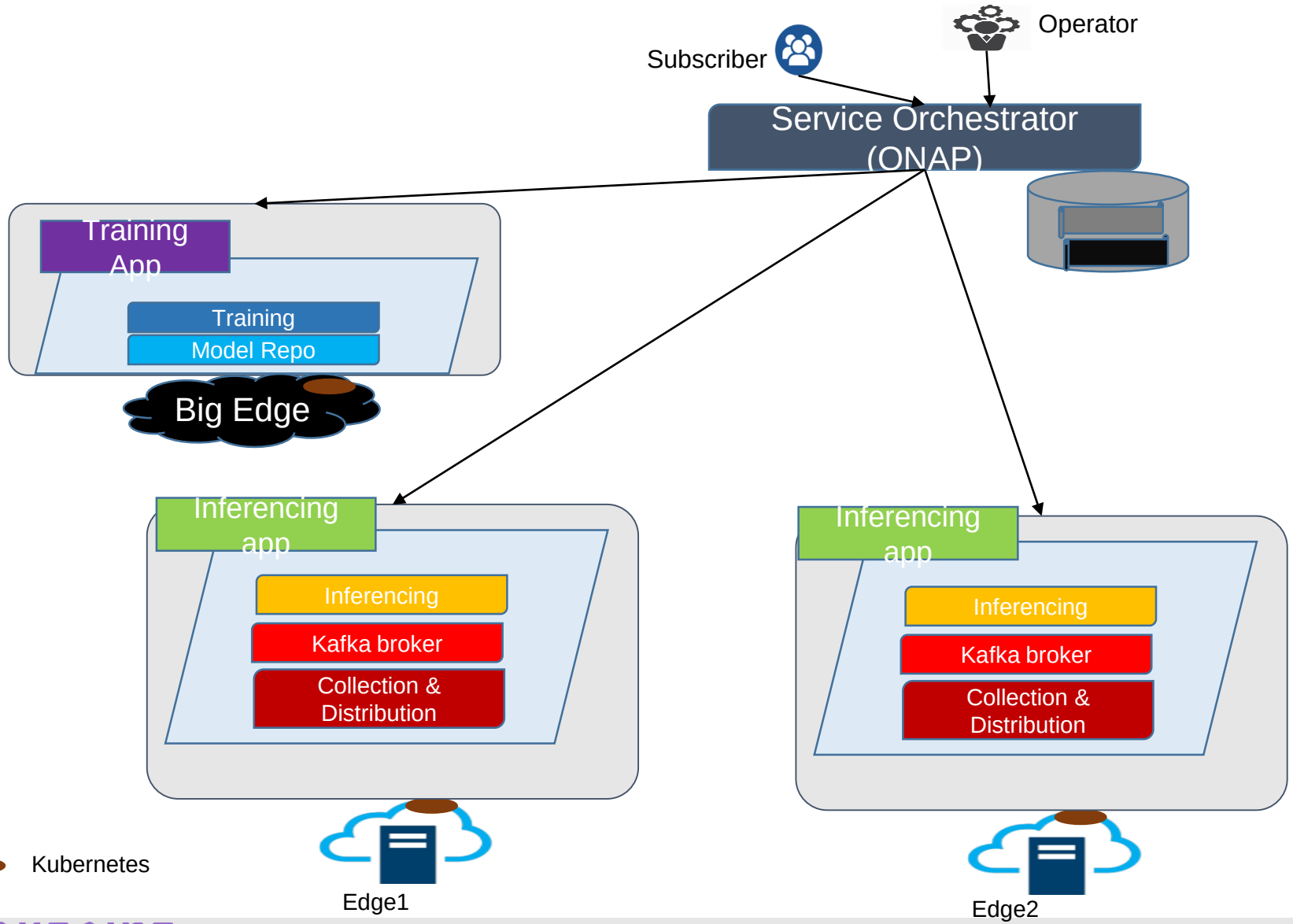


ICN Use cases

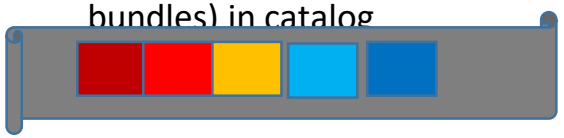
Managed SDWAN use case



Distributed Analytics as a Service
(Each site to have self contained inferencing and few sites with training)



1. Onboard Analytics framework (With 6 bundles) in catalog



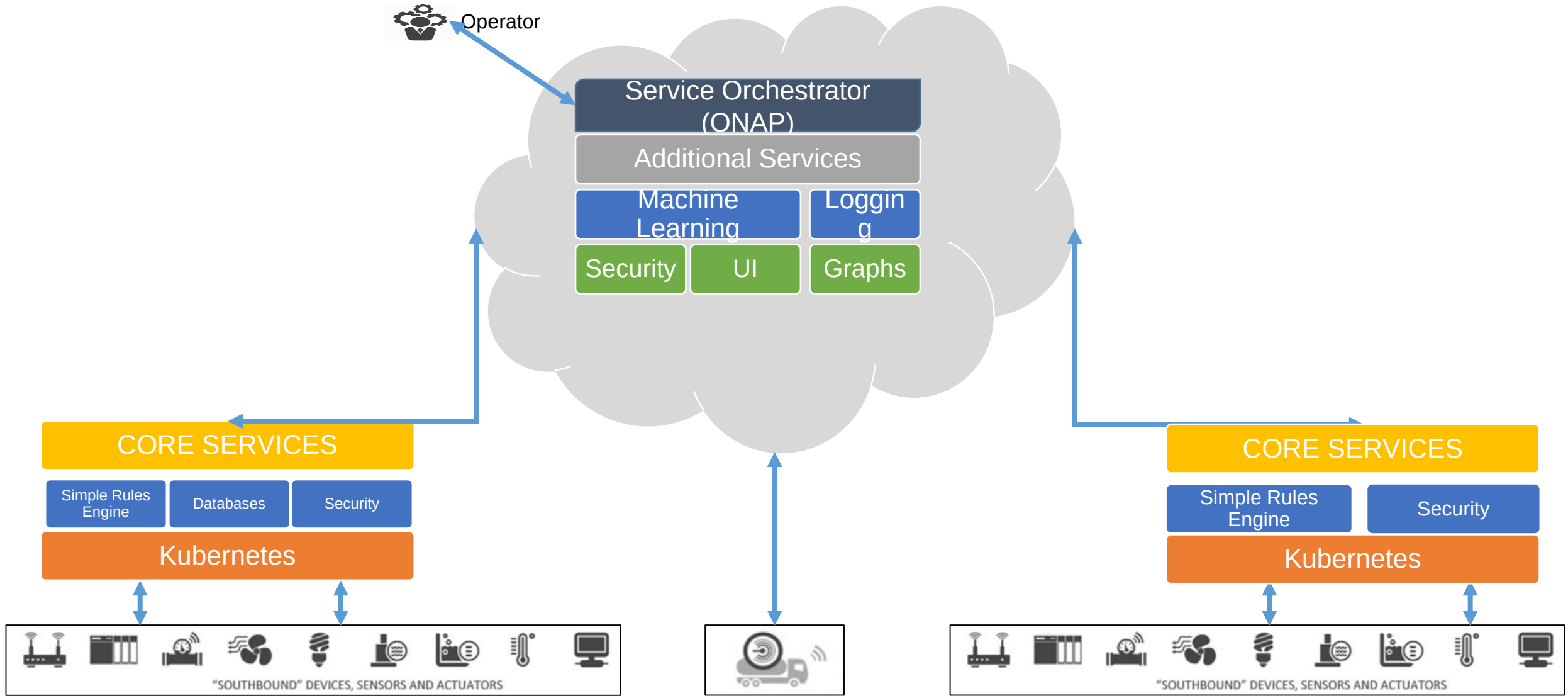
2. Activate framework

3. Onboard an analytics app

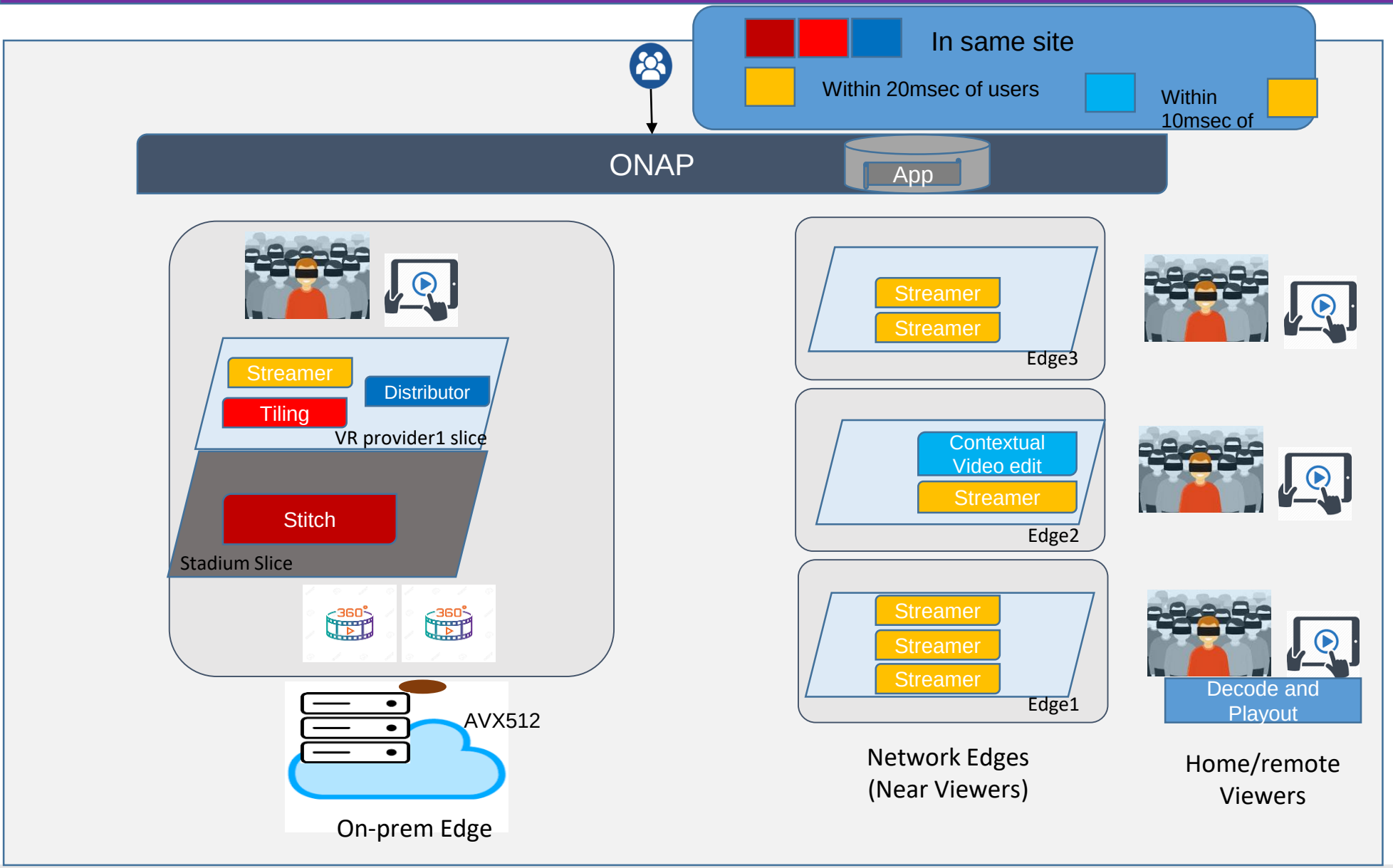
4. Activate analytics app

Federated Learning (future)

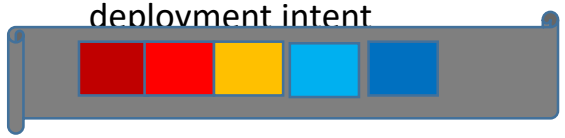
EdgeXFoundry use case



VR 360 streaming– Enable remote users to view the events/games via Edge-computing



1. Onboard App (With 6 services) in catalog with deployment intent



2. Active App (when event starts)

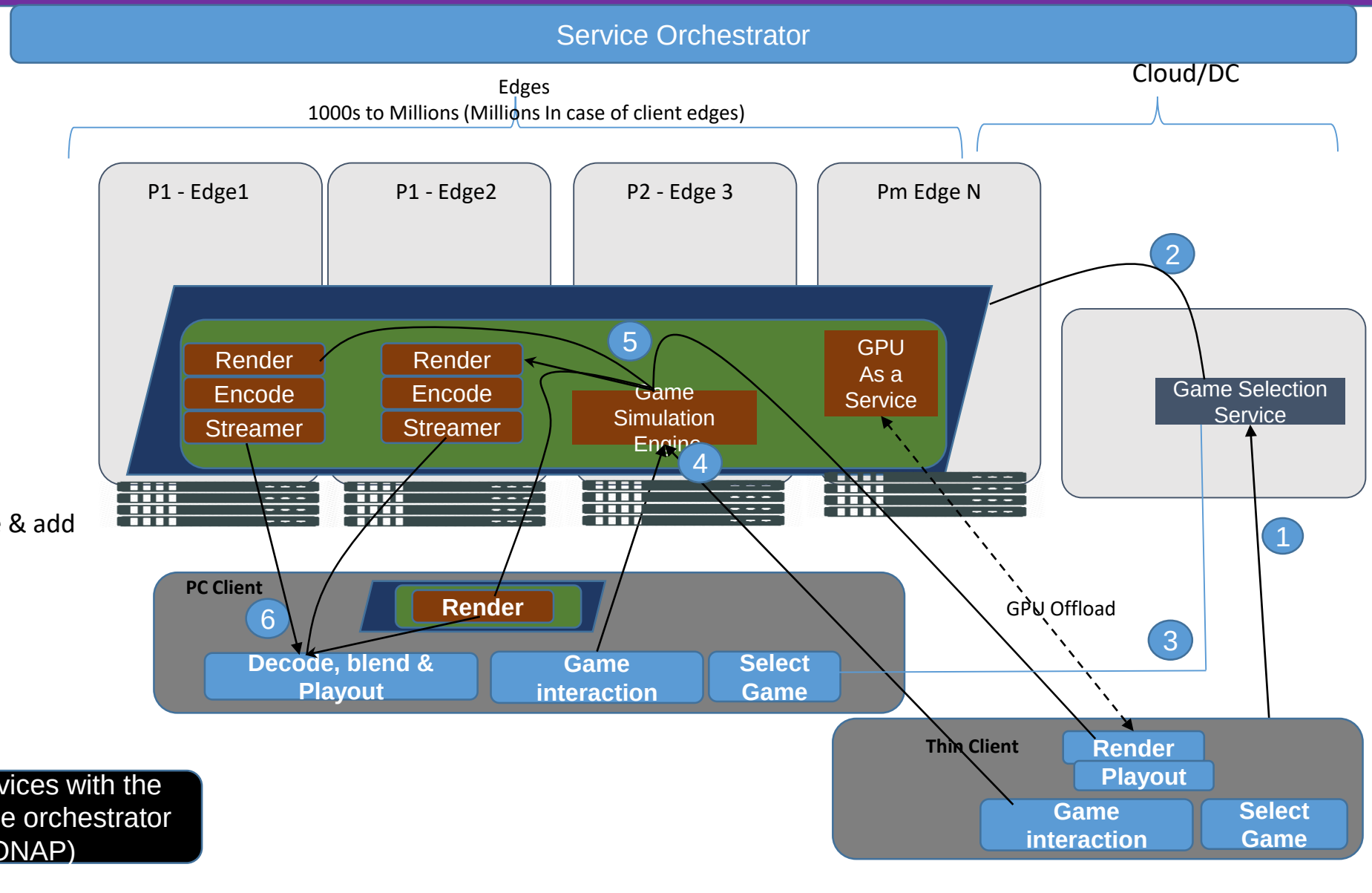
3. New users join the event (Auto bring up of services at Edge1 and Edge3)

4. Users join in a geo that requires additional context to be added to the stream.

5. More users join near edge1

6. Users disappear Edge2

Edge Computing – Cloud gaming app example



1. Game Selection
2. Slice bring up and App bring up
3. New player joins up, expand slide & add new micro-services
4. Game interaction
5. Distributed Rendering
6. Playout

Px Edge Provider x

Edge

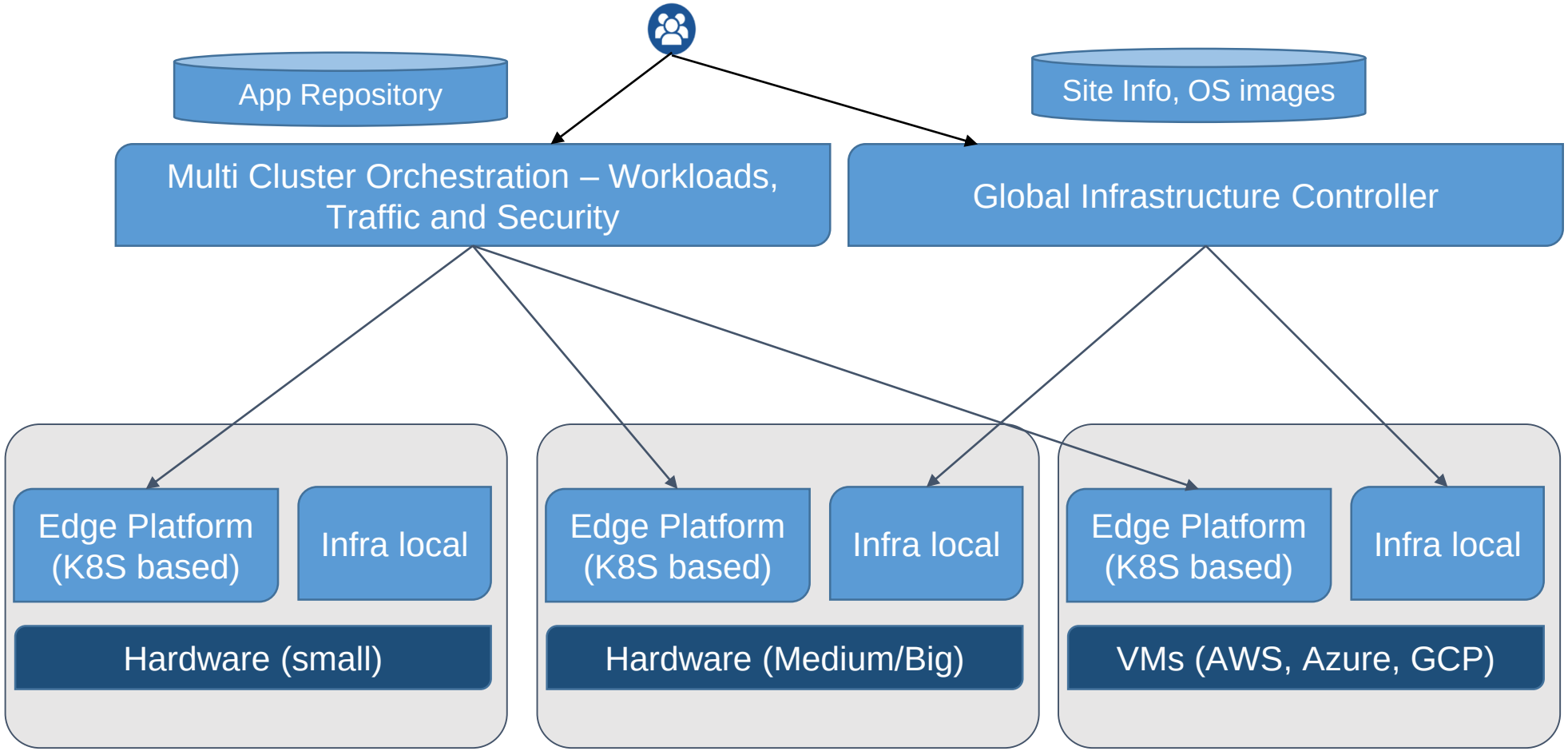
Slice

Game Services

Bring up services with the help of service orchestrator (e.g ONAP)

AKRAINO EDGE STACK

End2End Solution



Multi-Edge and Multi-Cloud BP

Akraino Executive Intro

Akraino Executive Summary

AKRAINO EDGE STACK

Zero Touch
Edge Cloud
Automation

Akraino is an Edge project targeted to

- Address Telco, Enterprise and Industrial IoT use cases

Mission:

1. Create end to end configuration for a particular Edge Use case which is complete, tested and production deployable meeting the use case characteristics {Integration Projects - Blueprints}

2. Develop projects to support such end to end configuration. Leverage upstream community work as much as possible to avoid duplication. {Feature Projects}

3. Work with broader edge communities to standardize edge APIs {Upstream Open Source Community Coordination - For example, Socialization, so community tools and Blueprints can interoperate. This work can be a combination of an upstream collaboration and development within the Akraino community [i.e. a feature project]}

4. Encourage Vendors and other communities to validate Edge applications and VNFs on top of Akraino blueprints {Validation Project - ensures the working of a Blueprint}

THE LINUX FOUNDATION

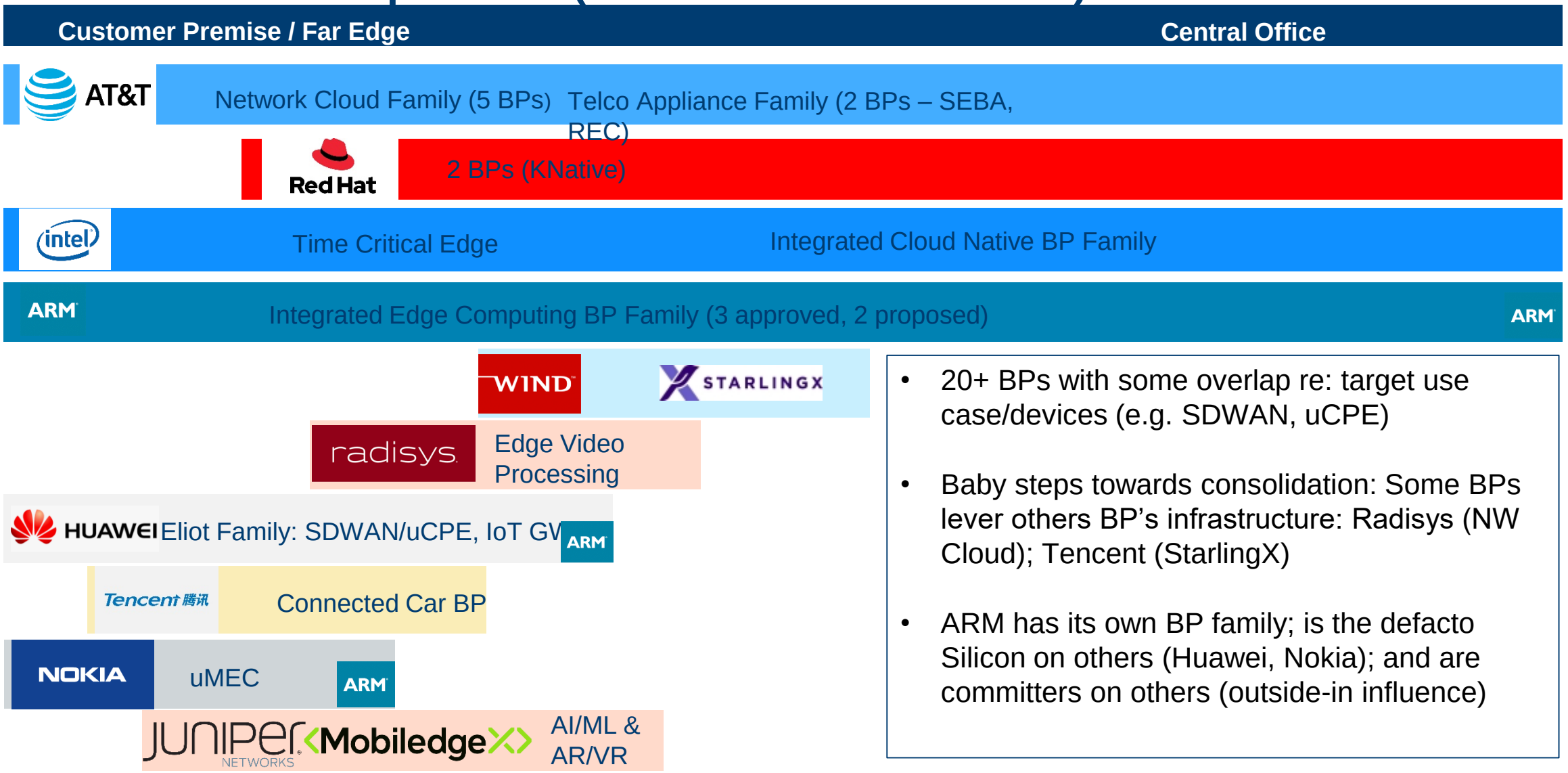
LF EDGE

Combine to one slide

Akraino Governance

- Project under Linux Foundation Edge
- Targeted to address Telco, Enterprise and Industrial IoT use cases
- AT&T is TSC chair and ARM is co-chair
- Srinivasa (Srini) Addepalli is Intel TSC rep
- Akraino members - https://www.lfedge.org/members/
- TSC reps from

Akraino Blueprints (as of June 2019)



- 20+ BPs with some overlap re: target use case/devices (e.g. SDWAN, uCPE)
- Baby steps towards consolidation: Some BPs lever others BP's infrastructure: Radisys (NW Cloud); Tencent (StarlingX)
- ARM has its own BP family; is the defacto Silicon on others (Huawei, Nokia); and are committers on others (outside-in influence)

ICN for Edge Stack

Why Edge?

Combine to one slide

Massive Data from/to Devices – Data Reduction to Clouds
(Upstream : Data from Drones, Autonomous vehicles, factories
Downstream : 4K Streaming, AR/VR, Sports Casting, Live Gaming)

Real time and Ultra real time performance
(Closed loop control in case of IOT, On-demand compute for AR/VR, Live Gaming etc…)

Contextual Services
(User based Services, Location based Services)

Data sovereignty
(GDPR and other regulations)

Cost savings
(Large bills from CSPs)

Answer : Do compute at the Edge (Edge Computing)

AKRAINO EDGE STACK

Edge : Contrasting with the Clouds

Differences

Learn from Clouds

Constrained Resources
(Cost, Power, Space)

Ease of Use and Ease of consumption of services

Massive Geo-Distributed Computing
(Tens of thousand of Edge locations for applications)

Support for all kinds of workloads
(VMs, Containers, functions)

Not as good physical security
(Insecure locations, No guards, Regulatory concerns)

Multi-Tenancy
(Use compute for multiple tenants)

Orchestration at scale
(Infra Orchestration and App Orchestration - App deployment across multiple edge providers, across edges & clouds, App Visualization, Analytics, Connectivity)

Time to Market
(Support for common services across applications, but with public API to meet Cloud native requirements)

Asks

Combine to one slide

Operator feedback (Enterprise Edge Managed Services)

Do more with less resources – Enable all accelerations, smartNIC, one resource orchestrator
Soft Multitenancy – Operator workloads vs Customer workloads
Sharing of resources across NFs and Apps
SFC across Enterprise Edge and Network Edge
Multi Cluster Orchestration

Retail (Who like to manage their own clusters)

One cluster for both network functions and Apps
Dedicate a node for network functions
Smaller processors as K8S cluster requires three machines for redundancy.
Cost of cluster to be less than 2000$
Centralized Software provisioning

Software/Solution Provider

Centralized software provisioning
High performance stack
K8S for all workloads
Programmable NICs
Programmable switches and Switch controllers.

What is ICN?

View in slide show mode

- Opinionated Stack that satisfy good number of use cases
- Cloud Native Stack for both Network functions and Applications
- Supports only Intel HW platforms with possible non-Intel peripherals
- Optimized stack (leverage HW accelerators, Nis)
- Generic platform and Application common services (New to ICN- Consider in future releases)
- Multi-Cloud & Multi-Edge & Multi-Party Orchestrtion
- Fix the gaps to make consumable/deployable solution

Target Users of ICN

Combine to one slide

Enable companies to become Edge providers

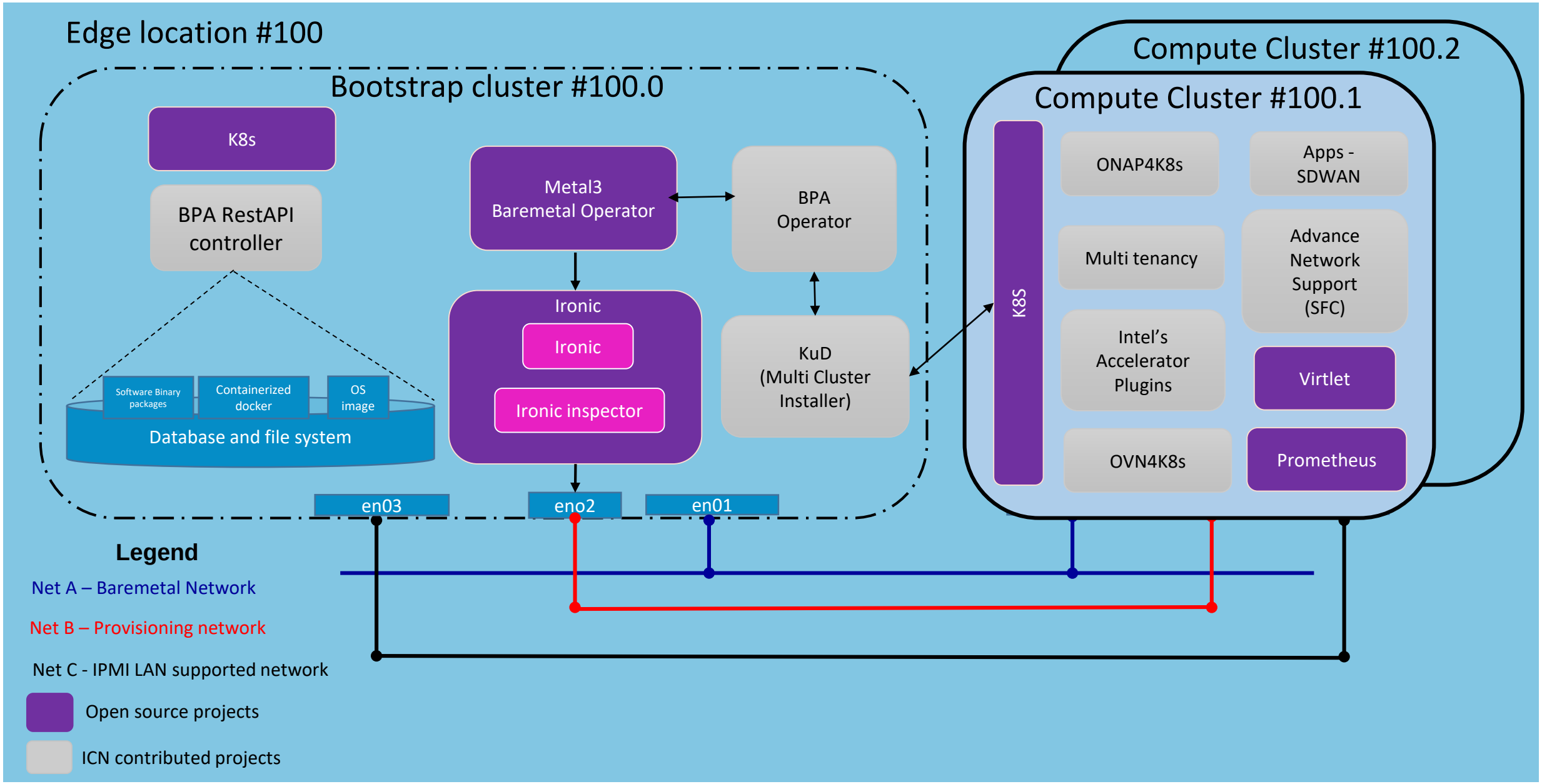
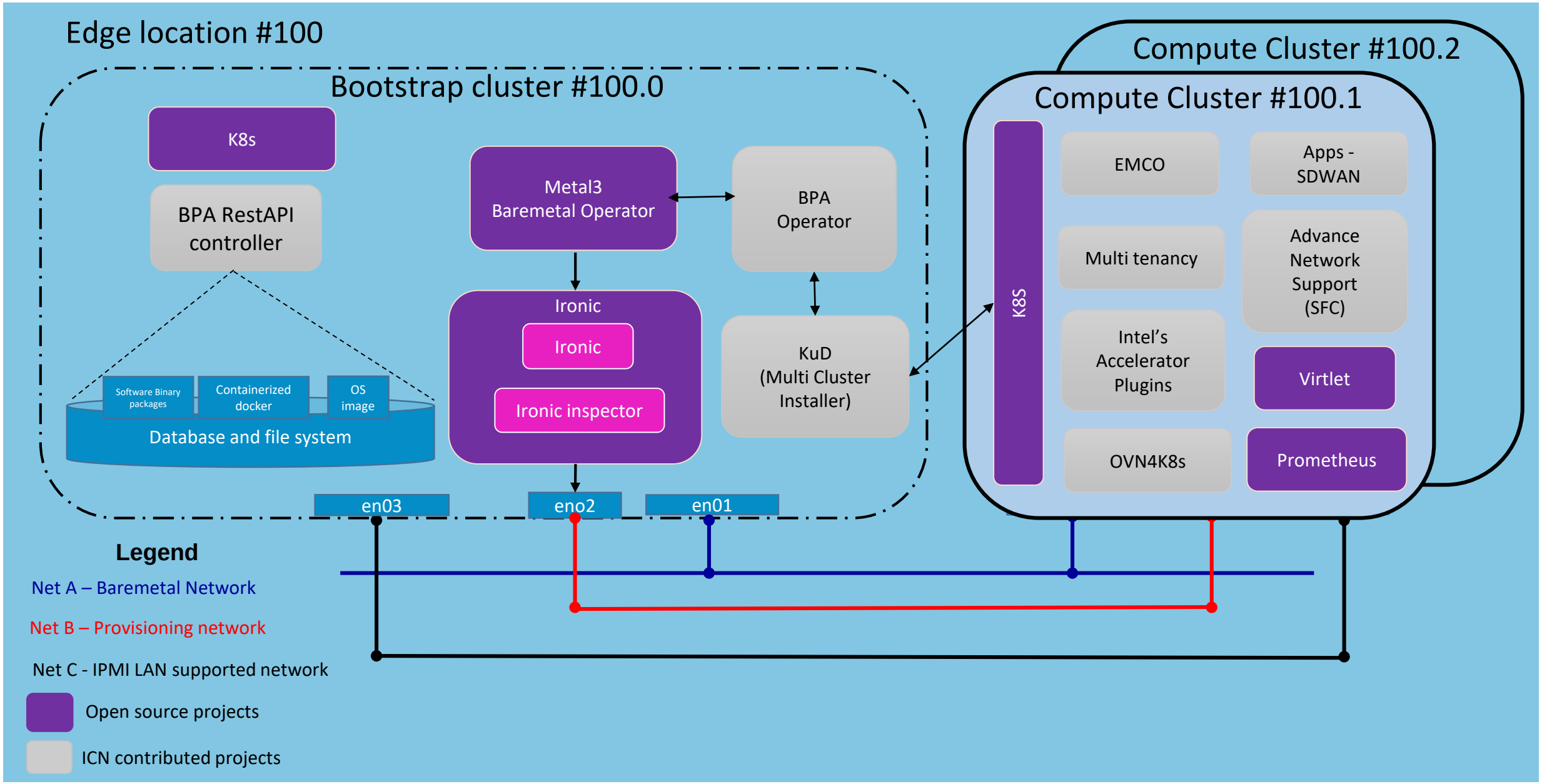
Targets

1. Enterprises that have multiple offices (Retail, Hospitals, Banks, Large corporations)
2. Telcos planning to become edge providers
3. SaaS providers
4. Independent providers
5. Managed Service Providers

Enable ISVs and SIs who like to add value and provide commercial support

Enterprises, factories, Network Edges, Big Edges
Tunable/Customizable

ICN Infrastructure– Infra local controller



ICN Infrastructure– Infra local controller