Multi-server Integrated Cloud Native NFV/App stack

ICN Blueprint Family

Goal: Is to have end-to-end Cloud native platform

R4 Overview and R5 updates

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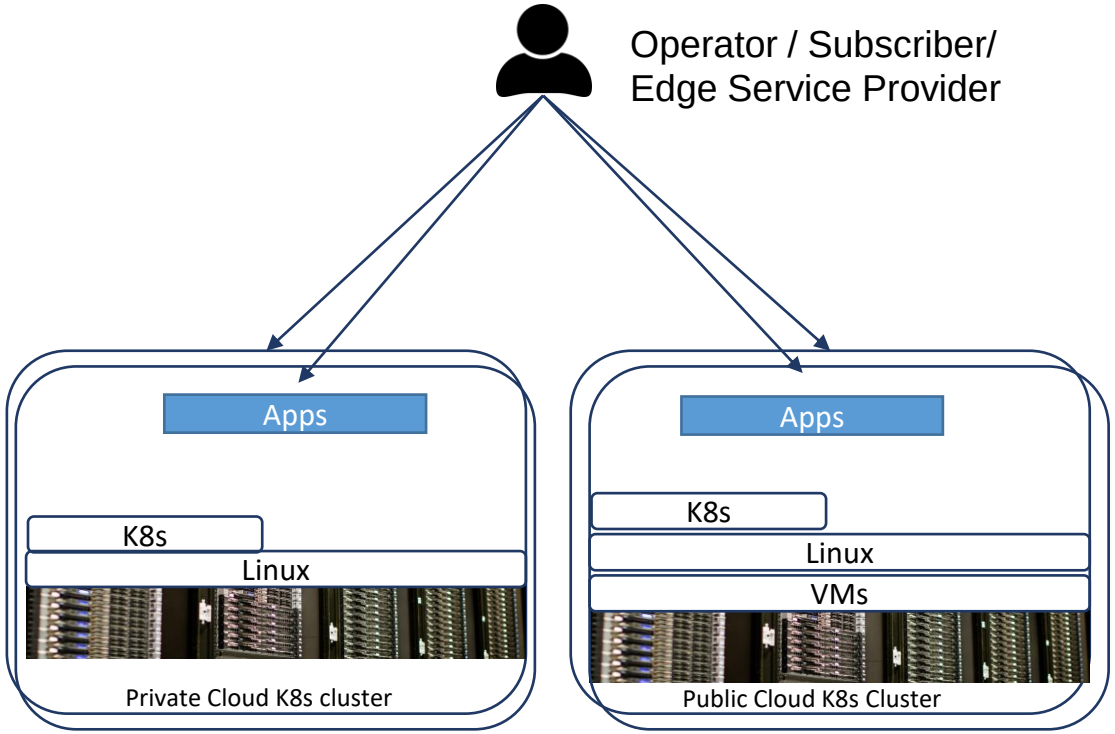
What is ICN ?

- A reference architecture/integration initiative targeting edge computing use cases
- Approved (incubation phase) as a ‘blueprint’ family within the Akraino project (LF)
- ICN Family has three blue prints
  - Multi-server Integrated Cloud Native NFV/App stack
  - Private LTE/5G
  - Multi-Tenant Secure Cloud Native Platform
- Lead ICN use case is SD-EWAN, Distributed Cloud Manager, Distributed Analytics as a Service; IOT framework - EdgeXFoundry, Video CDN & Streaming to follow
- ICN Family has 16 Partners:
  - Verizon, VMWare, Dell, Orange, Airbus, T-Mobile US, Juniper Networks, Cloudlyte – Tata Communications, MobileEdgeX, Aarna Networks…
- Intel-optimized ingredients include: OpenNESS, EdgeX, SRIOV, QAT, CSI/Optane, K8s HPA, etc.
- Highly dependent on Intel’s upstream enabling

Traditional Cloud Native frameworks
For Enterprise applications

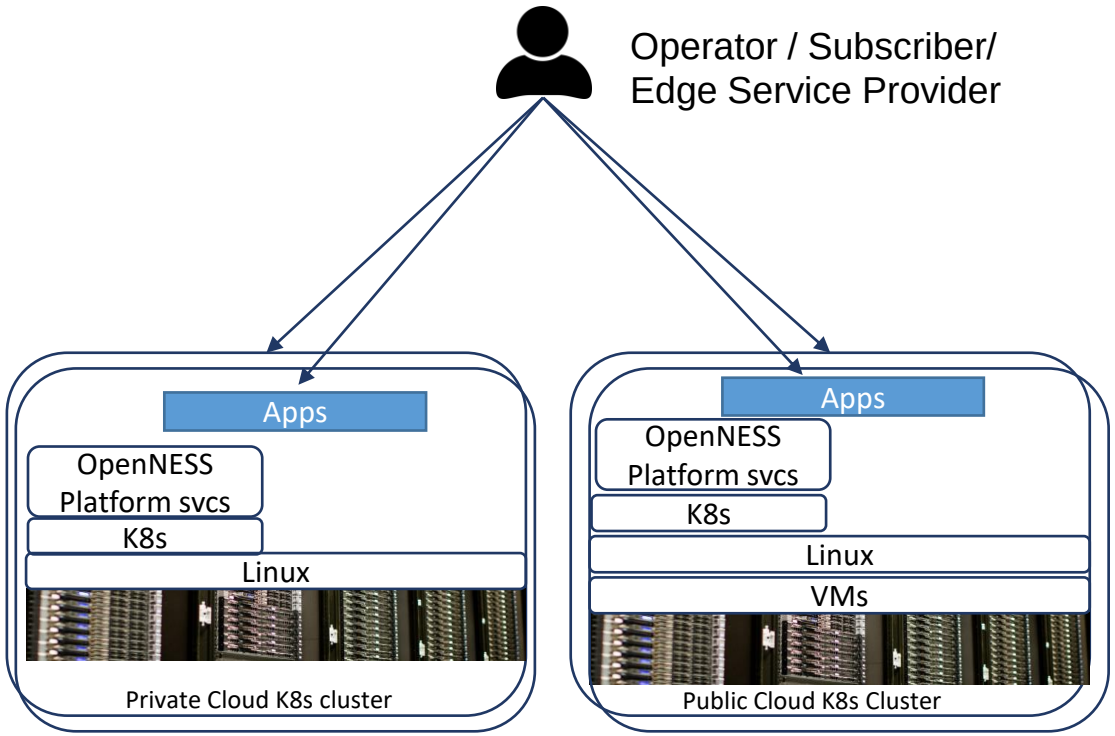


Traditionally

- Number of K8s clusters are small
- K8s Cluster installation/upgrades are mostly done independently in each location.
- Deployment of applications on K8s clusters is also done independently.
- K8s clusters are used for normal applications
- Network and security functions are deployed outside of K8s clusters as physical appliances or virtual appliances

Today K8s Clusters are not meant for Network functions and Telcos. Need for Telco grade platform.
Let us see the needs

Need: High performance applications
Low latency, Deterministic performance & high throughput



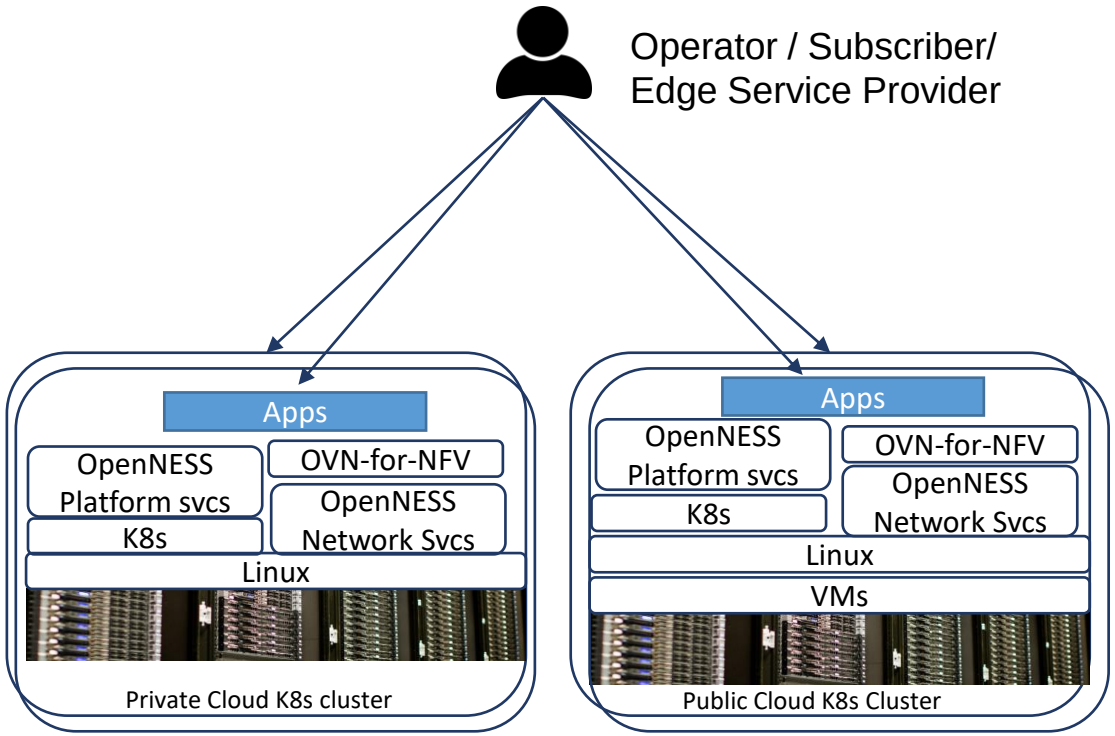
High performance applications requirement

- *Dedicate cores*
- *Core affinity*
- *L3 Cache allocation*
- *NUMA aware placement*
- *Dedicating Memory bandwidth*

Intel ICN solution

- OpenNESS platform micro-services
  - CMK for core affinity/dedication.
  - Topology manager for NUMA aware placement
  - KPI aware scheduling
  - RDT configuration

Need: Cloud Native network functions
Resource constrained Edges, Data plane NF (such as UPF, firewall, RAN) support
Separate Management Interface



Network function requirements

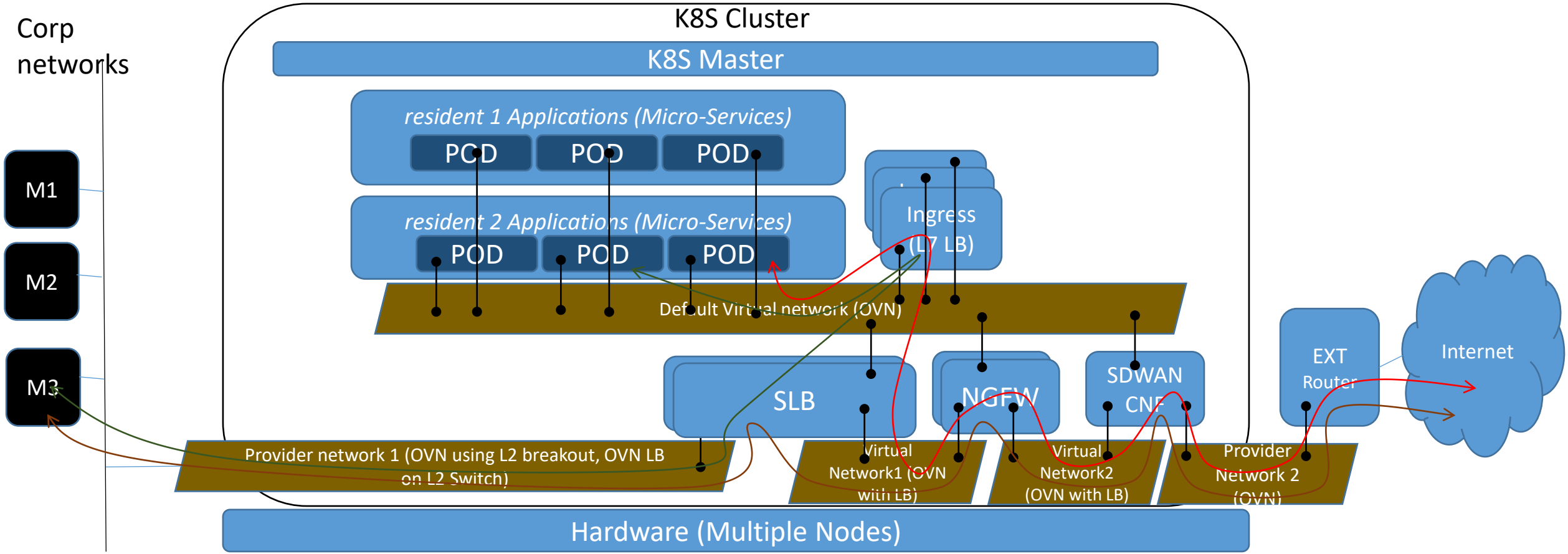
- *SRIOV-NIC support*
- *Multiple CNIs*
- *Multiple virtual networks*
- *Provider network support*
- *Service function chaining*
- *Some cases, attaching GPU and FPGA based accelerators.*
- *Platform feature exposure*

Intel ICN solution:

- OpenNESS Network Services
  - SRIOV-NIC device plugin/CNI
  - FPGA Device service.
  - Multus for Multiple CNI support
  - NFD
- OVN-for-K8s-NFV Network Controller:
  - For Multiple virtual networks, Provider networks & Service function chaining

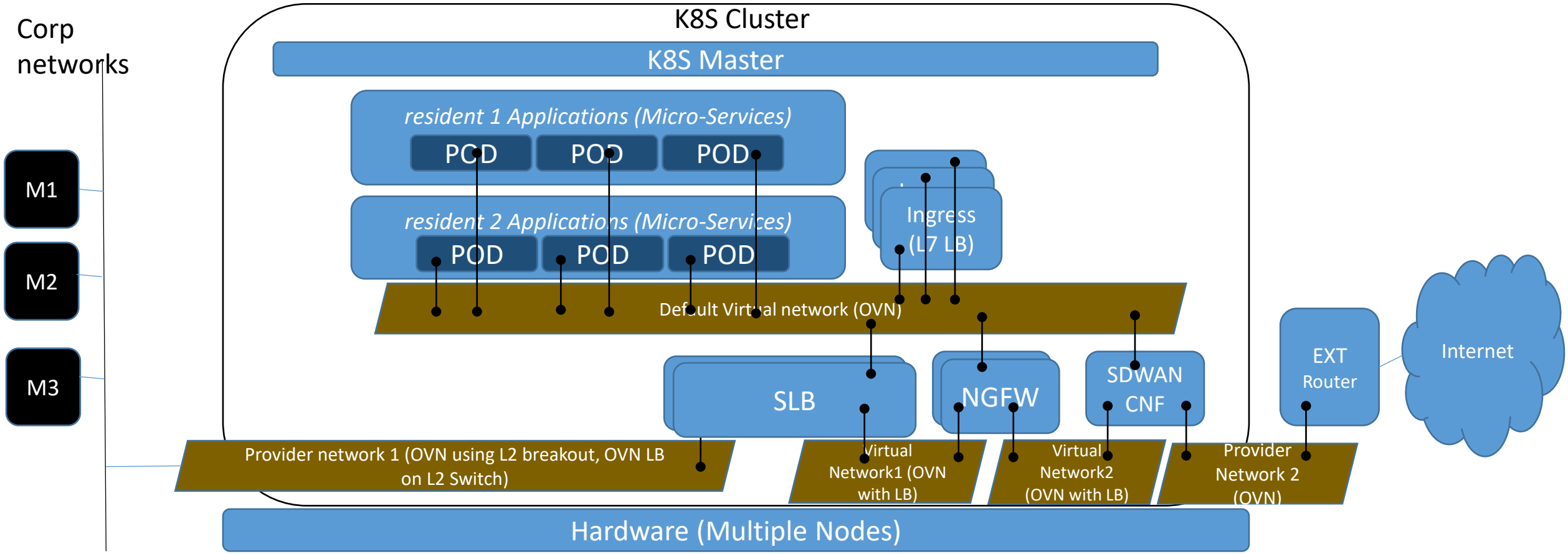
How does NFV based deployment with Cloud Native network functions look like ? (Taking SDWAN with security NFs as an example)

View in Slide show



Mx Desktop/laptop/servers

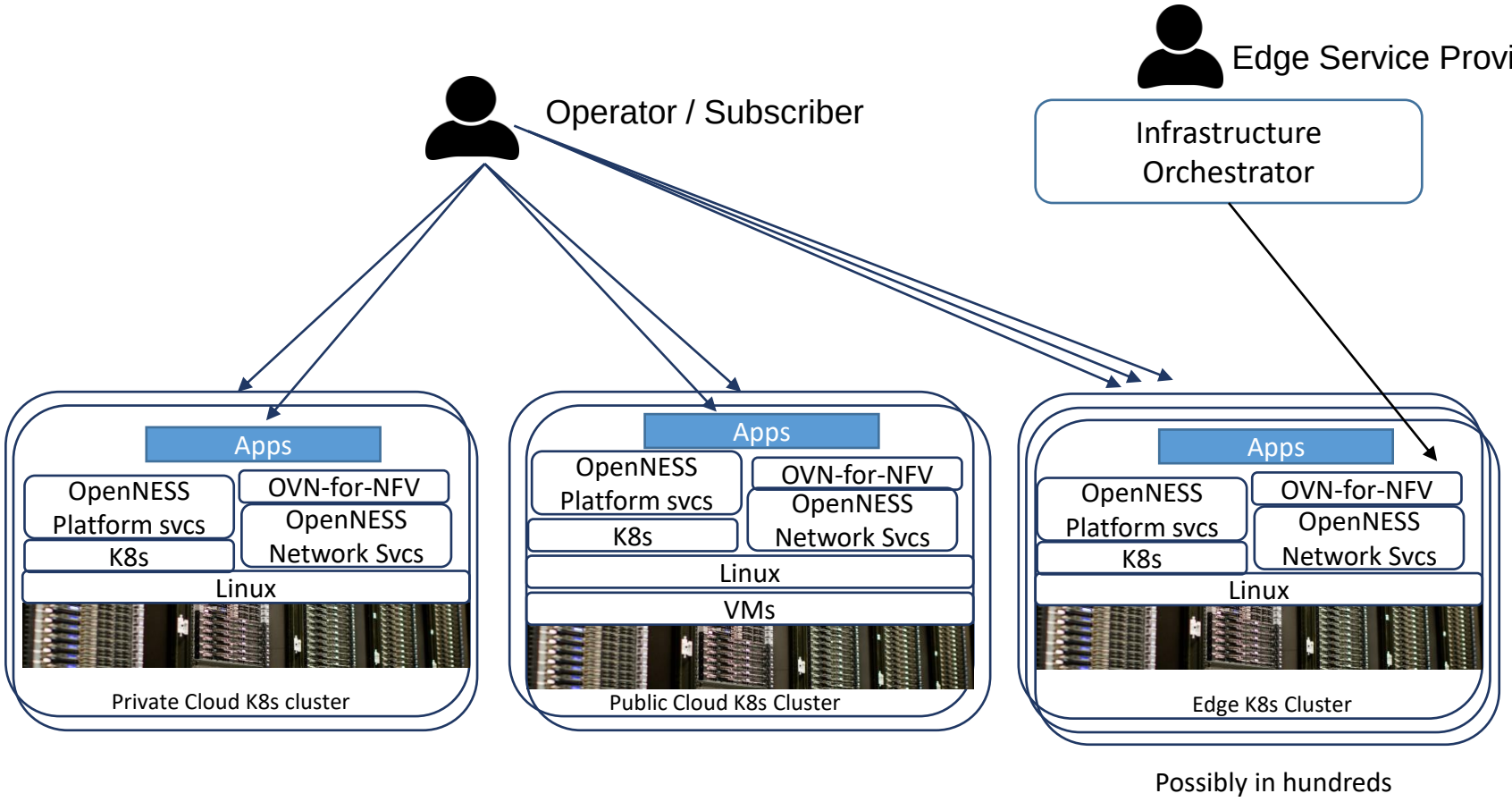
NFV based deployment with Cloud Native network functions requirements



Feature Reqmts	Dynamic virtual Networks	Provider networks	Multiple interfaces	Network function chaining	Network function load balancing
Implementation Consideration	No changes to NFs	No changes to Apps	Configuration via operators	OVN based SRIOV Overlays	Smart NIC friendly & AF_XDP for packet processing NFs

OVN4NFV: https://gerrit.opnfv.org/gerrit/admin/repos/ovn4nfv-k8s-plugin

Need: Support for Large number of Edges
Simplify cluster life cycle management

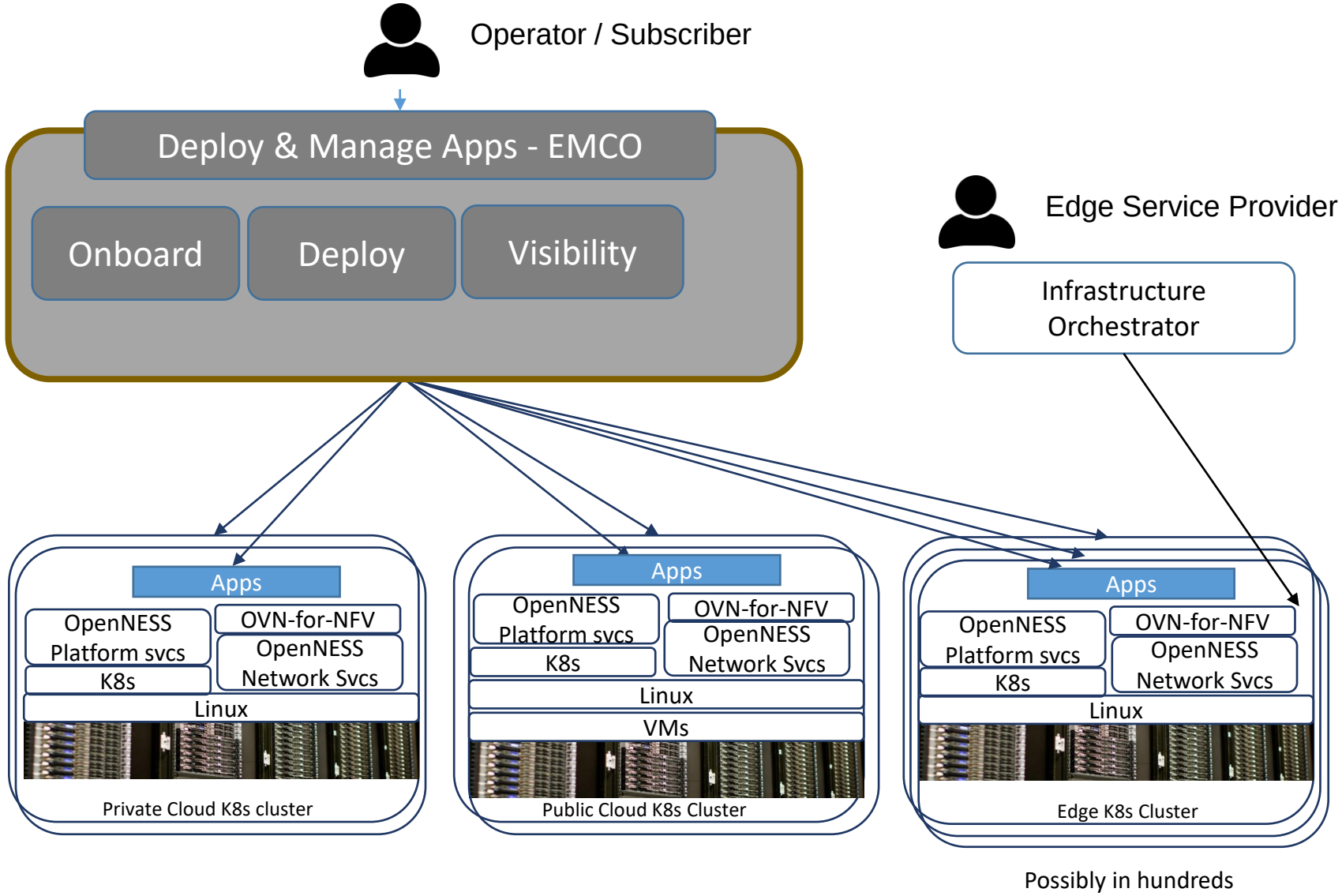


Large number of Edge Cluster
- Install, upgrade/patch and terminate are complex operations

Intel ICN solution
- Infrastructure orchestration (**infra-local-controller**) based on ClusterAPI, Metal3 and Ironic.

ICN Infra local controllers:
https://gerrit.akraino.org/r/admin/repos/icn

Need: Geo-Distributed Application (Such as 5GRAN, 5GC)Life Cycle management For geo-distributed applications across multiple K8s clusters



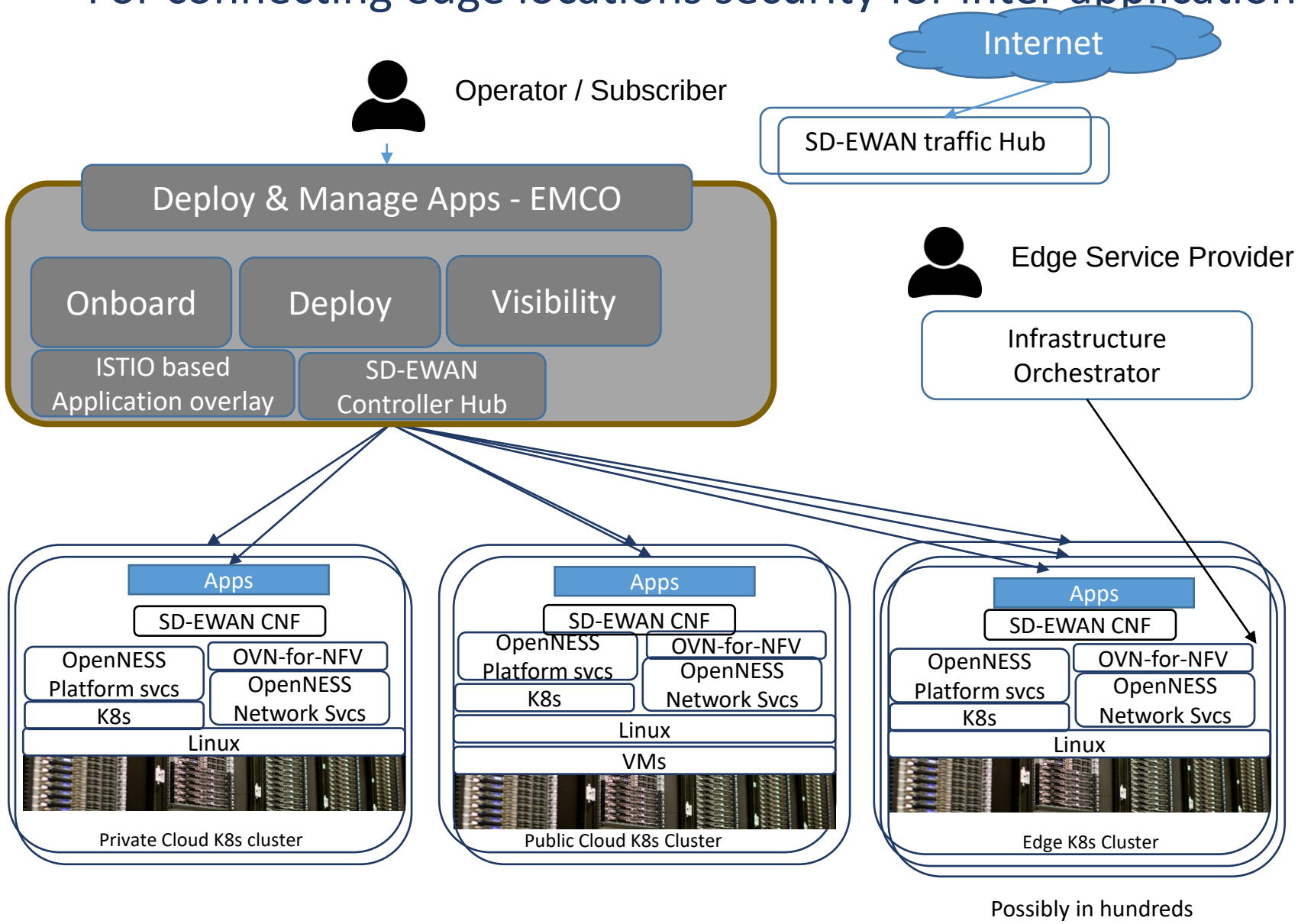
Distributed Application deployment and visibility

- Simplify
- Geo distribution

Intel ICN solution:

- EMCO
  - Onboarding of composite applications
  - Deployment intent
  - Configure ISTIO and security of edges automatically
  - Comprehensive visibility across clusters

Need: Secure Overlay
For connecting edge locations security for inter application traffic



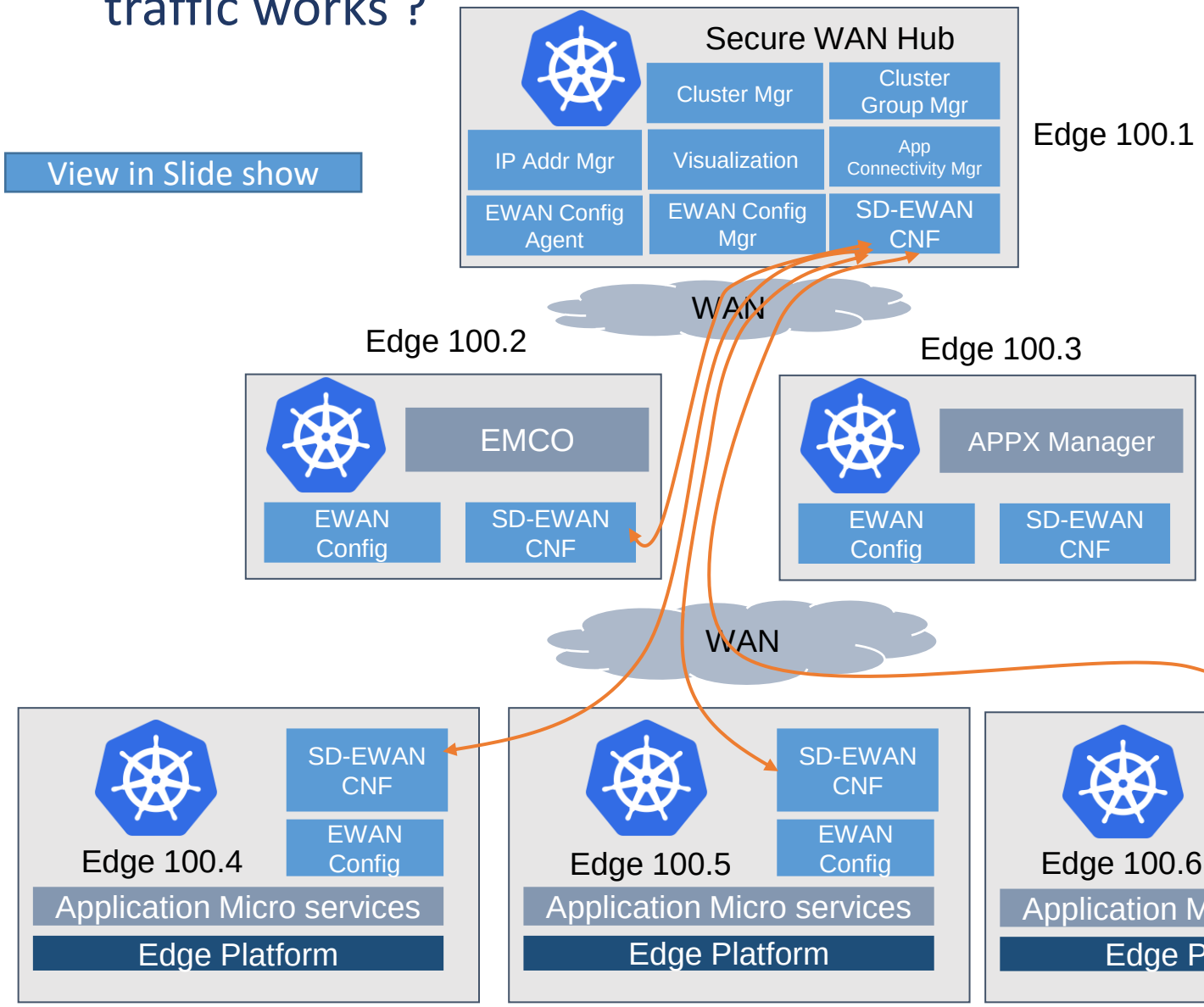
Unique Edge challenges (No public IP, Less bandwidth links, Prone to DDOS attacks) and the need for overlay

Intel ICN solution:

- SD-EWAN
  - OpenWrt based
  - CNF
  - Cloud native configuration
  - Traffic Hub for traffic sanitization
  - Controller Hub to create security and WAN policies dynamically
  - FW+NAT+DPI+IPSEC+SLB
- ISTIO/Envoy based Application overlay
  - Automation of ISTIO (Ingress, egress & SC) across edges for microservice connectivity

How the Secure Overlay For connecting edge locations security for inter application traffic works ?

View in Slide show



SD-EWAN

- Open WRT based SE-DWAN CNFS
- Cloud Native based SD-EWAN controller and IPSec controller
- Zero touch automation
- Solution to all Edge Challenges identified
- Centralization controller for configuration
- Traffic Hub for sanitization

Advantages

- No changes to application Micro services and configuring Edges
- Supporting both green field and brownfield requirements
- Work with third party SD-WAN VNFs (future roadmap)

Refer

Repo: https://gerrit.akraino.org/r/admin/repos/icn/sdwan

How the Secure Overlay For connecting edge locations security for inter application traffic works ?

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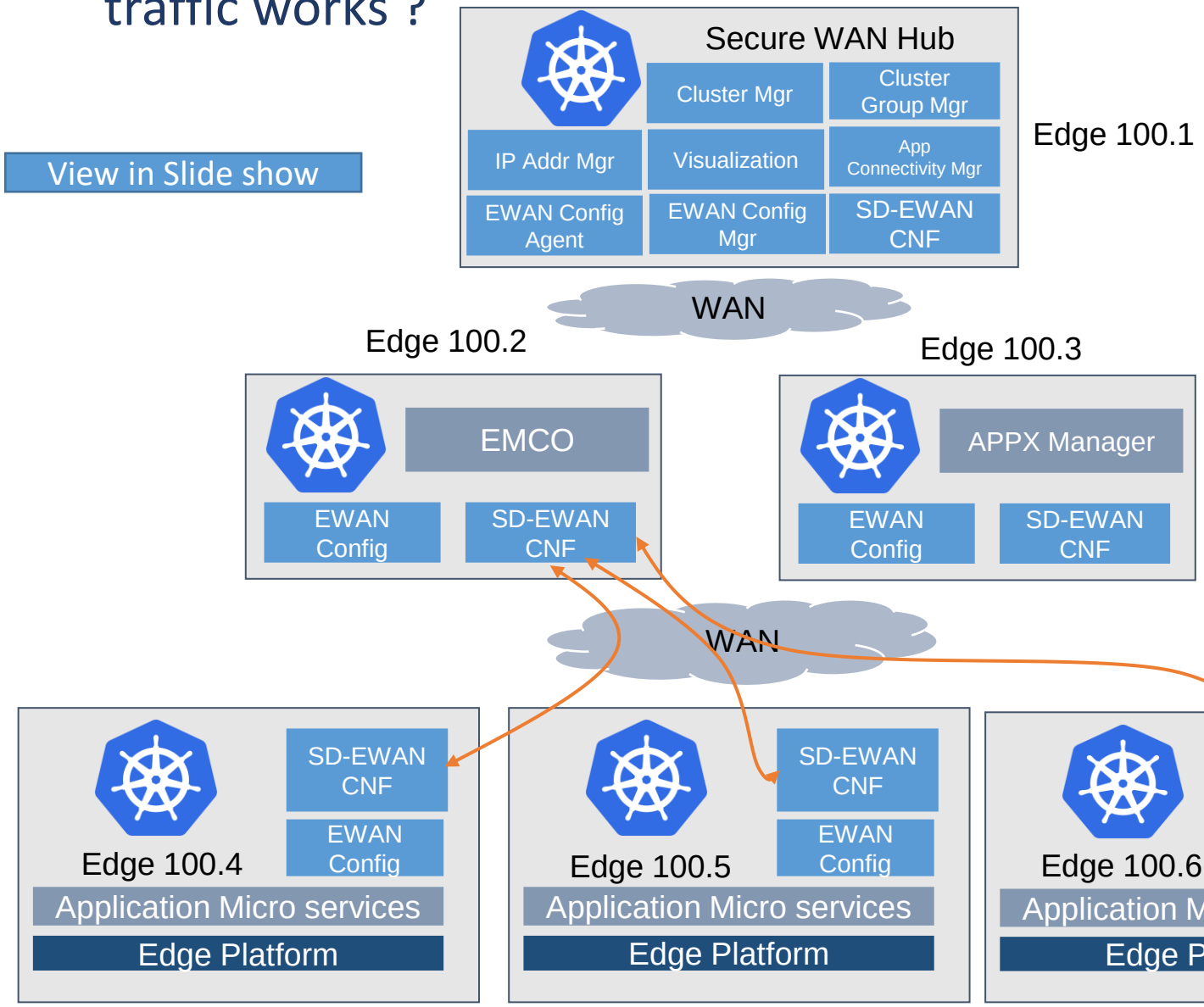

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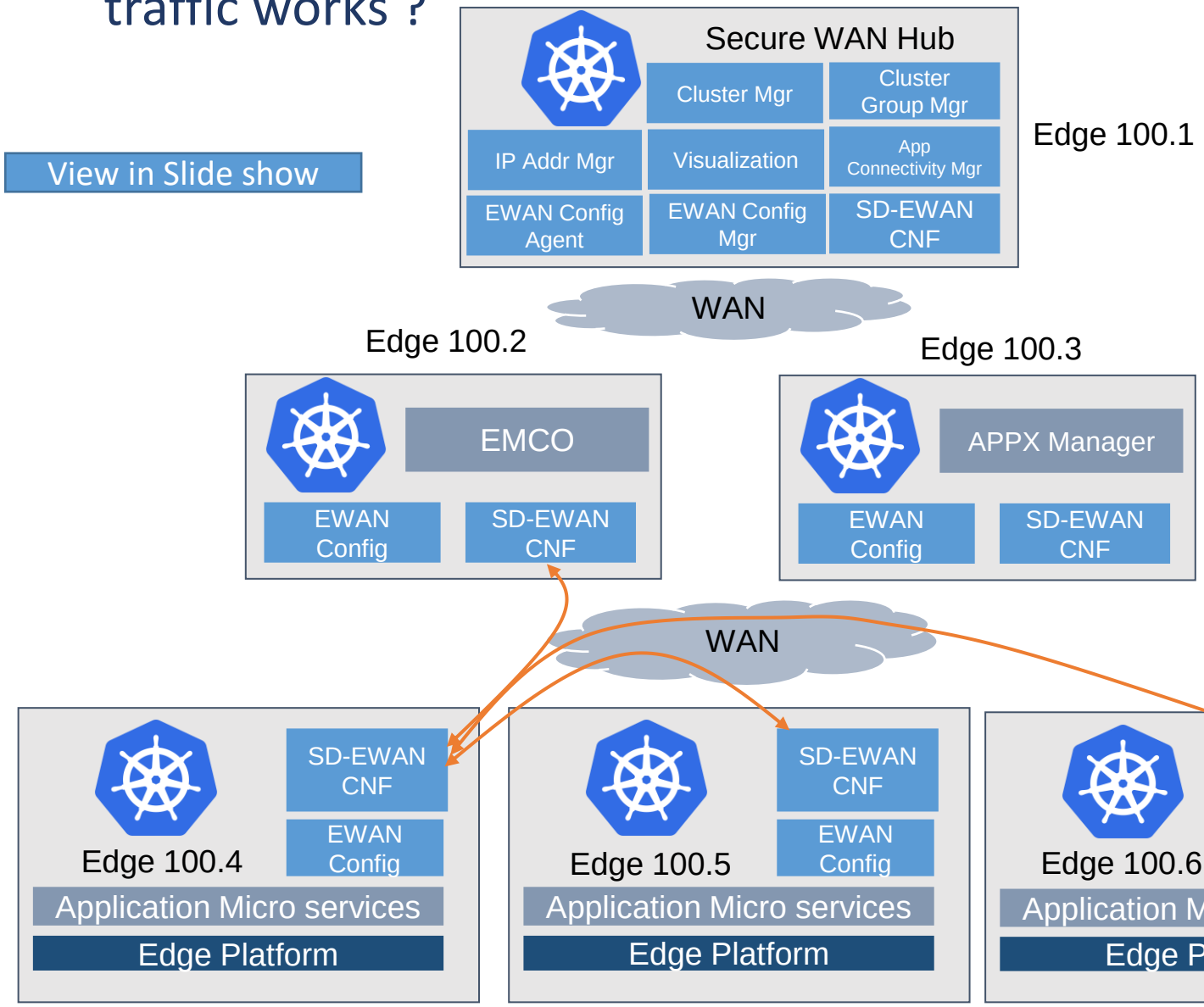

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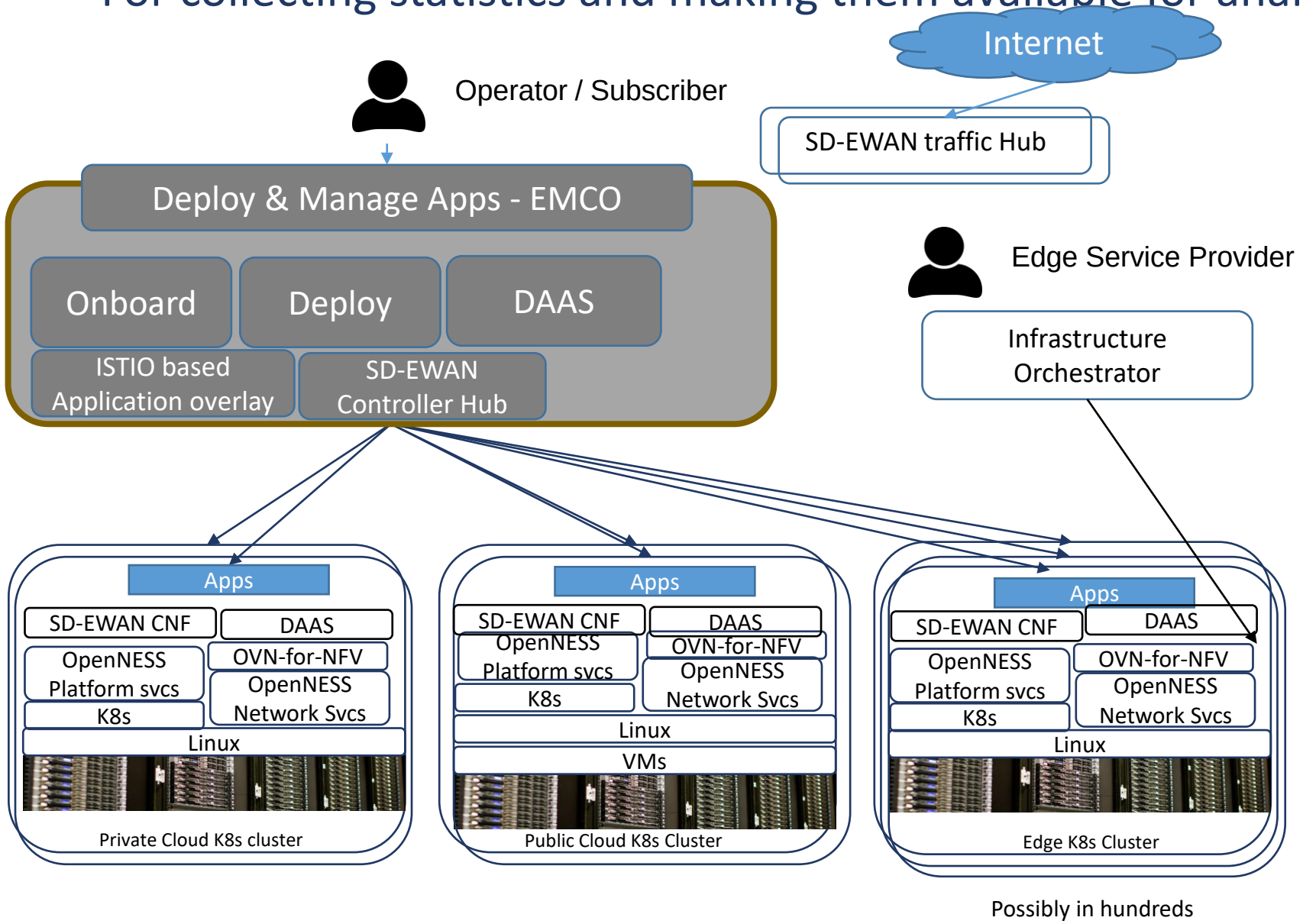
Need: Analytics
For collecting statistics and making them available for analysis & closed loops



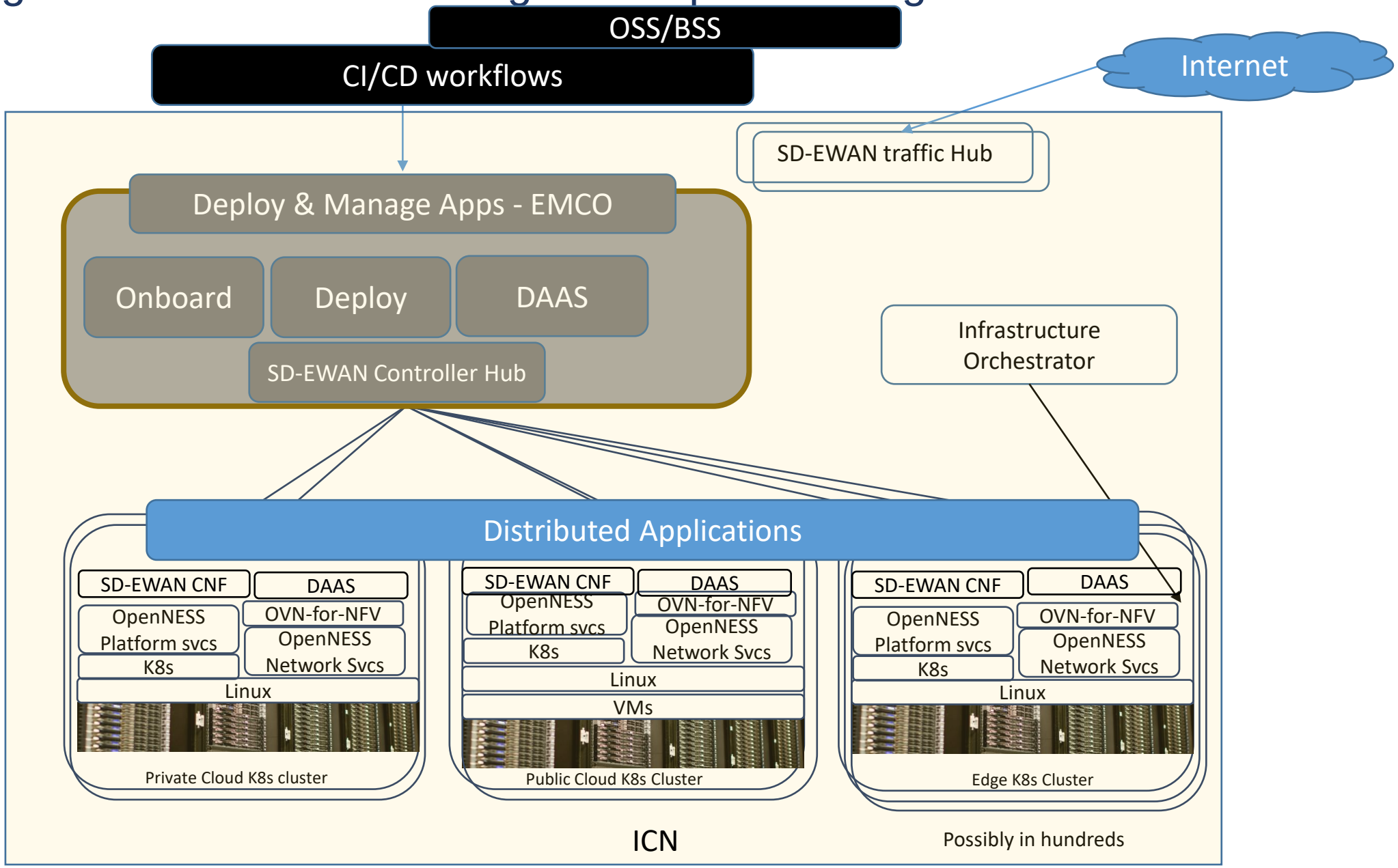
Local collection agents
Local inferencing and closed loop
Centralized metrics collection
Training
Model Reps
Policy based Analytics
Rule Synchronizer

Intel ICN solution:

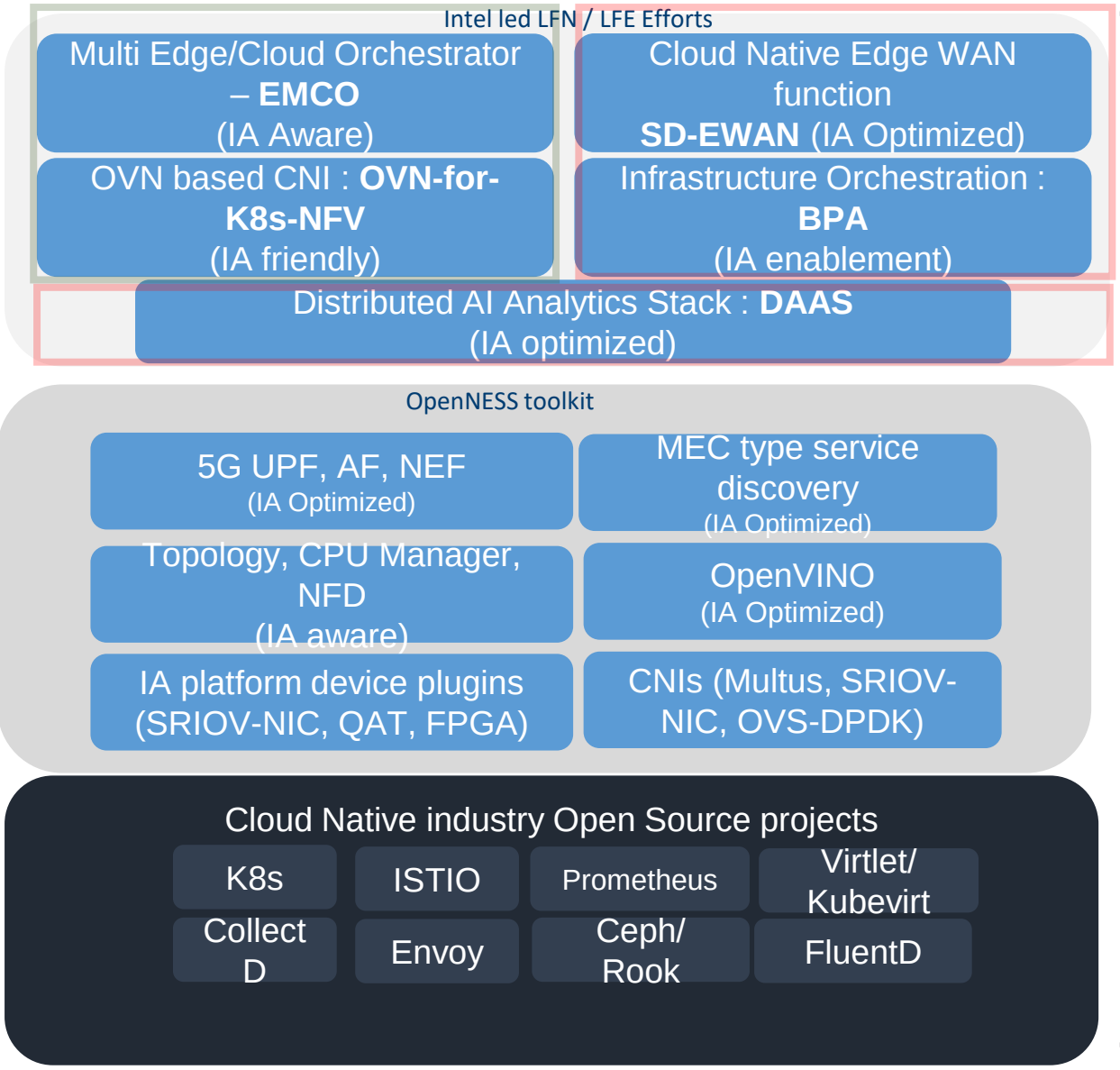
- Distributed AI Analytics
  - CollectD, Prometheus
  - Grafana
  - M3DB for central collection
  - Spark & TF for training
  - Kafka for distribution
  - Minio for storage

- Flexibility to deploy various pieces at various locations.

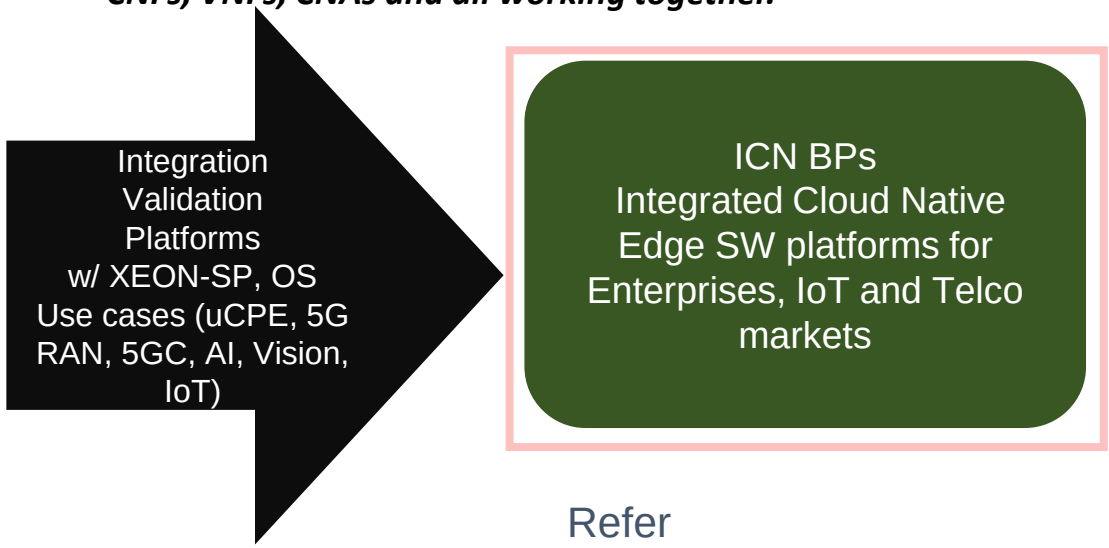
MICN
Integrated Platform combining all components together



ICN Recipe



- ***ICN is an excellent starting point for Cloud native Telco grade PaaS***
- ***Far better than a generic baseline***
- ***But with modular extensions and services that can be built upon in Telco , Enterprise and IOT uses cases***
- ***ICN is complete End2End platform – All SW and HW necessary for Edge Service Providers and Telcos that require deployment of CNFs, VNFs, CNAs and all working together.***



Refer

ICN: https://gerrit.akraino.org/r/admin/repos/icn
EMCO: https://gerrit.onap.org/r/admin/repos/multicloud/k8s
OVN4NFV: https://gerrit.opnfv.org/gerrit/admin/repos/ovn4nfv-k8s-plugin
SD-EWAN: https://gerrit.akraino.org/r/admin/repos/icn/sdwan
DAAS: https://gerrit.akraino.org/r/admin/repos/icn/daaas

Openness: https://github.com/open-ness/specs/blob/master/doc/architecture.md

Upcoming features in ICN R5 Release

- SDEWAN and IPSec controller, SDEWAN HUB
  - More Flexibility and more controllers for MWAN3, Firewall, SNAT/DNAT and IPSec
- Optimization with Intel IA accelerators (QAT, AES-NI)
- OVN4NFV as Network plugin in Kubespray
- Multi Network Service Function Chaining (SFC) using OVN4NFV in ICN
- Introducing Kubevirt in the ICN stack
- More device plugin integration to meet high performance workloads based on GPU, FGPA

Call for Action

- Try it yourself !!
  - https://wiki.akraino.org/display/AK/ICN+Installation+Guide
- What to be a ICN contributor – Please sign up here with LF ID !!
  - https://wiki.akraino.org/x/BAi3
- Missing Features or bug ? – create an issue here !!
  - https://jira.akraino.org/projects/ICN/issues
- Talk to us regarding your Edge use cases in Akraino ICN slack
  - Invite yourself - https://akraino-icn-admin.herokuapp.com/

Q&A