

K8s(Kubernetes) and SDN for Multi-access Edge Computing deployment

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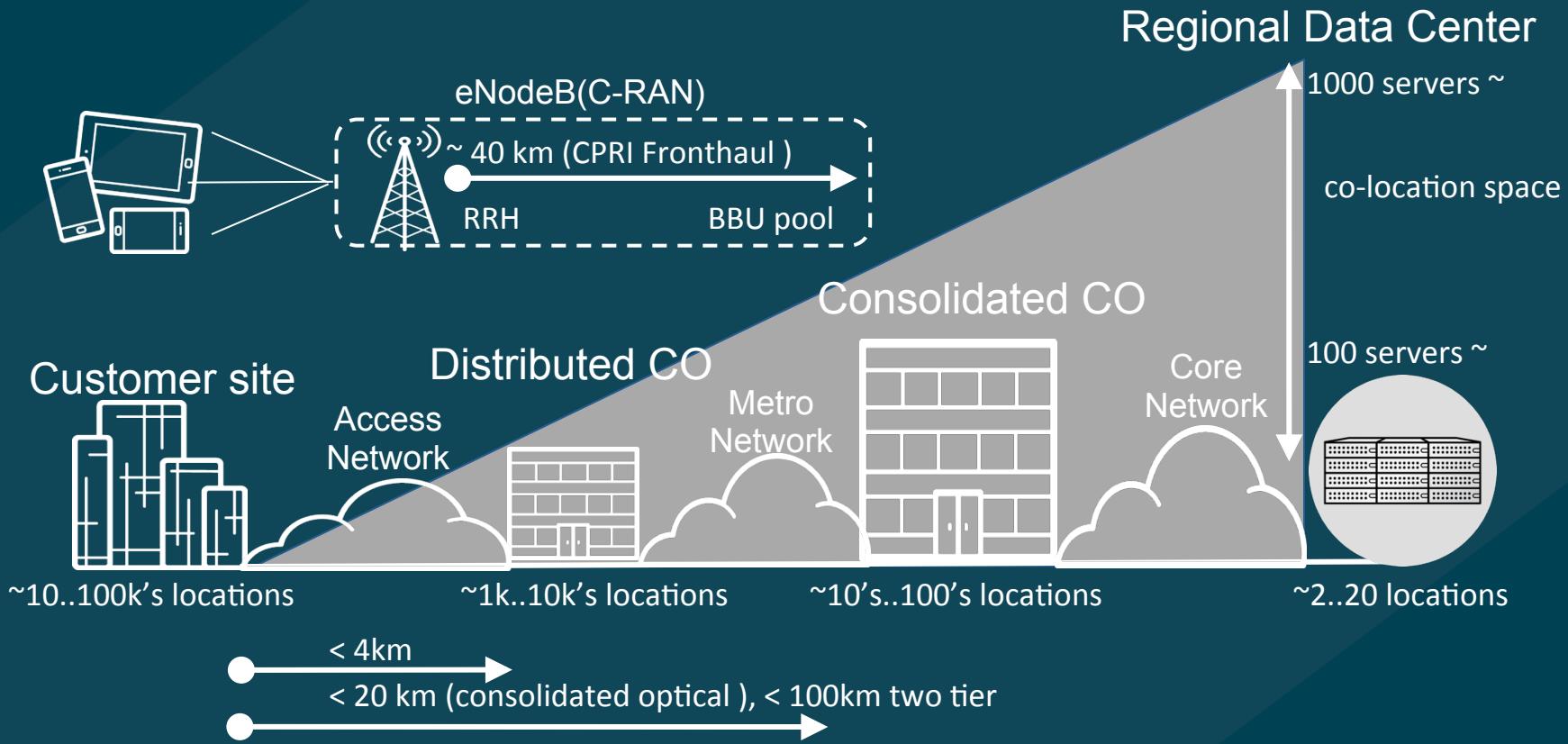
AGENDA

- Multi-access Edge Computing(MEC) use cases
- K8s/Openshift as candidate for Edge PaaS in MEC
- Adapting to MEC - K8s/Openshift on OpenStack
- Conclusion

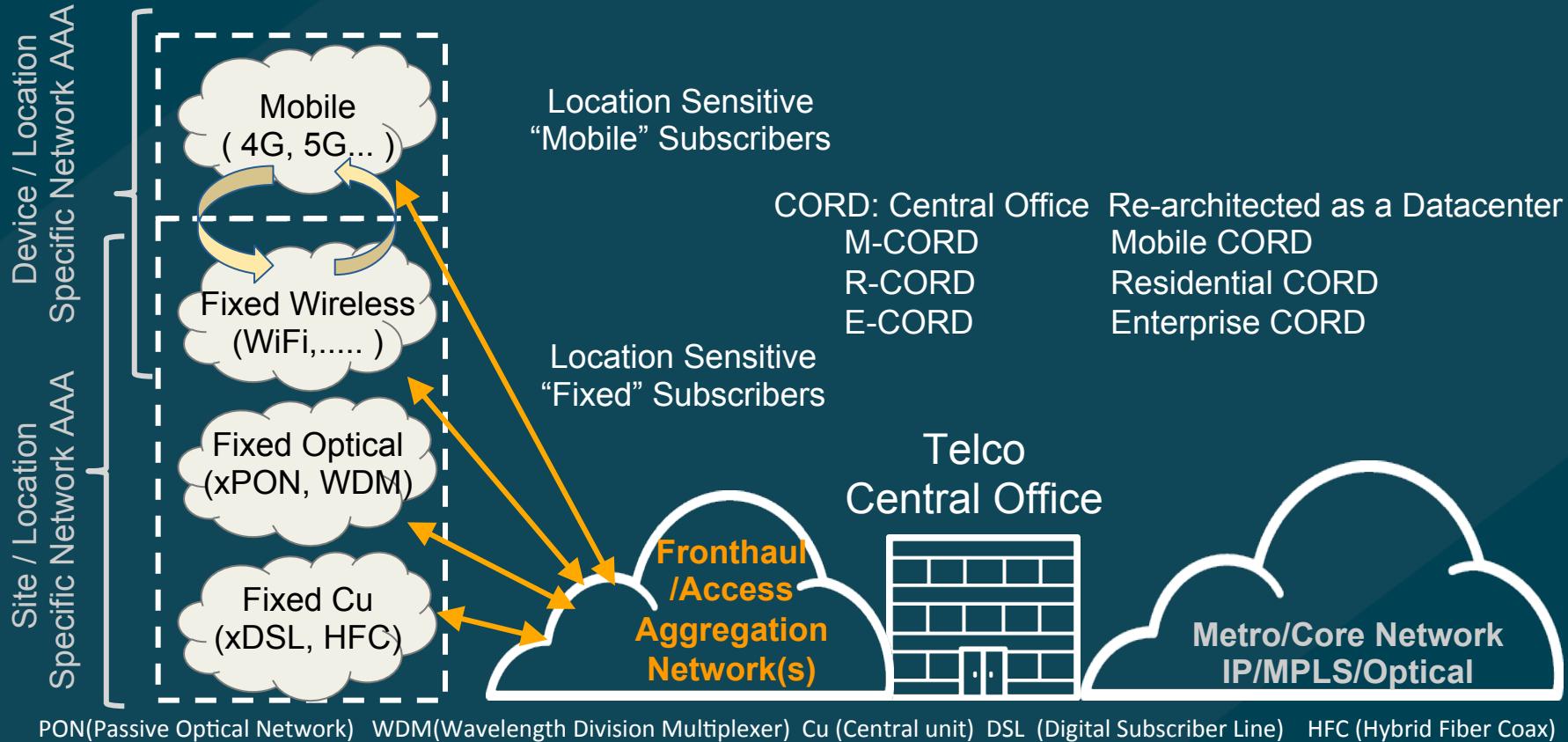
WHAT IS EDGE FOR YOU?

- Regional Data Center ?
- Network access node, core node(Telco Central Office) ?
- eNodeB, Mobile Packet Core node(Telco Central Office) ?
- CPE at customer site ?

MULTI-SITE FOR TELCO

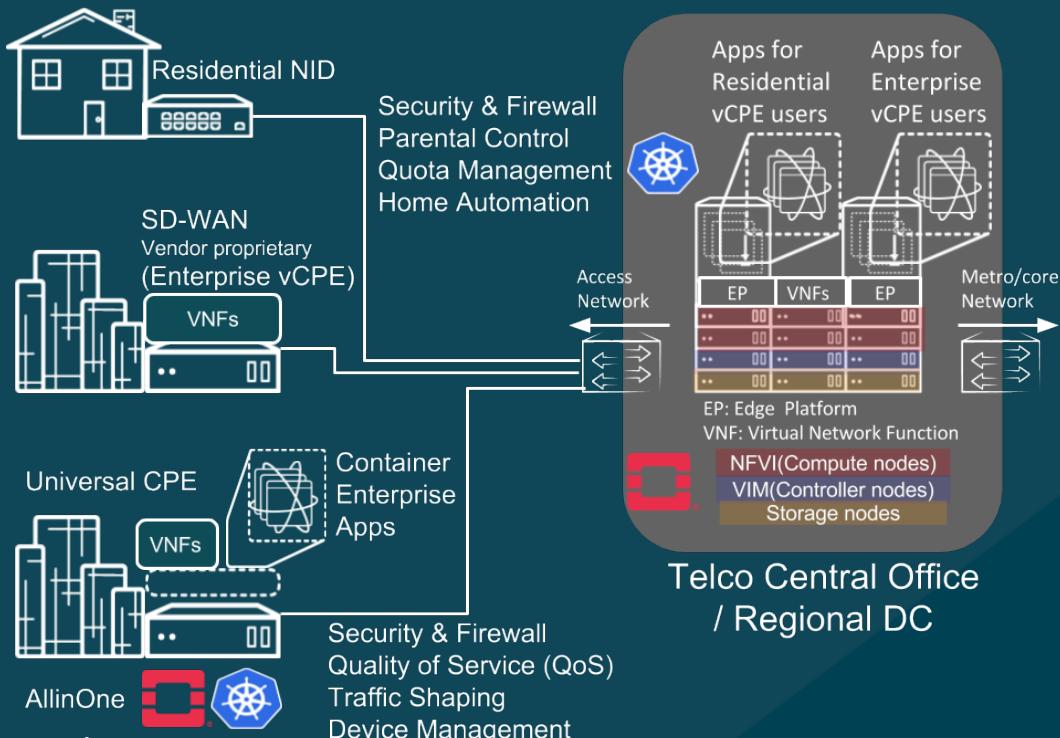


MULTI-ACCESS NETWORKS



EDGE COMPUTING USE CASE-1

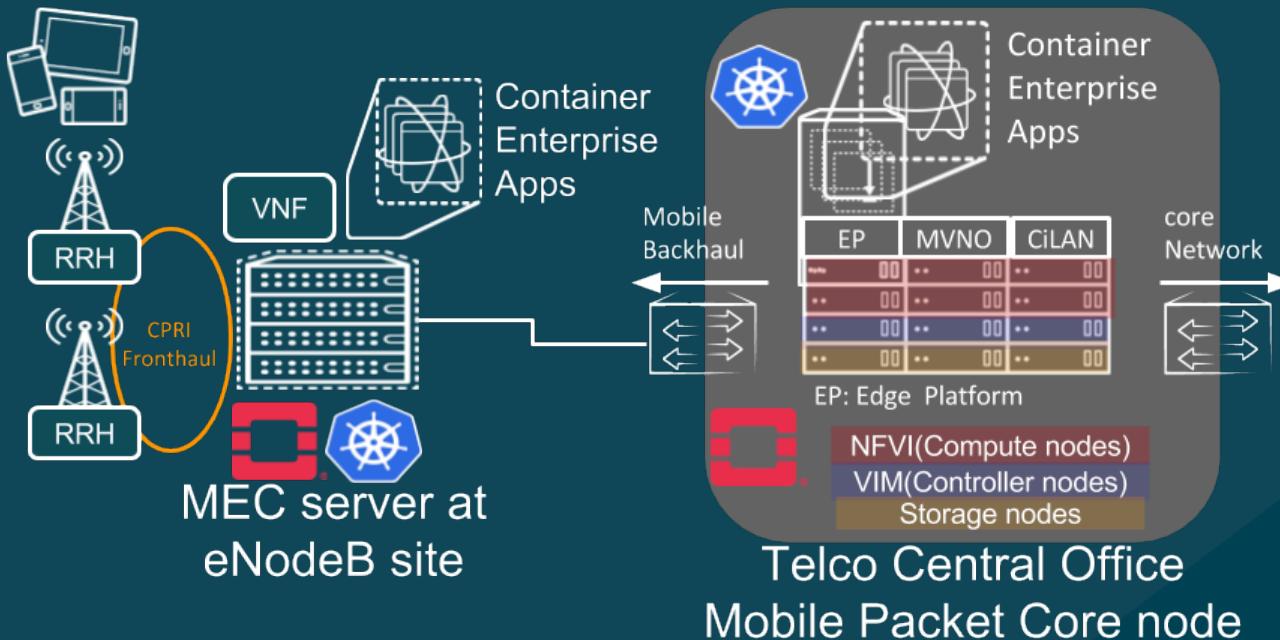
- Residential vCPE service at CO/DC
- Enterprise vCPE/ Universal CPE* service at customer site(replacement of SD-WAN) and CO/DC



* Universal CPE is out of scope in this session.

EDGE COMPUTING USE CASE-2

- Mobile Edge Computing(MEC) at eNodeB node
- Mobile Edge Computing at Mobile Packet Core node (vGiLAN, MVNO, etc)



MEC APPLICATION USE CASE

Network-performance Service Scenarios
Intelligent Video Acceleration



Consumer-oriented Service Scenarios
Augmented Reality



IoT Service Scenarios
Video Analytics



Third-party Service Scenarios
Connected Vehicles



- 7 A Radio through
- 8 The int ensure downl
- 9 Enables

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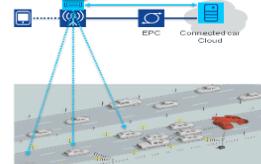
- 8 The MEC application a location; objects view reality content.
- 9 Enables unique experi points of interest
- 10 Ensures low latency ar

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- 9 Distributed live vi
- 10 Events are trigger enables fast detect
- 11 Optimizes backha
- 12 Applicable to pub

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Vehicle-to-infrastructure

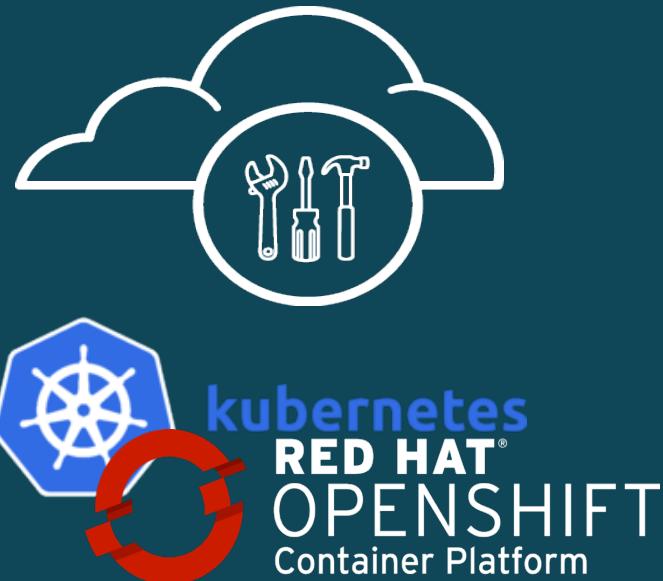


- 10 Existing cloud services are extended into the highly distributed mobile base station environment, leveraging the existing LTE connectivity.
- 11 The MEC application operates as a roadside unit for vehicle-to-infrastructure (V2I).
- 12 Road hazards can be recognized and warnings can be sent to nearby cars with extremely low latency.
- 13 Enables a nearby car to receive data in a matter of milliseconds, and the driver to react instantly.

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KUBERNETES/OPENSIFT

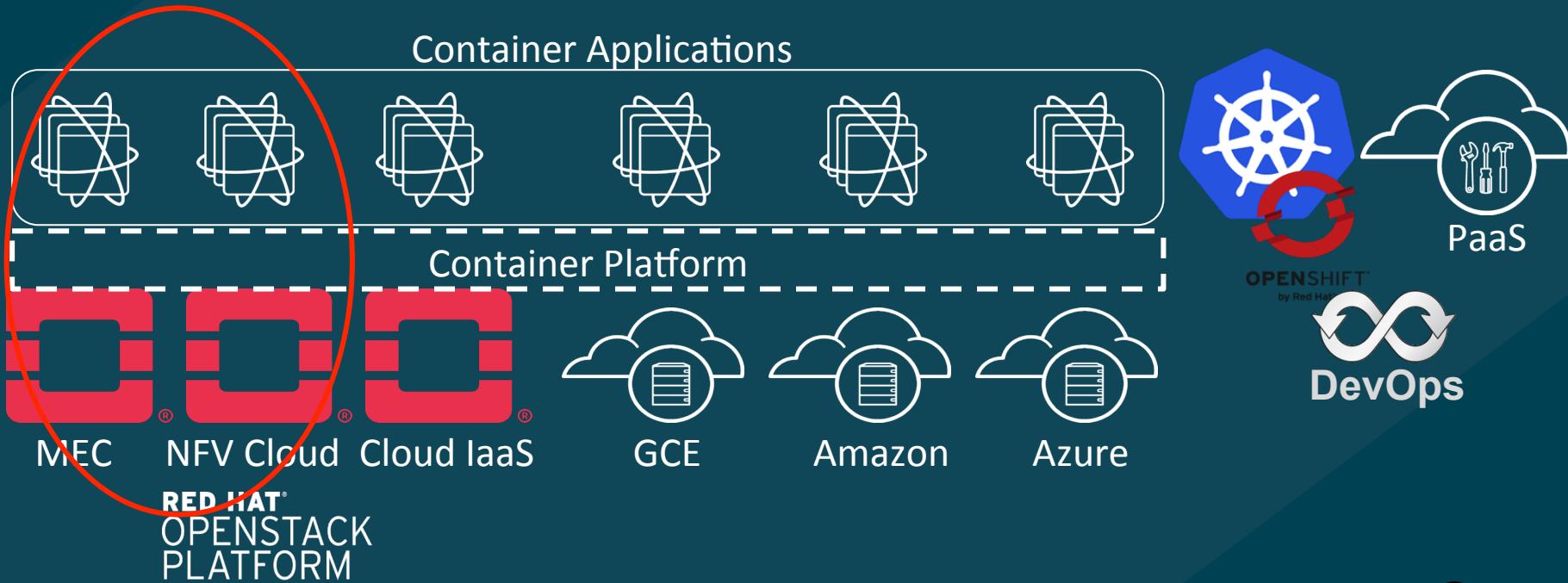
Candidate PaaS for Container Applications in
Edge Computing



WHY KUBERNETES?

Universal Edge service platform

Application can be run Anytime Anywhere selected by user!



KUBERNETES

CONTAINER ORCHESTRATION AT SCALE

Open Source platform

Portable:

Public, Private, Hybrid, Multi-cloud, Bare metal

Extensible:

Modular, Pluggable, Hookable, Composable

Self-healing:

Auto-placement, Auto-restart, Auto-replication, Auto-scaling

Strong ecosystem



CORE CONCEPTS

- Master(openshift master)
- Worker Node(openshift node)
- Pod (image -> Container -> Pod)
- Service

Load-Balanced Virtual-IP (layer 4)

Abstraction layer for your App

Enables Service Discovery

- DNS, ENV

- Labels
- Replication Controller
- Router

Layer 7 LB /Reverse Proxy

SSL/TLS Termination

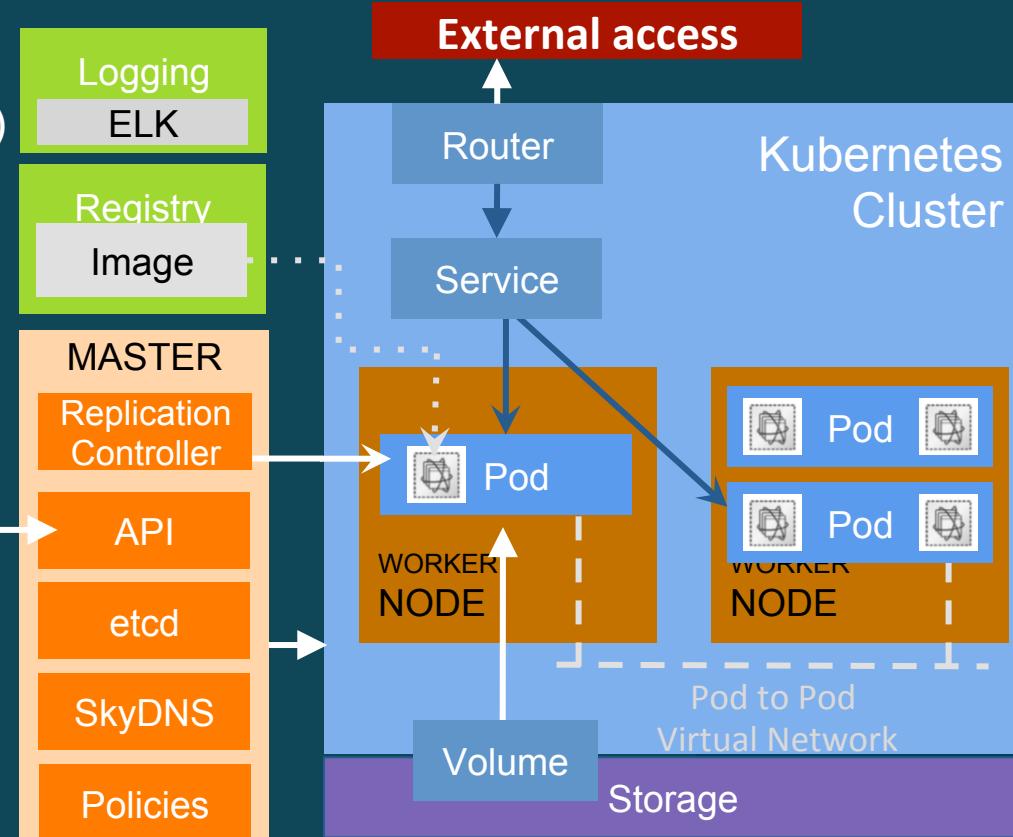
Name based Virtual Hosting

Context Path based Routing

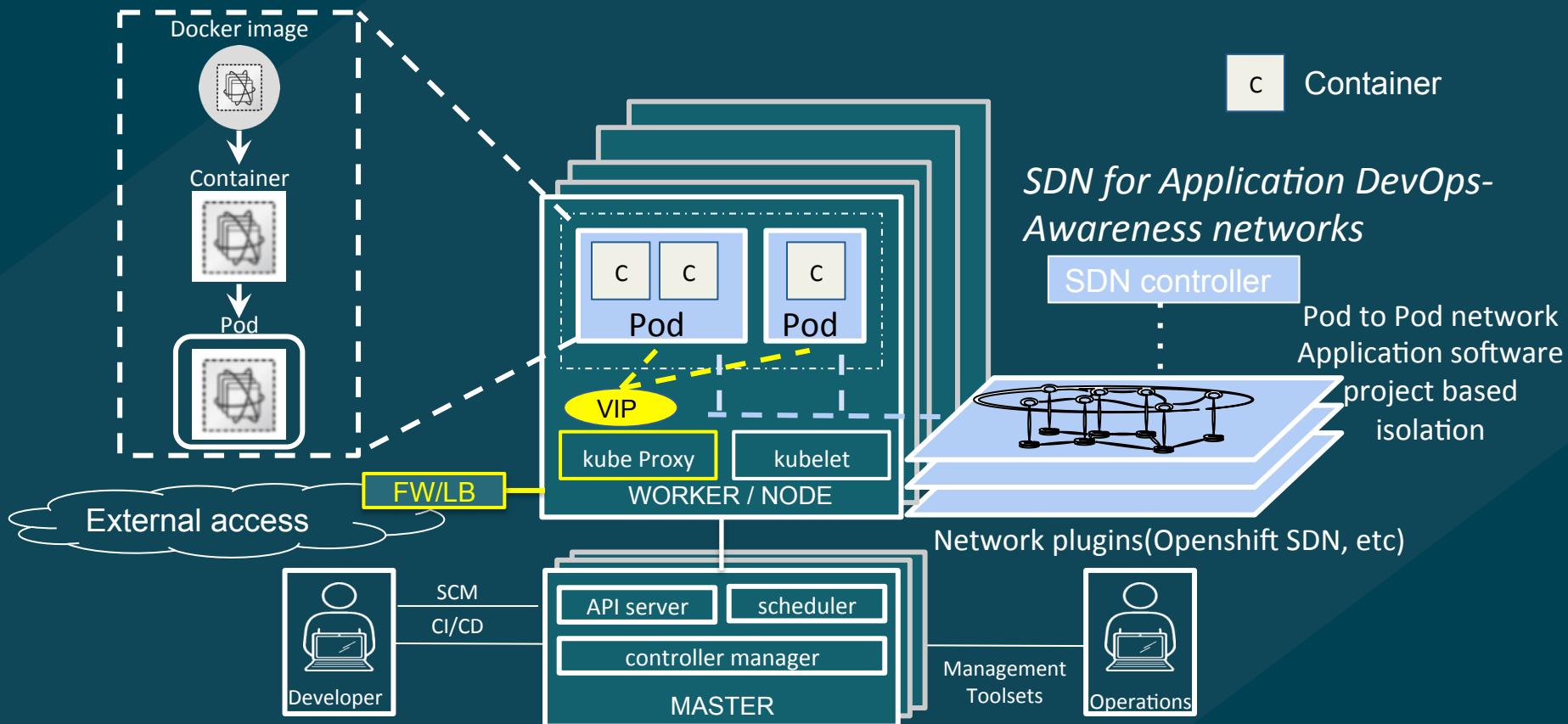
Customizable (image)

- HA-Proxy, F5 Big-IP

Dev/Ops
admin



K8s/OPENShift NETWORKING



POD TO POD NETWORKING

Application DevOps awareness network

- Service Providers; Google Compute Engine, etc
 - 1. Flannel
 - 2. OVS(Open VSwitch)
 - 3. Nuage VCS (Virtualized Cloud Services)
 - 4. Big Switch Networks Big Cloud Fabric
 - 5. Openshift SDN(OVS, VXLAN)
 - 6. OVN(Open Virtual Networking)
 - 7. Calico
 - 8. Contiv (native L3 using BGP, overlay vxlan, classic L2 or Cisco-SDN/ACI)
 - 9. Contrail (Juniper Contrail/OpenContrail)
- etc

MEC ADAPTATION

K8s/Openshift on Openstack



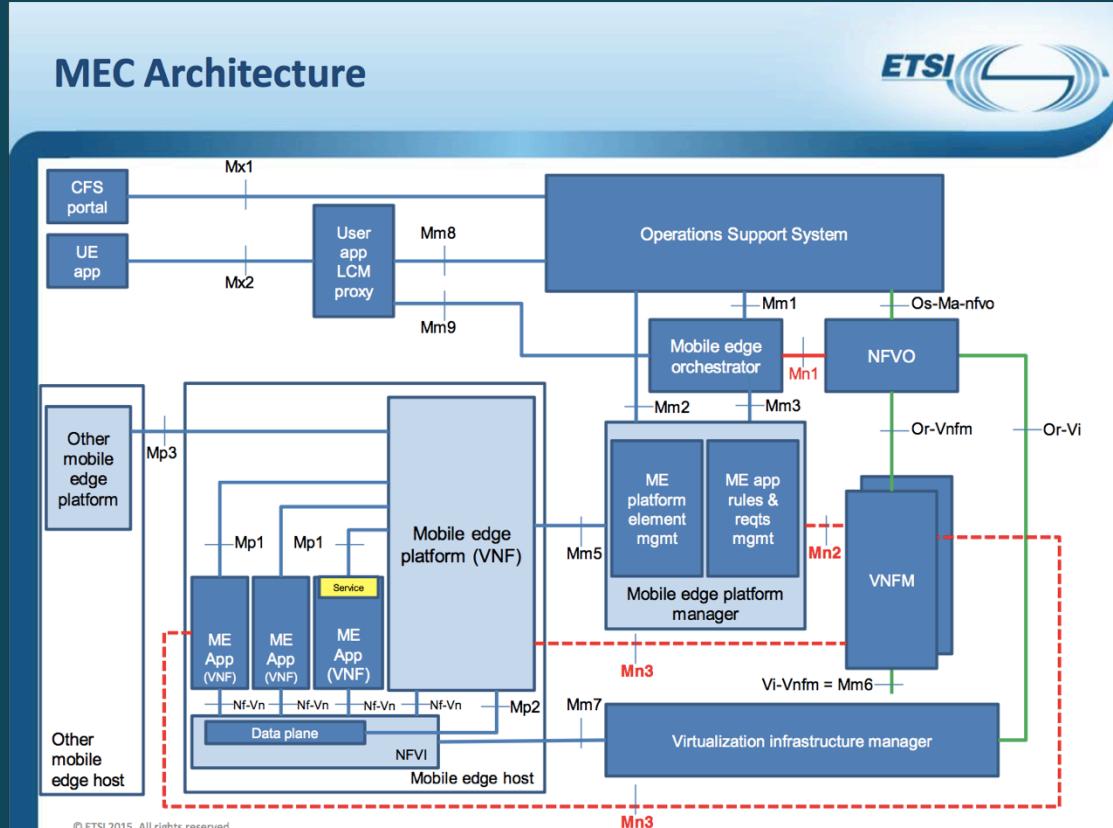
OpenStack and Kubernetes better together:

http://superuser.openstack.org/articles/openstack_kubernetes_better_together/

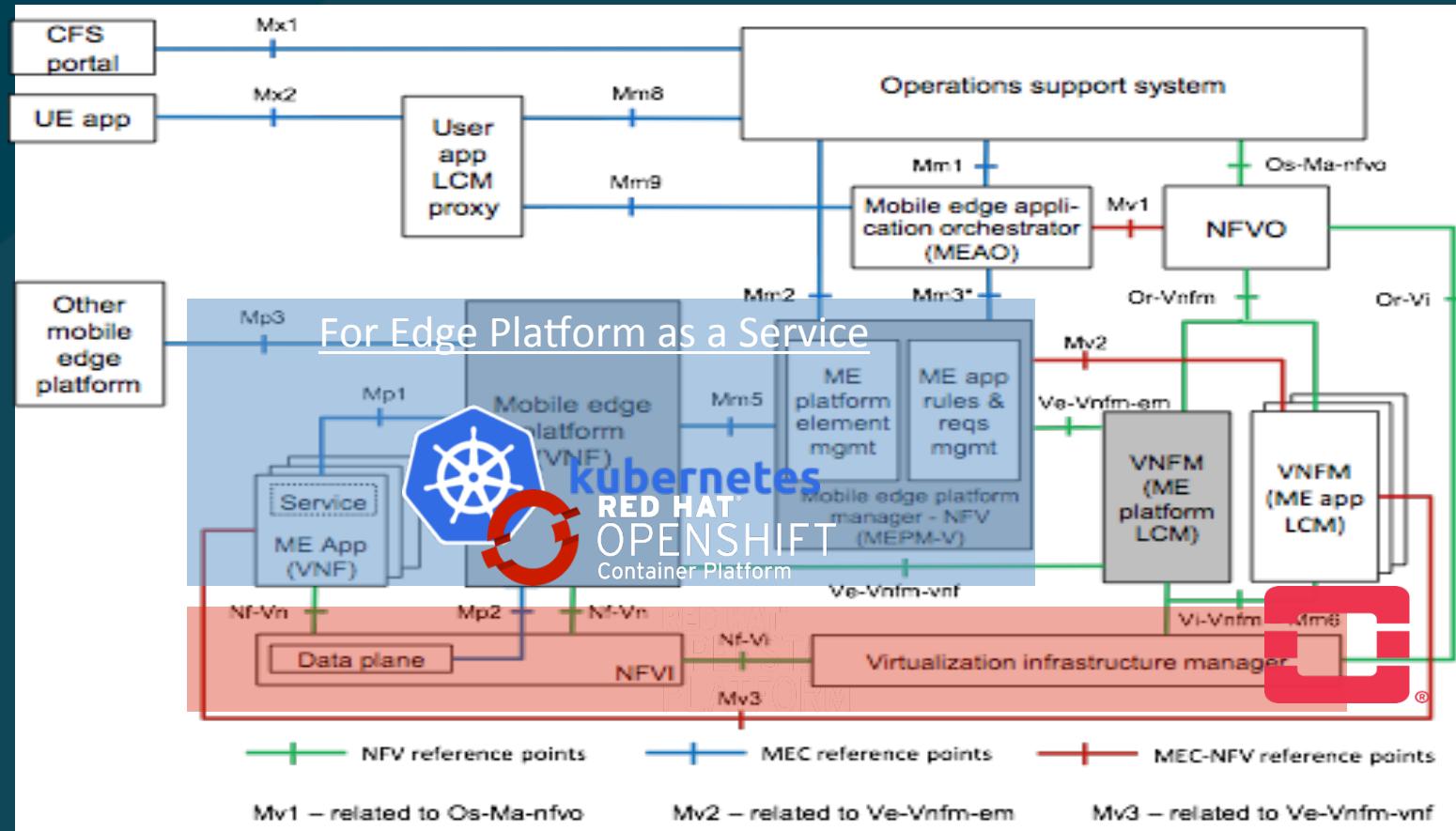
MULTI-ACCESS EDGE COMPUTING(MEC)

Can become a major use case for Containerized VNFs (IoT, etc)

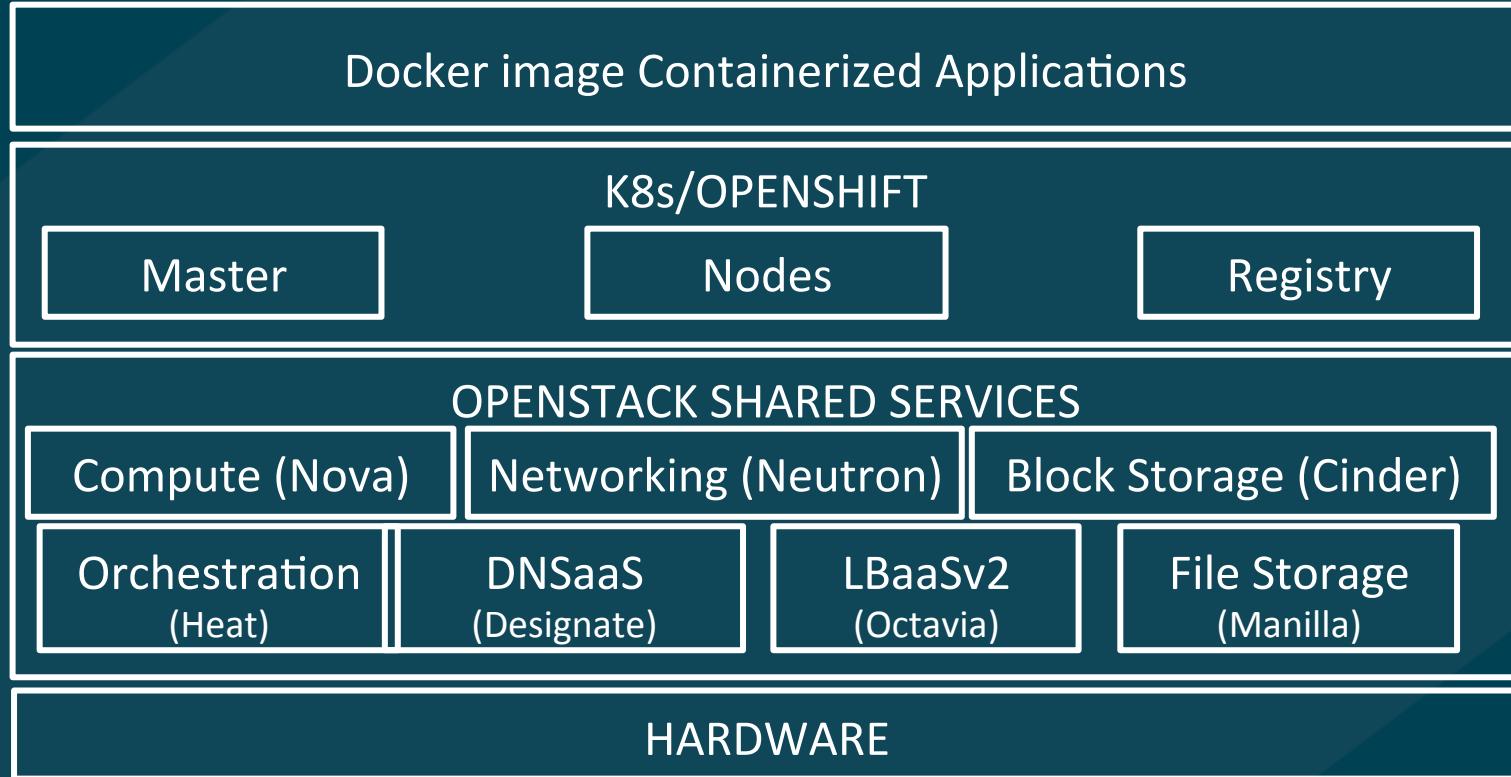
Opens for new services and development models in different market verticals (e.g. Edge PaaS for some of the IoT gateway functionalities)



MEC REFERENCE ARCHITECTURE



K8s/OPENSIFT ON OPENSTACK



NEW PROBLEMS AT NETWORKING SETUP

- OpenStack VM-to-K8s Pod data-plane performance
- Double-tunneling will have negative impact on data-plane performance (e.g. Kubernetes ‘flannel’ tunnel encapsulated in OpenStack ‘vxlan’ tunnel when running Kubernetes on top of OpenStack).

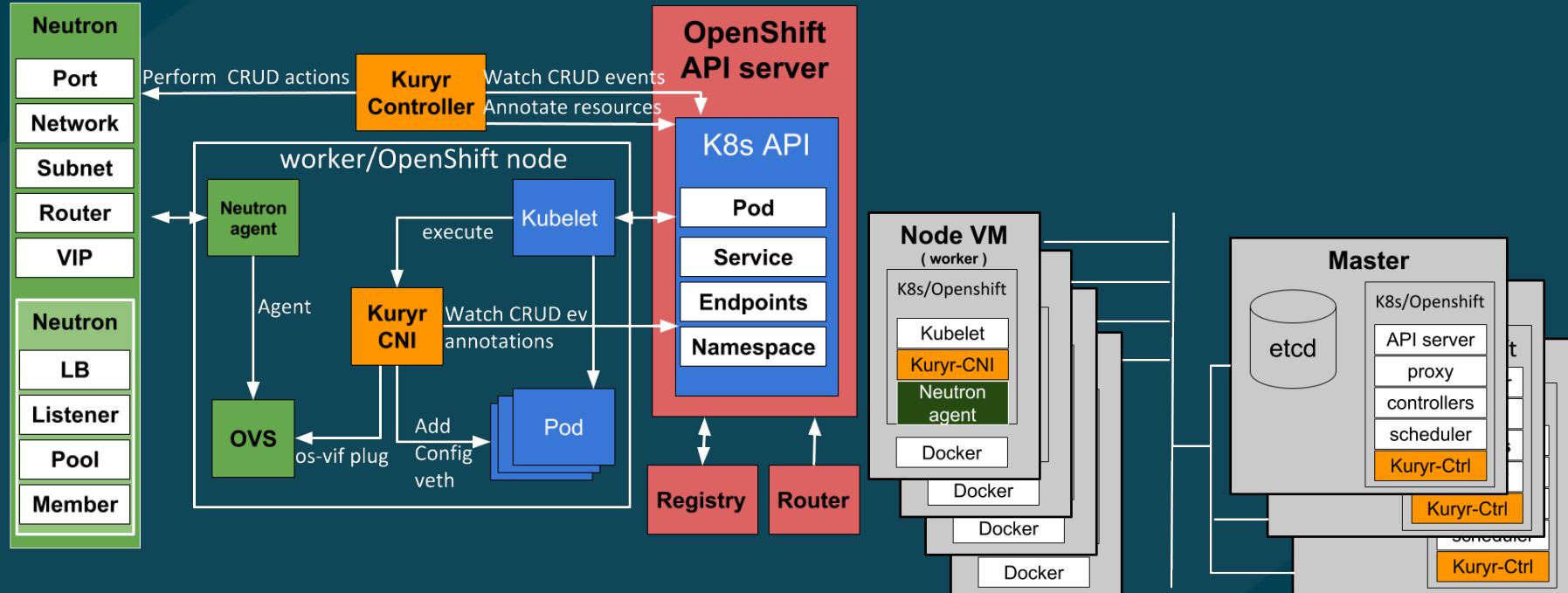
Solution :

Kuryr-Kubernetes, by enabling native Neutron-based networking in Kubernetes.

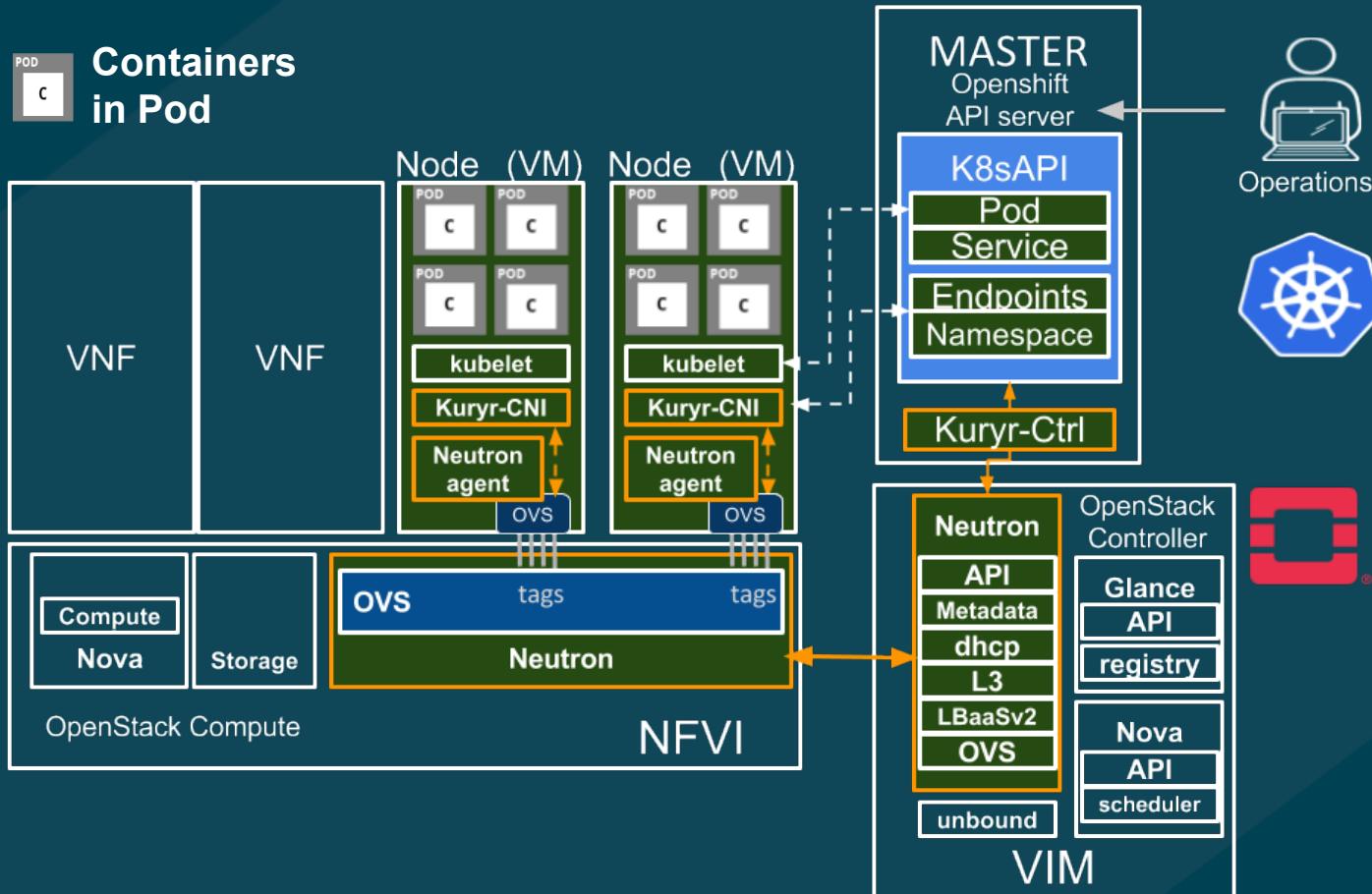
KURYR CNI & KURYR CONTROLLER

Kuryr-Kubernetes

<http://superuser.openstack.org/articles/networking-kubernetes-kuryr/>

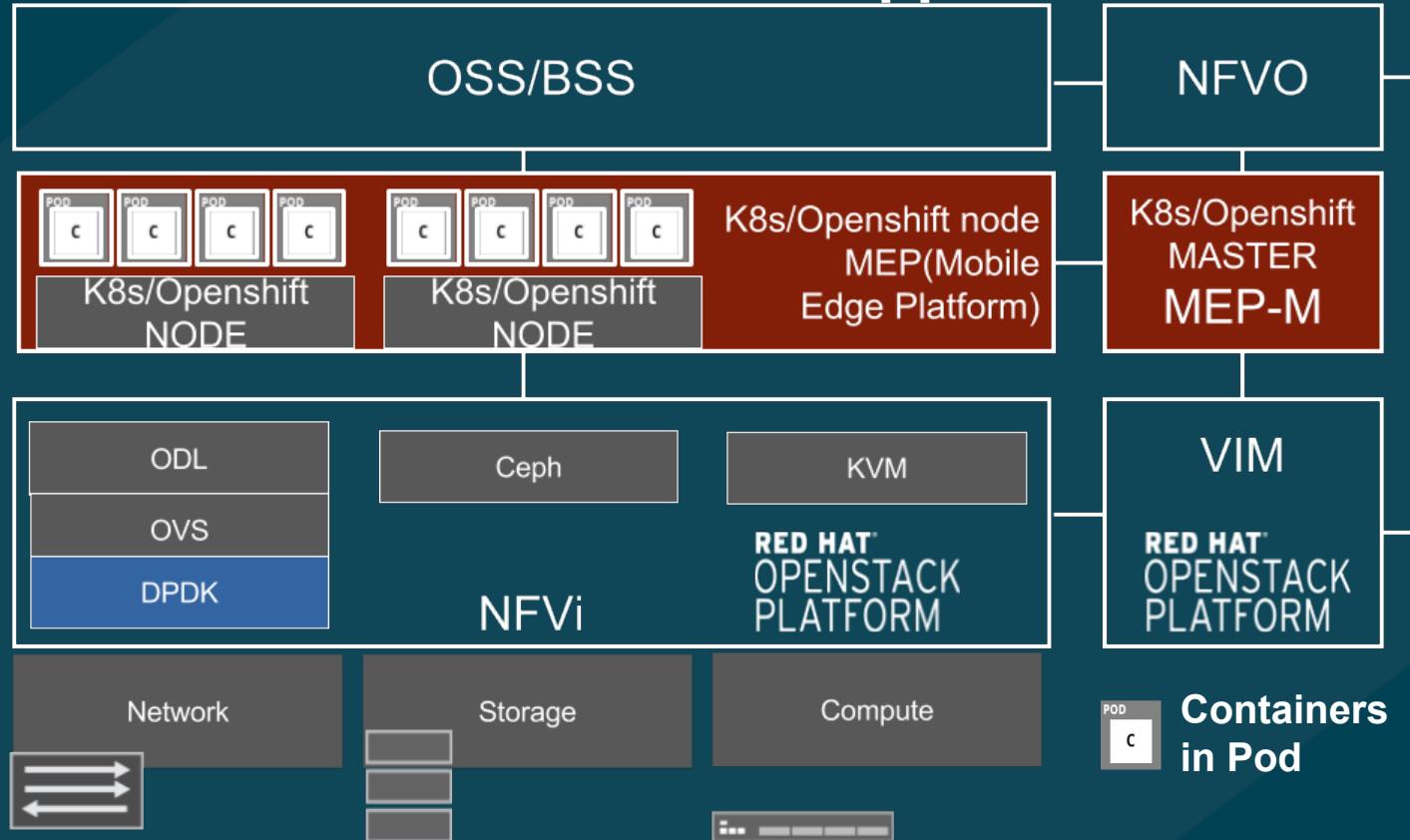


K8s/OPENSIFT ON OPENSTACK = MEC

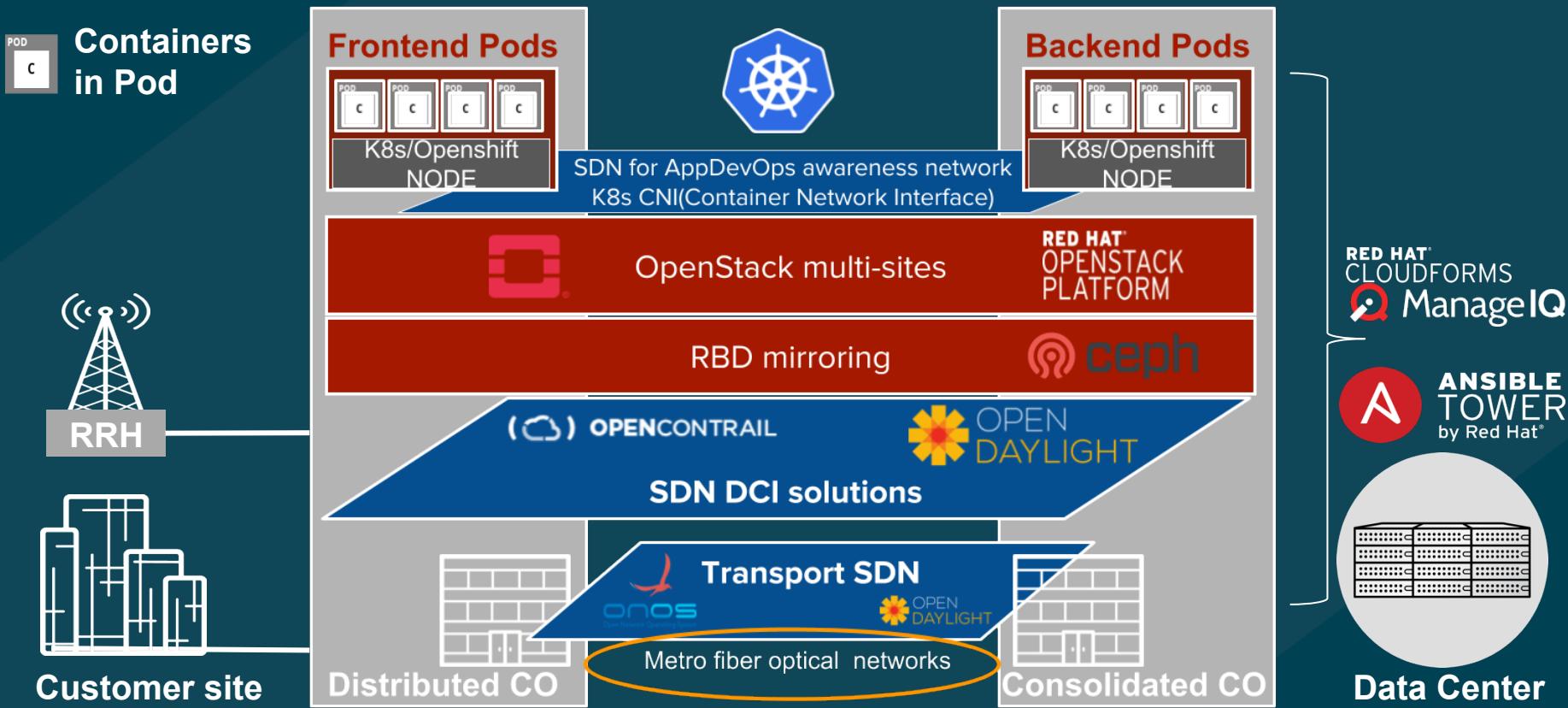


MULTI-ACCESS EDGE COMPUTING

PaaS for container applications

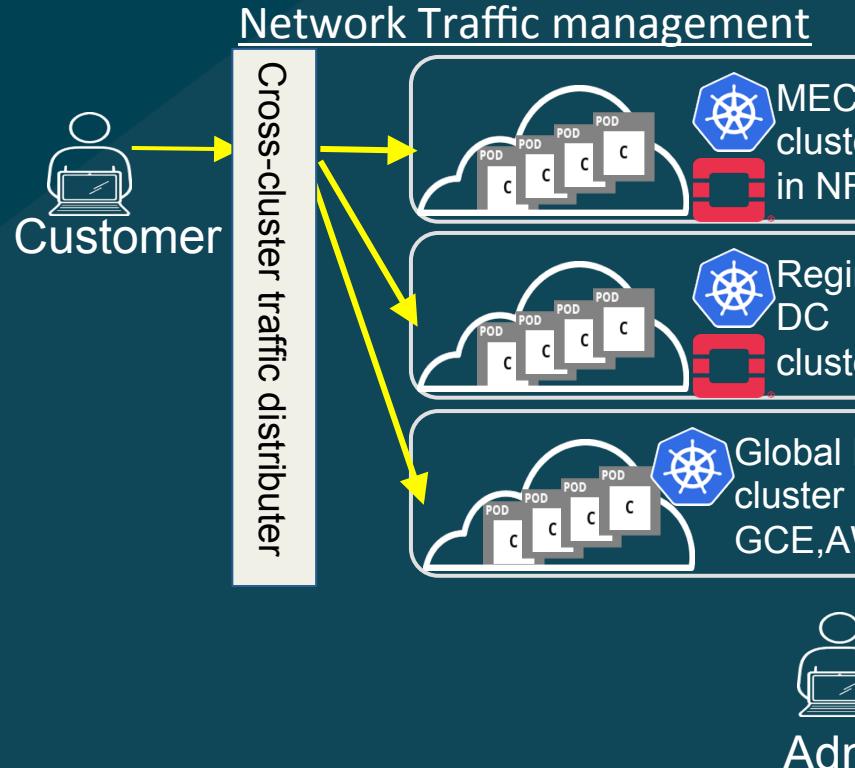


MEC ACROSS MULTI-CENTRAL OFFICES



KUBERNETES FEDERATION - FUTURE

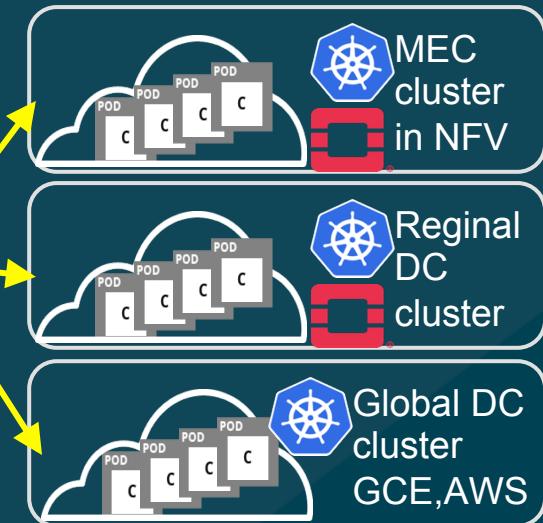
High Availability, Multi-Cloud, Multi-region, GEO locality to end users



Resource placement

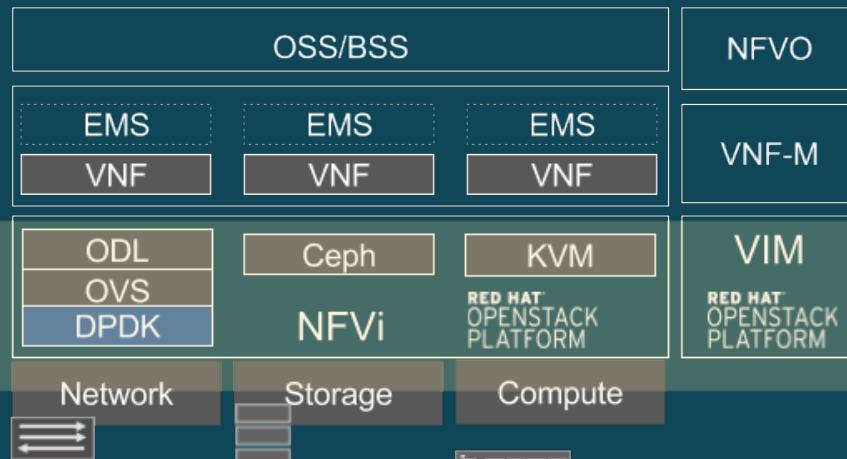
Cluster Federation

Admin

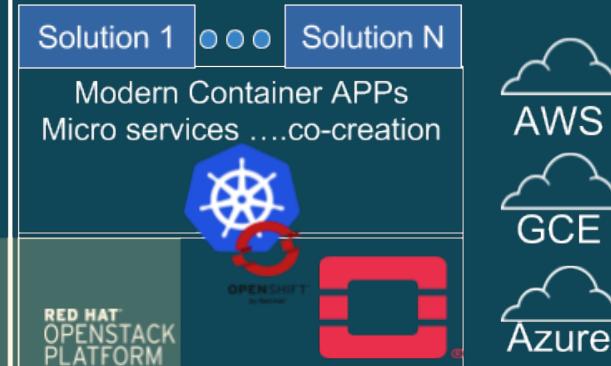


BIMODAL ICT IN TELECOM INDUSTRY

Mode1: NFV Carrier Grade solution



Mode2: MEC Edge PaaS DevOps for Open Innovation



CONCLUSION

- K8s/OpenShift on OpenStack is adaptable to Edge PaaS in Multi-access Edge Computing.
- SDNs have to control traffic to;
 - Container in Pod, Container in Pod in VM(K8s on Openstack NFV)
 - ... Leaf/spine switch across multi DCs/COs
- Many upstream projects in Kubernetes and etc
 - No need to create new feature spec from scratch for Multi-access Edge platform.
 - Evaluate existing upstream projects and find feature gap first.



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