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Comparison between Open Edge Projects & ETSI MEC RA

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Contents:

- Brief introduction to China Unicom's Cube-Net 2.0 & Cube-Edge
- Open Edge Project Comparison
- China Unicom's Architecture
- StarlingX Deep Dive
- Conclusion
- Q&A

China Unicom‘s CUBE-NET V2.0 Strategy

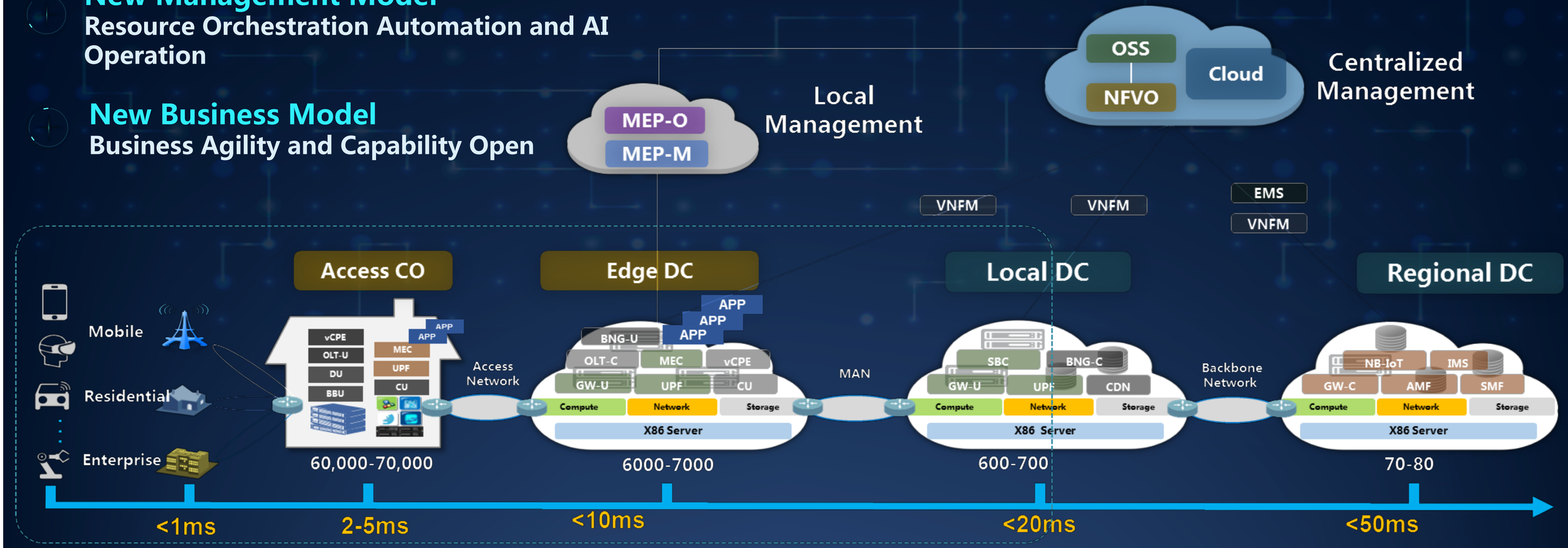
New Network
Shared NFV & Cloud Infrastructure

New Management Model
Resource Orchestration Automation and AI Operation

New Business Model
Business Agility and Capability Open

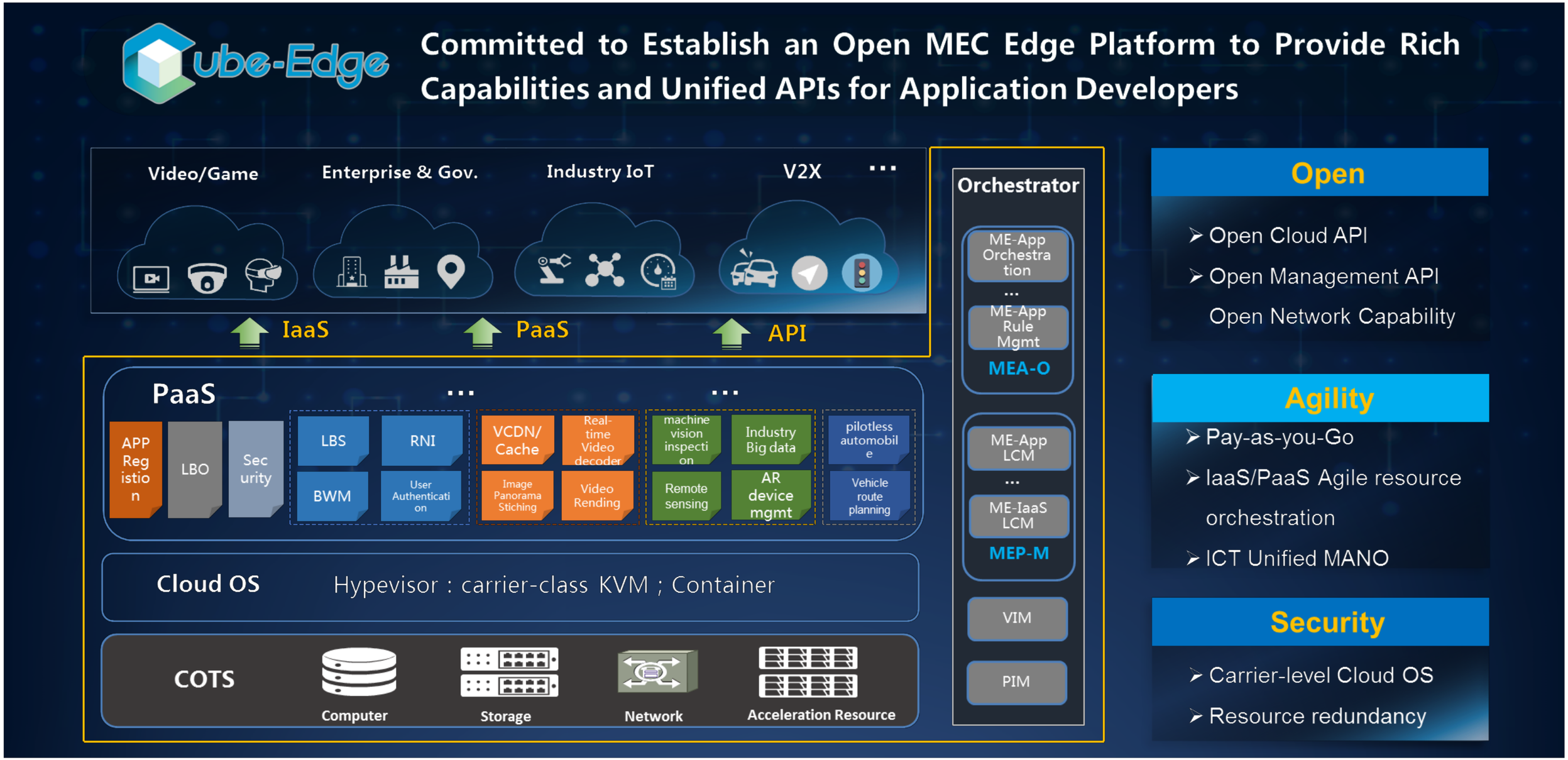
CUBE-Net
新网络 新服务 新生态

5G network of China Unicom will be an elastic network based on regional, local and edge data centers, which will quickly respond to and shorten the deployment time of new services.



China Unicom’ s Cube-Net 2.0 Architecture

China Unicom‘s Edge-Cloud Platform Vision



China Unicom‘s Edge Business Progress

In 2018 MWC，China Unicom announced Edge-Cloud pilot in 15 China provinces

5G Pilot

Shenyang Tianjin Qingdao Nanjing Shanghai Hangzhou Fuzhou Shenzhen Beijing Xiongan Zhengzhou Chengdu Chongqing Wuhan Guiyang Guangzhou

Edge-Cloud Pilot

Beijing Tianjing Shanghai Shandong Zhejiang Guangdong Chongqing Sichuan Fujian Hubei Hunan Hebei Henan Liaoning Jiangsu

Video & games

Manufacturing

Roads and traffic

Venues

…

…

Ports

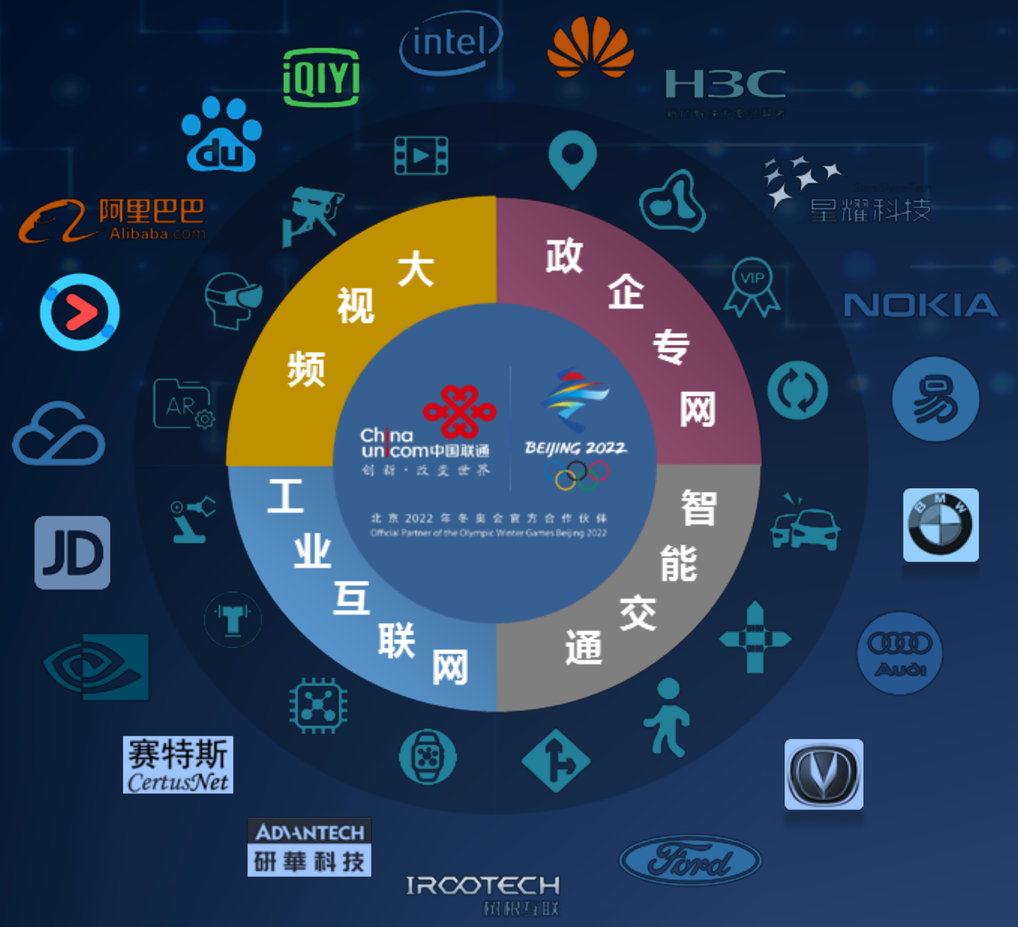
Security

Tourist attraction

Water Project

China Unicom‘s Edge Innovation Laboratory

Focus on 4 Areas, Work with Industry to Construct 5G Edge Ecosystem, More than 100 Partners



Establish Edge-Cloud Innovation Laboratory, **Investigate on StarlingX Project (Cooperation with INTEL & 99 Cloud)**

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Open Source Project Overview for Edge

vCO

	Akraino(Including StarlingX/Airship)	vCO	CORD
Mission	The Akraino Edge Stack is designed to improve the state of edge cloud infrastructure for enterprise edge, OTT edge, and carrier edge networks.	The goal of the Virtual Central Office project is to produce an OpenDaylight-based reference architecture that, when combined with other functional elements (such as NFV and Orchestration software stacks) can support the delivery of Residential, Business and Mobile Services.	To build an open reference implementation of CORD, bringing datacenter economies and cloud agility to service provider networks.
Foundation	Akraino : Linux Foundation Airship : OpenStack Foundation StarlingX: OpenStack Foundation	Linux Foundation→ OPNFV	Linux Foundation → ONF → CORD (?)
Edge Mano	ONAP/Tacker	ONAP(Started from v2.0)/Tacker	XOS
SDN	ODL/Commercial/	ODL	ONOS
Open VNF	n/a	n/a	Provide Open vEPC/vOLT and etc（*）
Since from	2018	2018	2016
Latest Version	1.0	2.0	6.0
HW Preference	n/a	White Box+Open Rack	White Box+Open Rack
Sub Projects	Airship, StarlingX	n/a	R-CORD/M-CORD/E-CORD
Edge Infra	OpenStack on Kubernetes (OOK),	OpenStack	OpenStack/K8S
Source Code	https://git.starlingx.io/cgit StarlingX https://git.airshipit.org/cgit Airship	No source code yet POF demo only	https://gerrit.opencord.org/#/q/status:open

* There is some GPL issue in using Open VNF https://wiki.opencord.org/display/CORD/GPL+Issue+August+2018

vCO Architecture

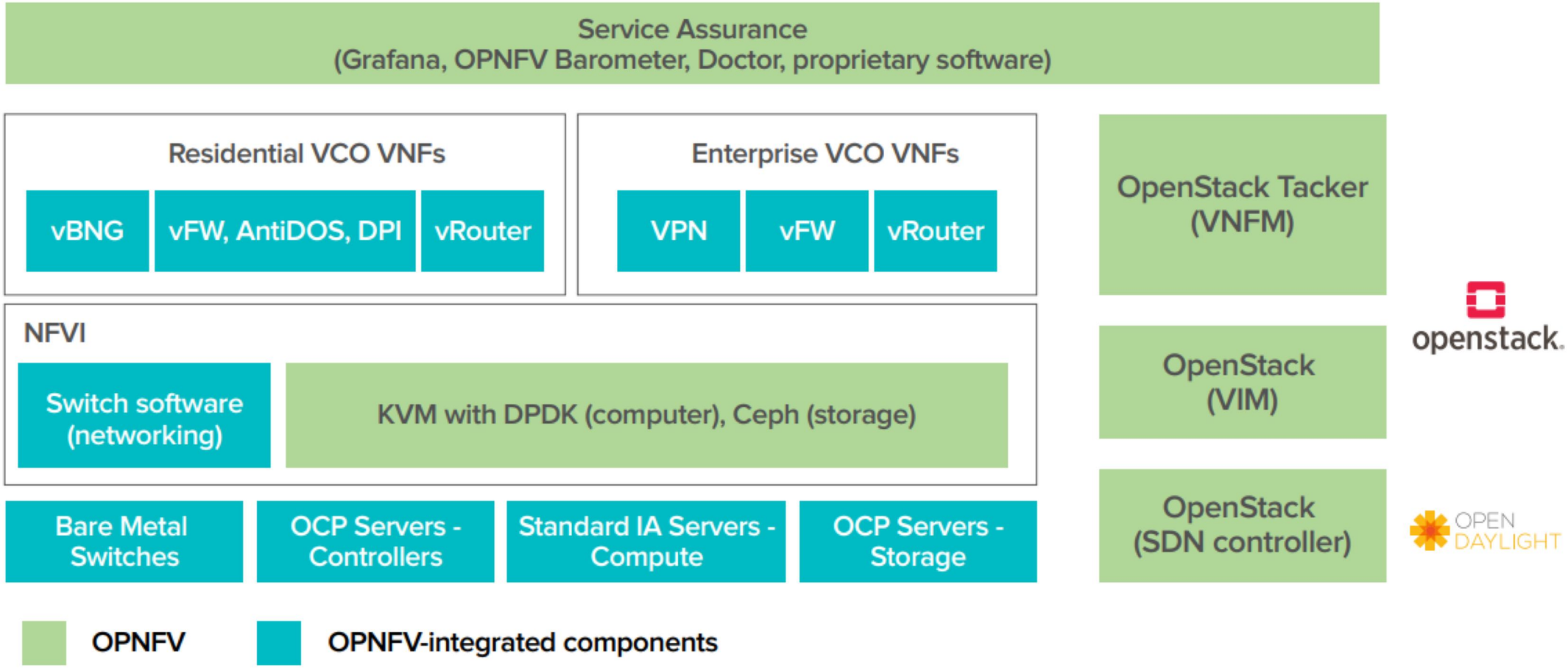


Figure 3: VCO Demo Reference Architecture

CORD Architecture

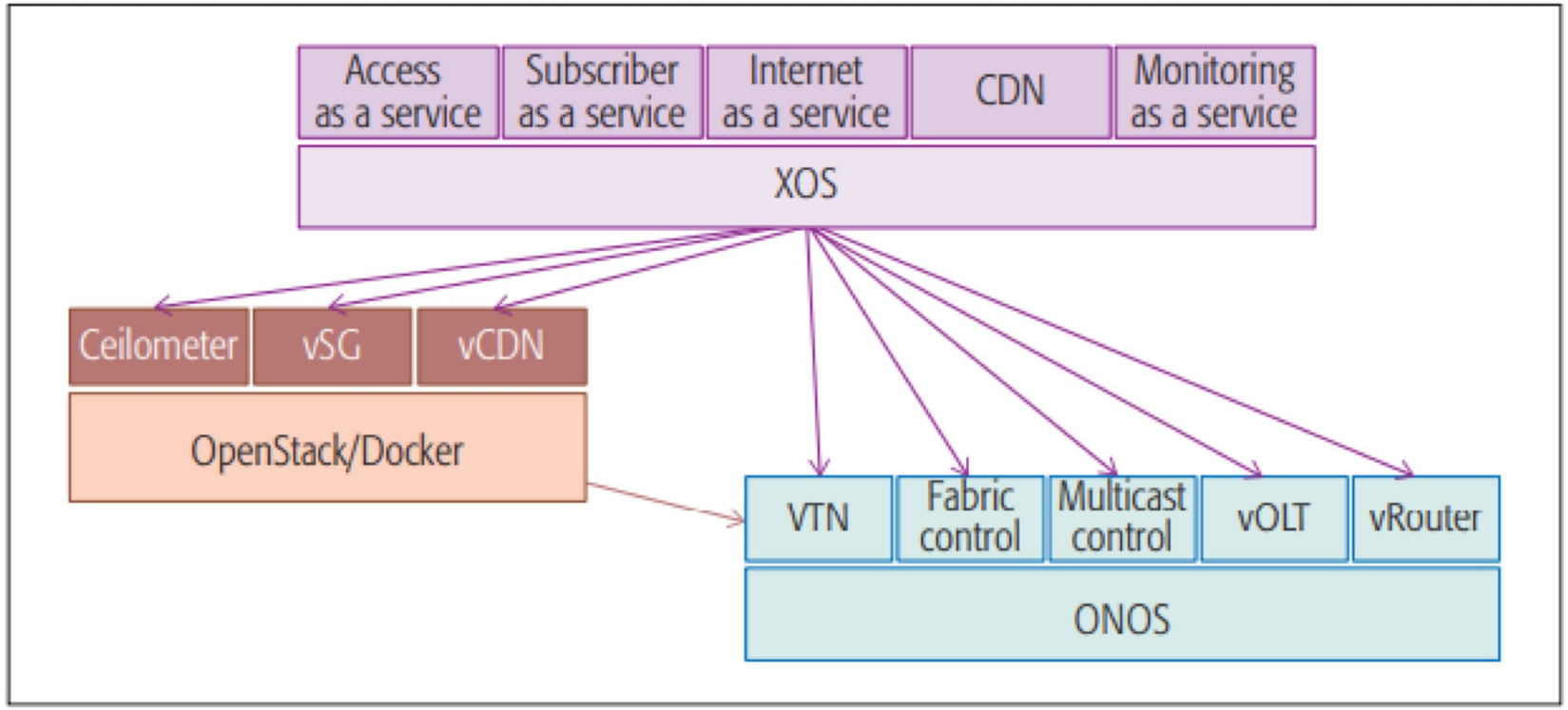
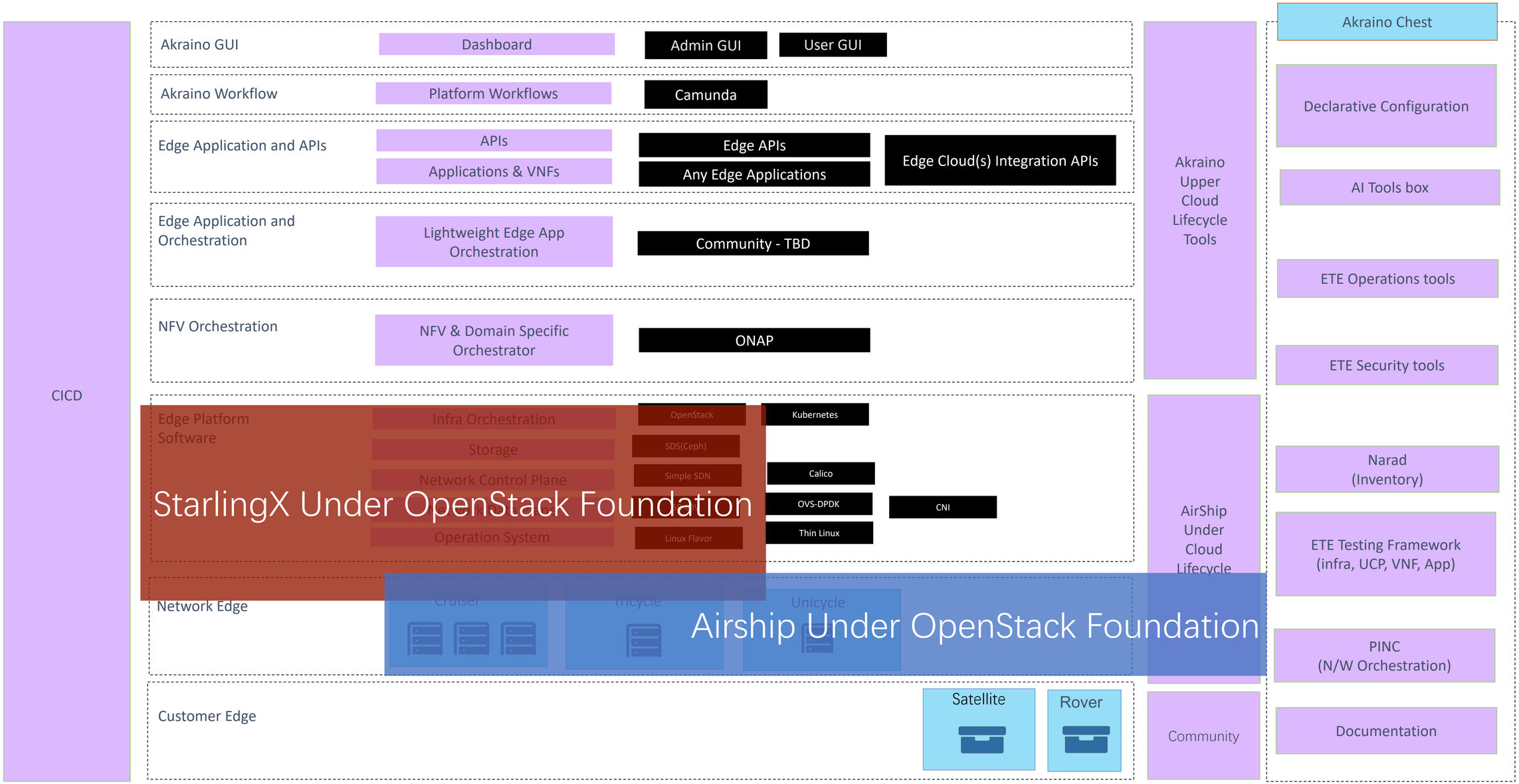
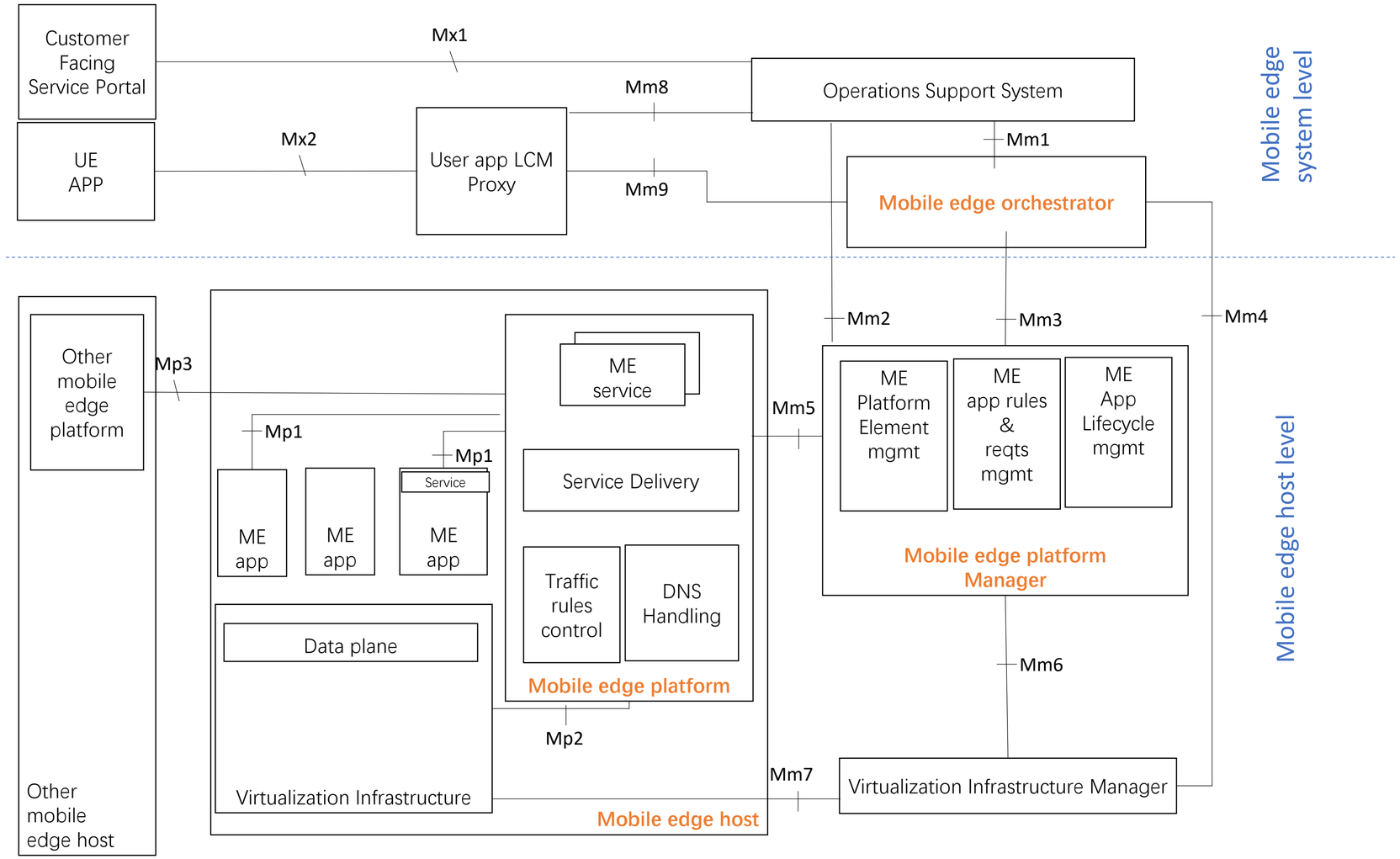


Figure 2. Open source software components in CORD. XOS assembles multi-tenant services, ONOS hosts control applications, and OpenStack/Docker manage compute instances. Specific services and control apps are described in later sections.

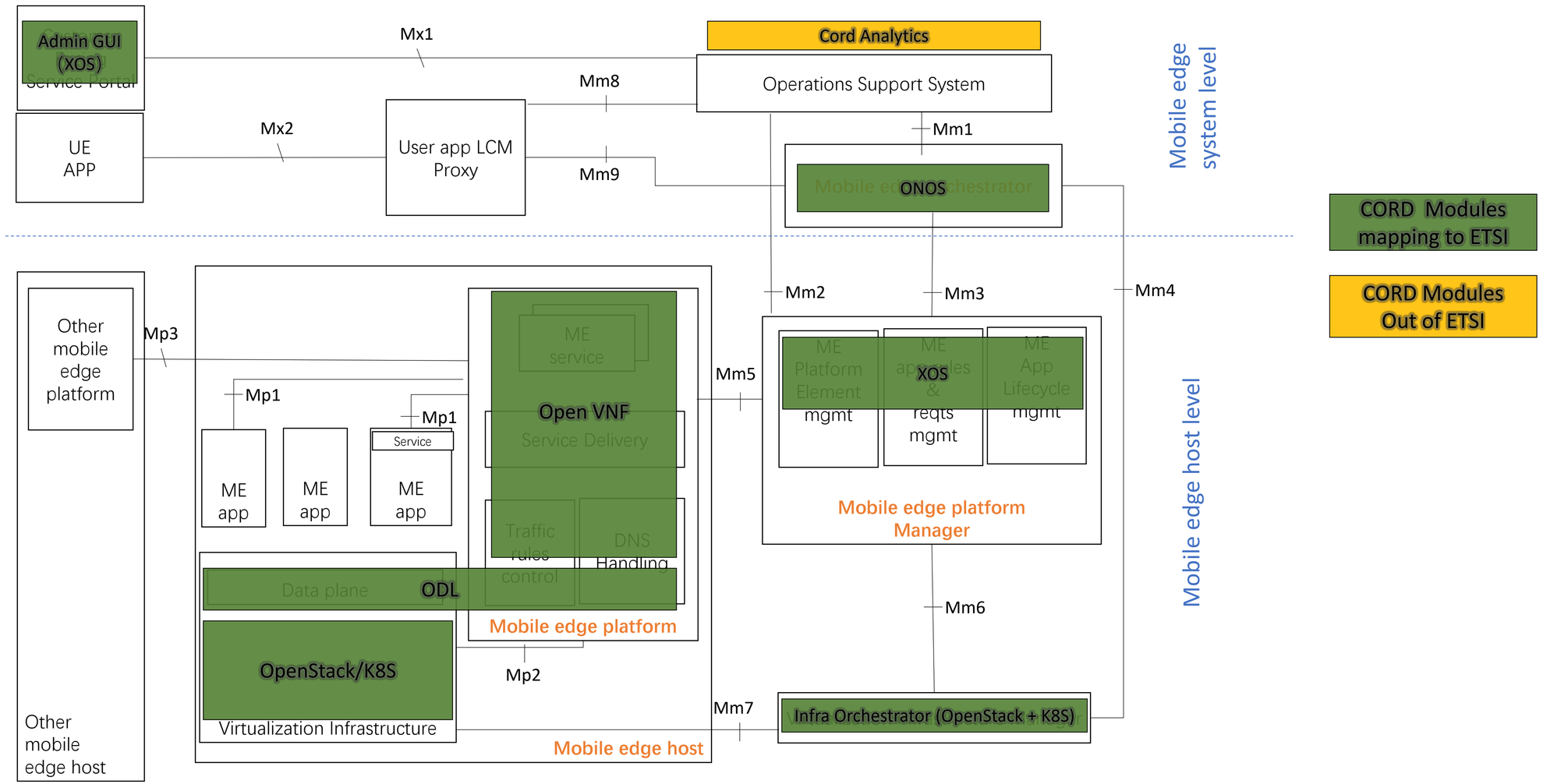
Akraino Architecture



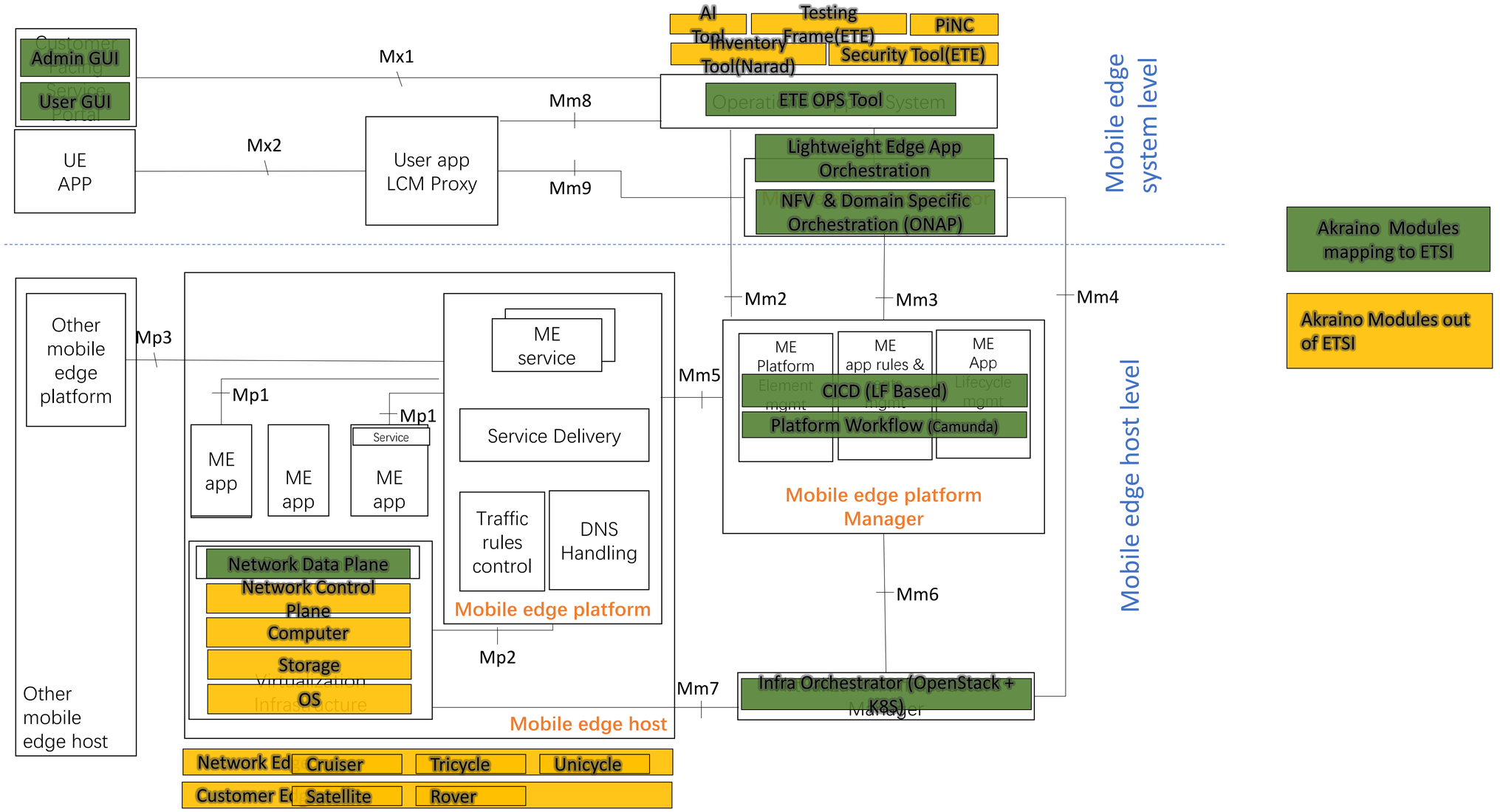
ETSI's MEC RA


Customer Facing Service Portal
UE APP
Mx1
Mx2
User app LCM Proxy
Mm8
Mm9
Operations Support System
Mm1
Mobile edge orchestrator
Mobile edge system level
Other mobile edge platform
Mp3
Mp1
Mp1
Service
ME app
ME app
ME app
ME service
Service Delivery
Traffic rules control
DNS Handling
Mobile edge platform
Data plane
Virtualization Infrastructure
Mp2
Mobile edge host
Other mobile edge host
Mm2
Mm3
Mm4
Mm5
ME Platform Element mgmt
ME app rules & reqts mgmt
ME App Lifecycle mgmt
Mobile edge platform Manager
Mm6
Mm7
Virtualization Infrastructure Manager
Mobile edge host level

ETSI's MEC RA v.s. CORD



ETSI's MEC RA v.s. Akraino



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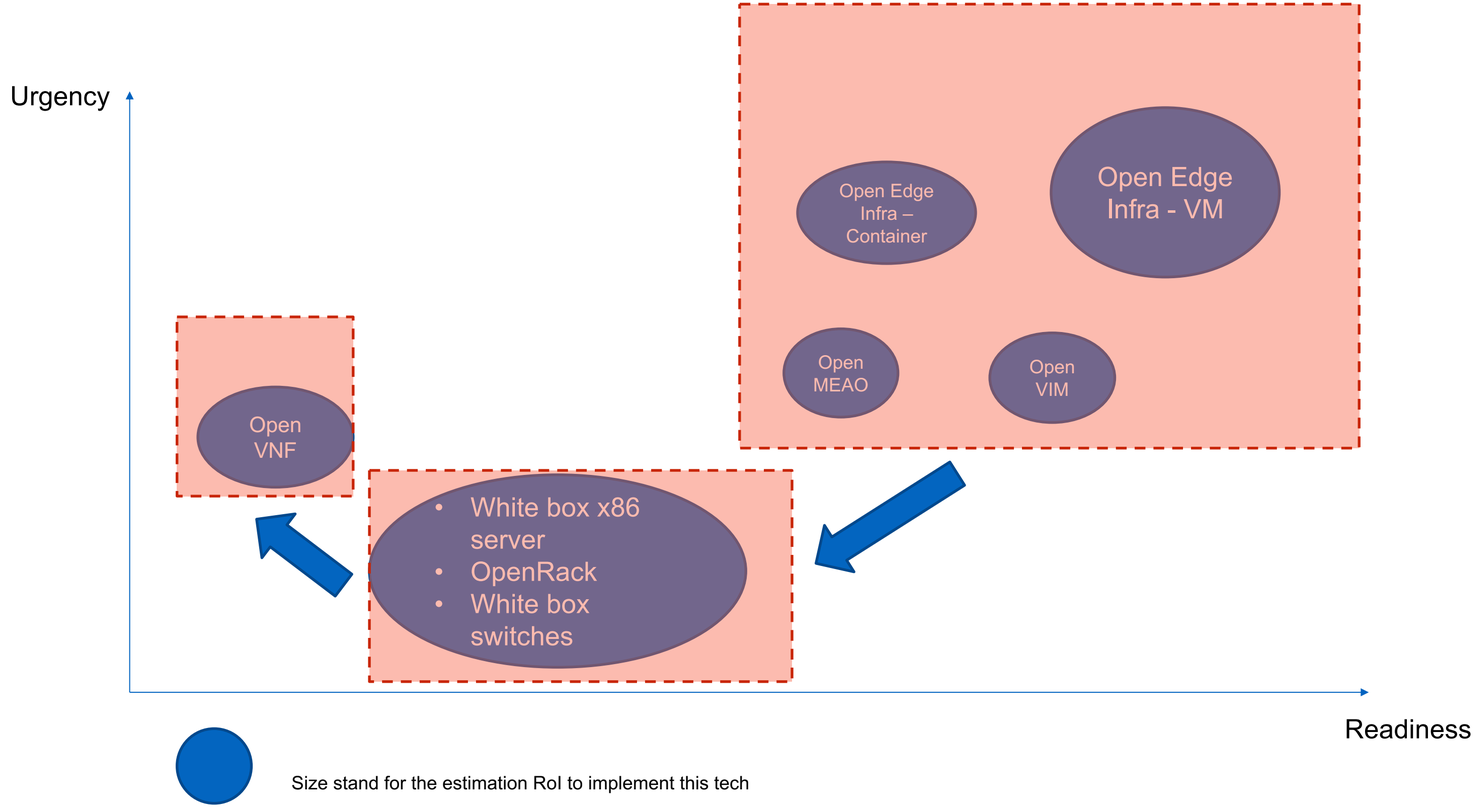
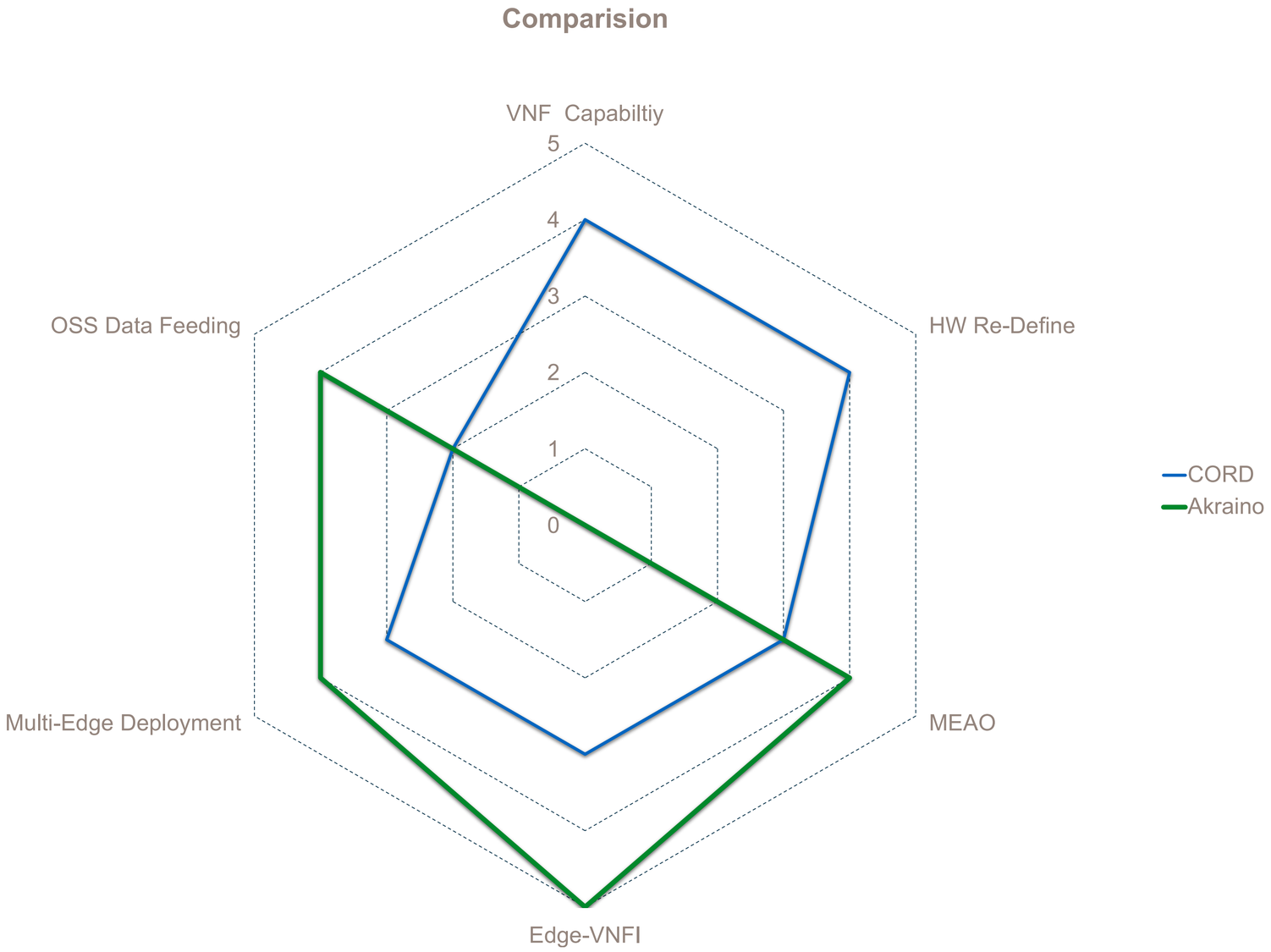
China Unicom's Decision Making Factors on Open Edge Platform Options

- The urgency level to support China Unicom's Edge roadmap
- The readiness level of open infra techs
- The ROI level of adoption for Open Techs

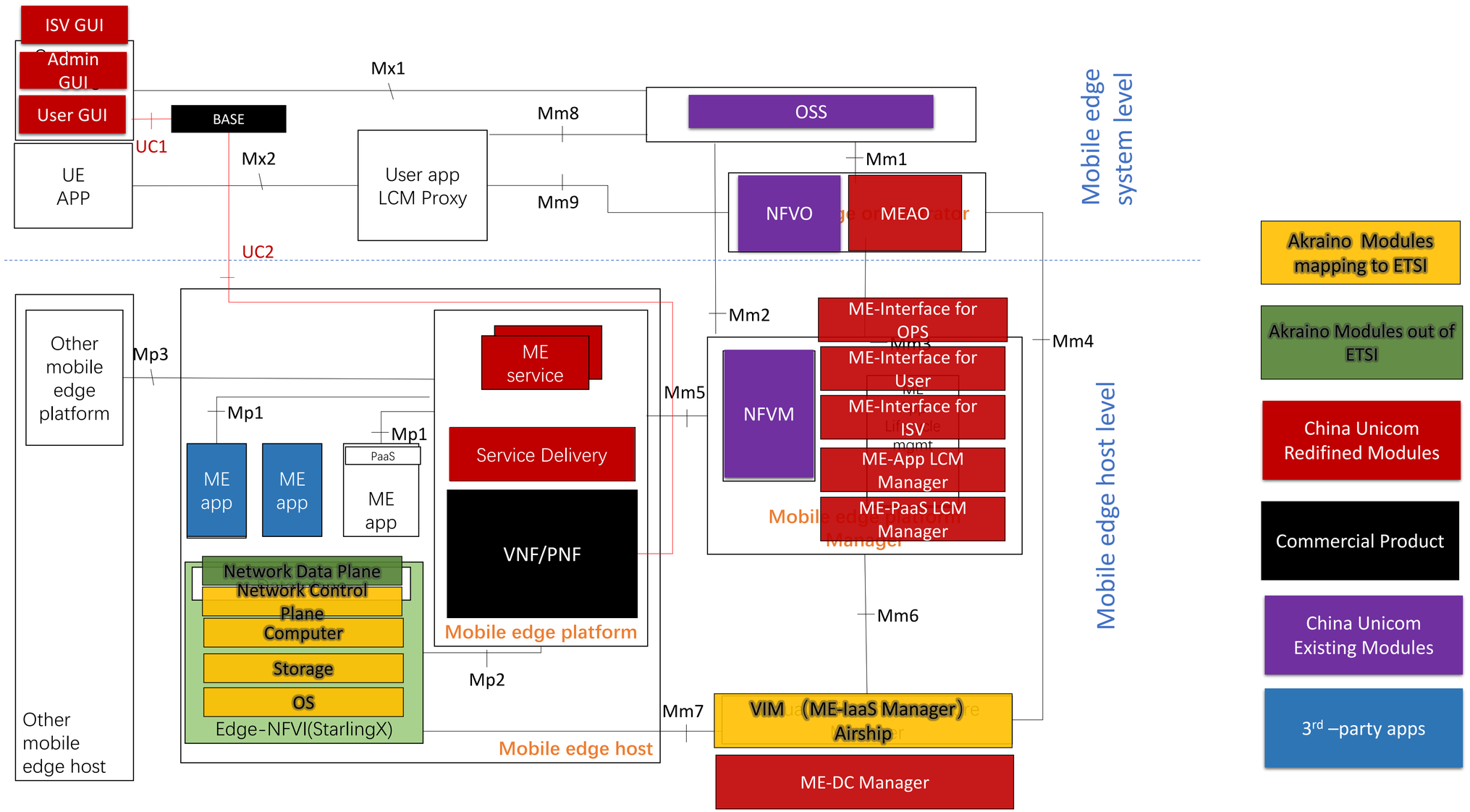


Category	Open Tech Examples
Open Edge Infra -VM	OpenStack StarlingX
Open Edge Infra - Container	K8S
Open Edge MANO	Tacker ONAP
Open Edge VIM	Airship
White box HW	OCP/RSD
Open VNF	Open vEPC, ngic, c3po

CORD v.s. Akraino



ETSI's MEC RA v.s China Unicom Design (Based on Akraino)



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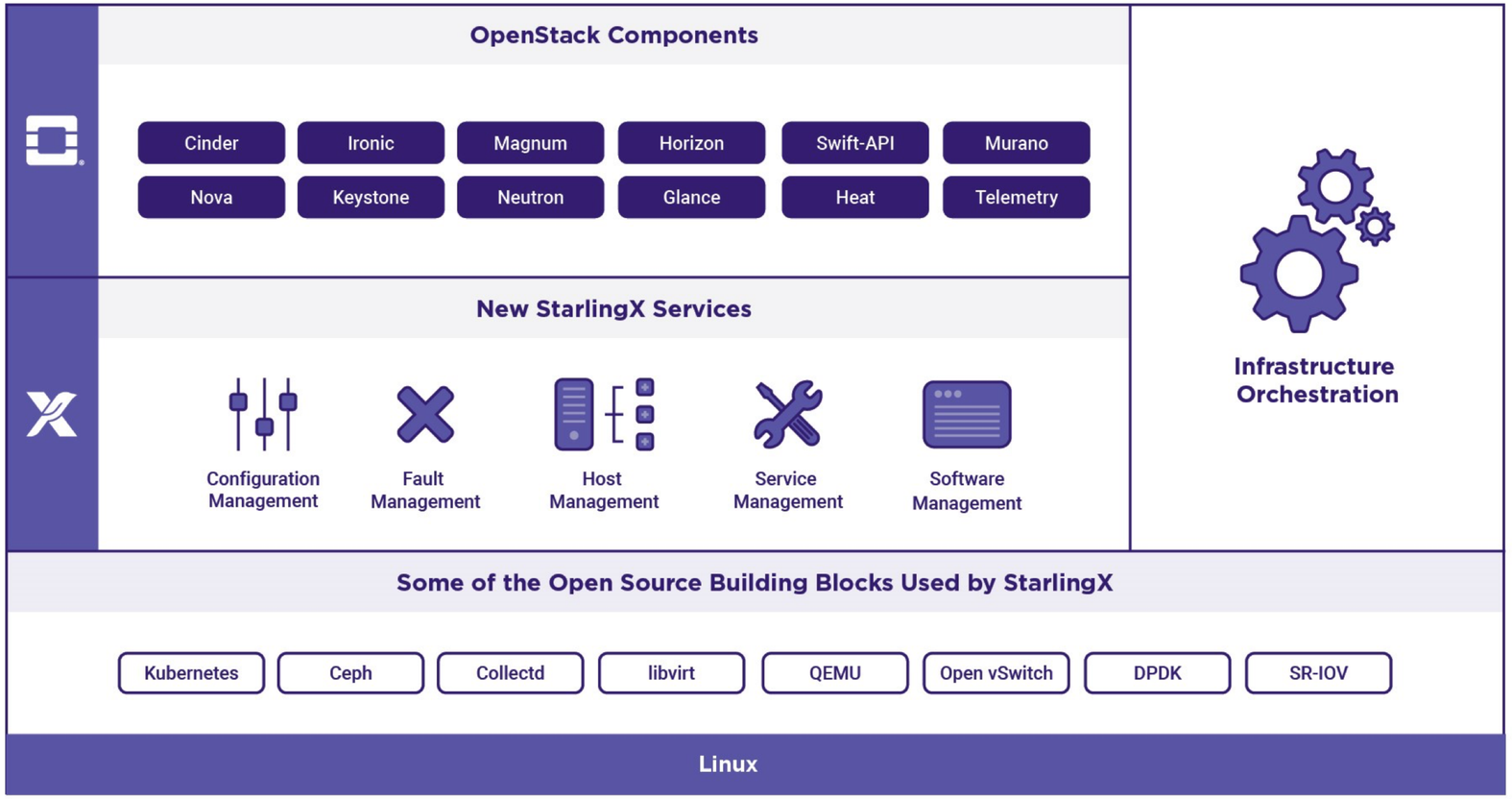
Intent of the StarlingX Project and its Services

Re-Configure Proven Cloud Technologies for Edge Compute

- Orchestrate system-wide for telco and other vertical markets
  - Deploy and manage Edge clouds, share configurations
- Simplify deployment to geographically dispersed, remote Edge regions



Transportation	Energy
Manufacturing	Retail
Video	Smart cities
Healthcare	Drones

*Other names and brands may be claimed as the property of others

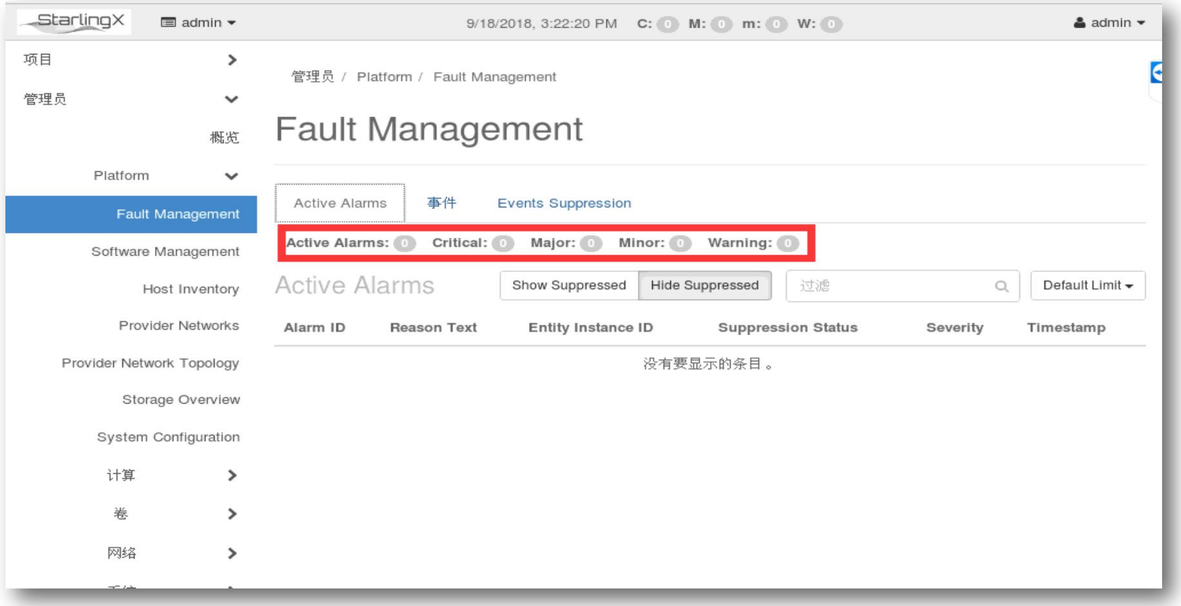
StarlingX Deep Dive （Mapping to ETSI Interface Requirement） – Fault Management & Event Suppression

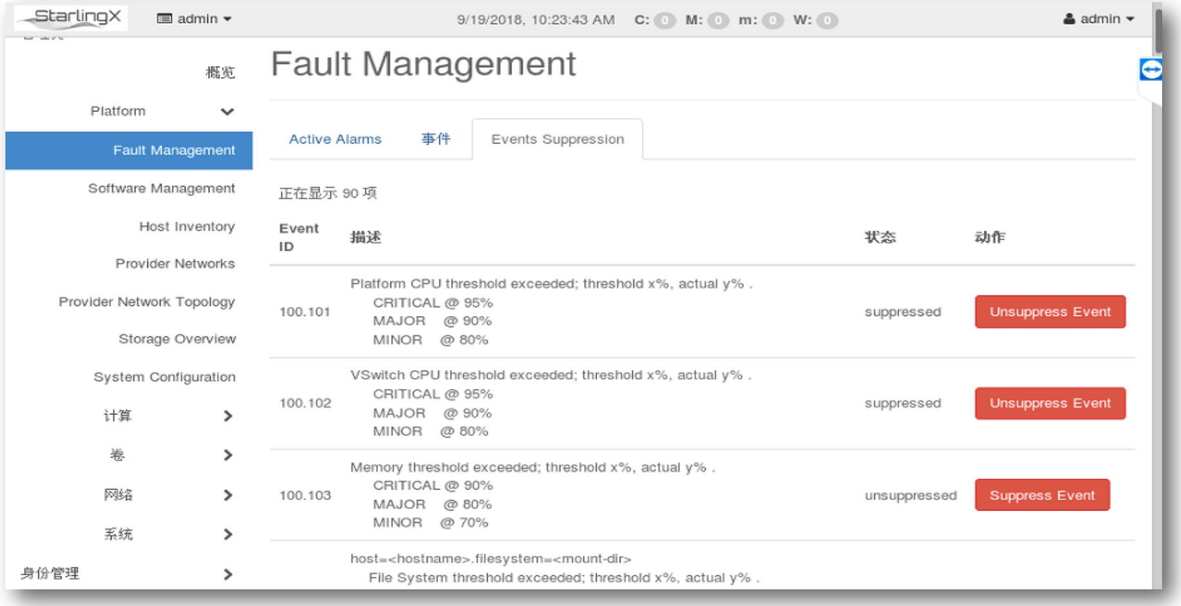
As ETSI GS MEC 010-1 V1.1.1 (2017-10) (*Mobile Edge Computing (MEC); Mobile Edge Management; Part 1: System, host and platform management*) defined:

7.3.1 Fault Management interface

For Alarm Management, the following 3GPP defined IRPs are used:

- ETSI TS 132 111-2 [4]: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Telecommunication management; Fault Management; Part 2: Alarm Integration Reference Point (IRP): Information Service (IS) (3GPP TS 32.111-2)".
- ETSI TS 132 332 [5]: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Telecommunication management; Notification Log (NL) Integration Reference Point (IRP); Information Service (IS) (3GPP TS 32.332)".





STARLINGX

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StarlingX Deep Dive （Mapping to ETSI Interface Requirement） – System Configuration

As ETSI GS MEC 010-1 V1.1.1 (2017-10) (*Mobile Edge Computing (MEC); Mobile Edge Management; Part 1: System, host and platform management*) defined:

5.1.1 Requirements for reference point Mm2

5.1.1.1 Requirements related to the mobile edge host

5.1.1.1.1 Configuration Management requirements

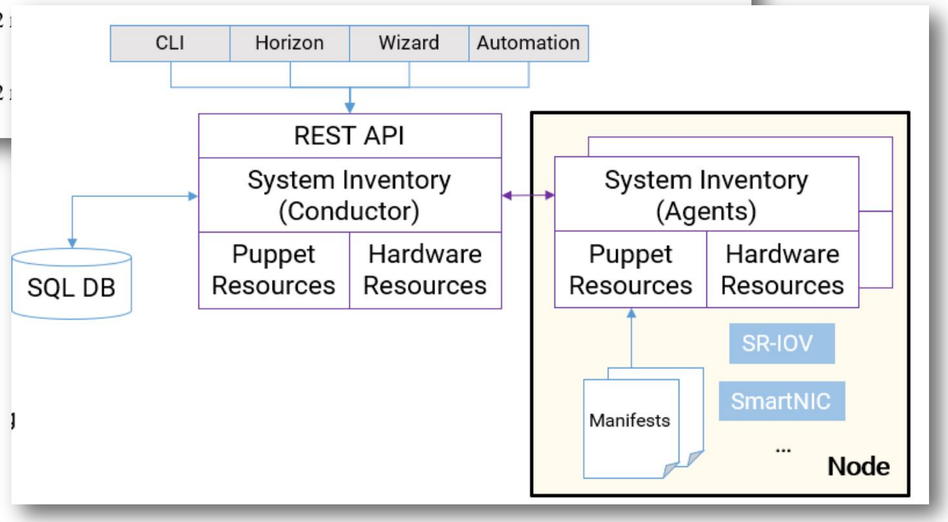
REQ-MM2-MEH-CM-1: The Mm2 reference point shall support a capability allowing the OSS to retrieve the information model of the mobile edge host, or parts thereof, from the mobile edge platform manager.

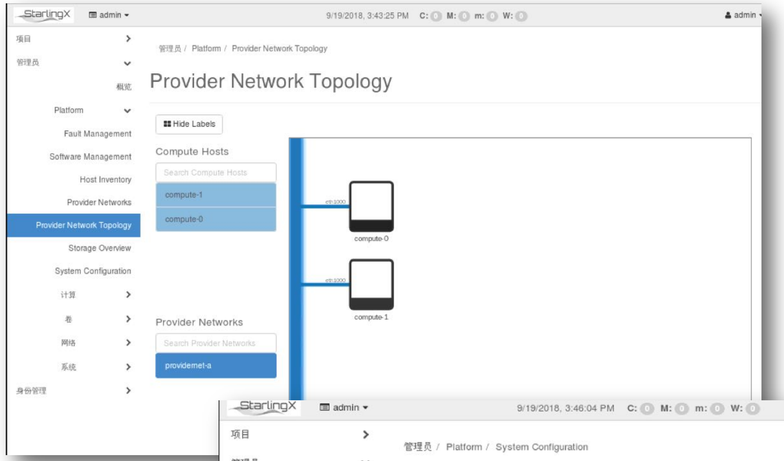
REQ-MM2-MEH-CM-2: The Mm2 reference point shall support a capability allowing the mobile edge platform manager to notify changes related to the information model of the mobile edge host to the OSS.

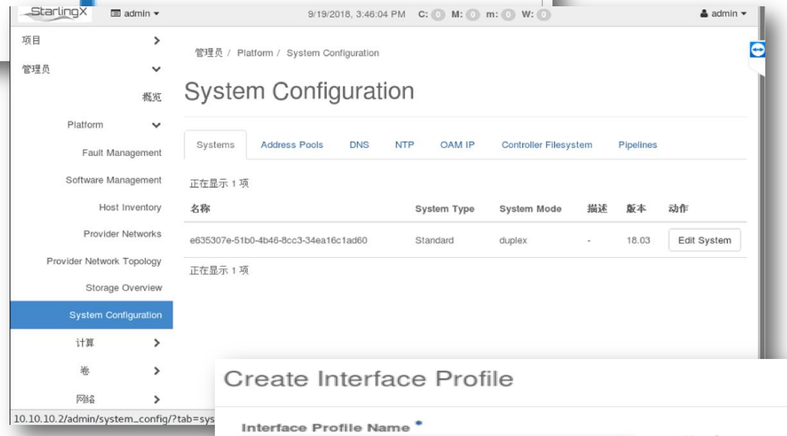
REQ-MM2-MEH-CM-3: The Mm2 reference point shall support a capability allowing the OSS to configure the mobile edge host.

REQ-MM2-MEH-CM-4: The Mm2 rules.

REQ-MM2-MEH-CM-5: The Mm2 rules.







STARLINGX

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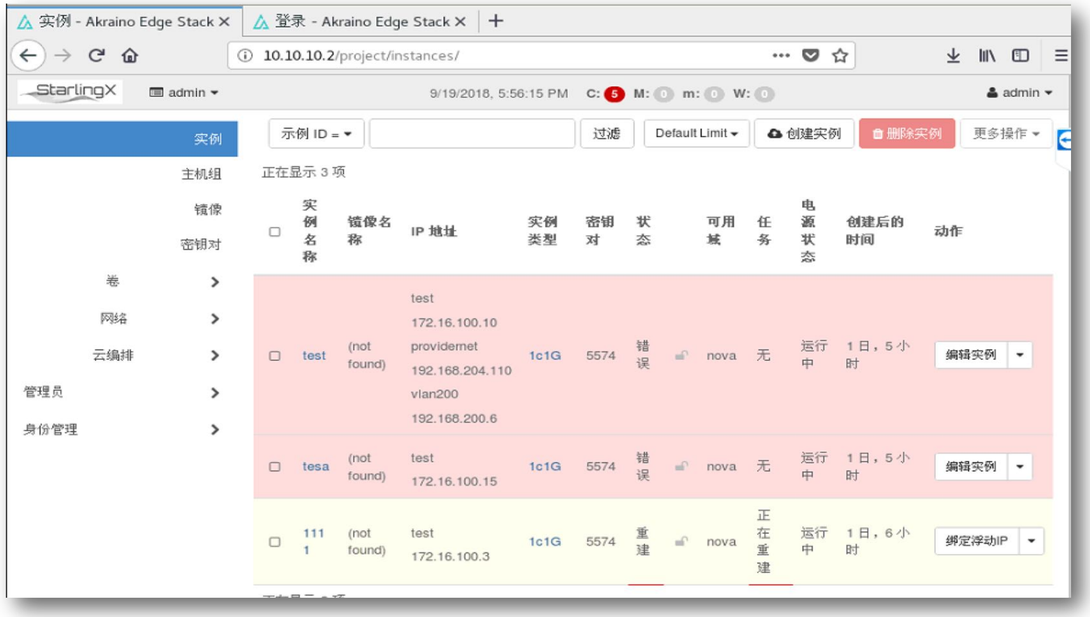
StarlingX Deep Dive （Not ETSI Required but critical to Edge）
- VM HA Acceleration




```
controller-0:~$  ping 172.16.140.152   | awk '{ print $0"\t" strftime("%H:%M:%S",systime()) } '
PING 172.16.140.152 (172.16.140.152) 56(84) bytes of data.      10:52:20
64 bytes from 172.16.140.152: icmp_seq=1 ttl=63 time=0.468 ms   10:52:20
64 bytes from 172.16.140.152: icmp_seq=2 ttl=63 time=0.265 ms   10:52:21
64 bytes from 172.16.140.152: icmp_seq=3 ttl=63 time=0.234 ms   10:52:22
64 bytes from 172.16.140.152: icmp_seq=4 ttl=63 time=0.218 ms   10:52:23
64 bytes from 172.16.140.152: icmp_seq=5 ttl=63 time=0.230 ms   10:52:24
64 bytes from 172.16.140.152: icmp_seq=6 ttl=63 time=0.206 ms   10:52:25
64 bytes from 172.16.140.152: icmp_seq=7 ttl=63 time=0.226 ms   10:52:26
64 bytes from 172.16.140.152: icmp_seq=8 ttl=63 time=0.232 ms   10:52:27
64 bytes from 172.16.140.152: icmp_seq=9 ttl=63 time=0.230 ms   10:52:28
64 bytes from 172.16.140.152: icmp_seq=10 ttl=63 time=0.244 ms  10:52:29
64 bytes from 172.16.140.152: icmp_seq=11 ttl=63 time=0.235 ms  10:52:30
64 bytes from 172.16.140.152: icmp_seq=12 ttl=63 time=0.252 ms  10:52:31
64 bytes from 172.16.140.152: icmp_seq=13 ttl=63 time=0.245 ms  10:52:32
64 bytes from 172.16.140.152: icmp_seq=14 ttl=63 time=0.217 ms  10:52:33
64 bytes from 172.16.140.152: icmp_seq=15 ttl=63 time=0.237 ms  10:52:34
64 bytes from 172.16.140.152: icmp_seq=16 ttl=63 time=0.253 ms  10:52:35
From 172.16.130.1 icmp_seq=46 Destination Host Unreachable      10:53:08
From 172.16.130.1 icmp_seq=47 Destination Host Unreachable      10:53:08
From 172.16.130.1 icmp_seq=48 Destination Host Unreachable      10:53:08
64 bytes from 172.16.140.152: icmp_seq=49 ttl=63 time=998 ms    10:53:09
64 bytes from 172.16.140.152: icmp_seq=50 ttl=63 time=0.191 ms  10:53:09
64 bytes from 172.16.140.152: icmp_seq=51 ttl=63 time=0.244 ms  10:53:10
```

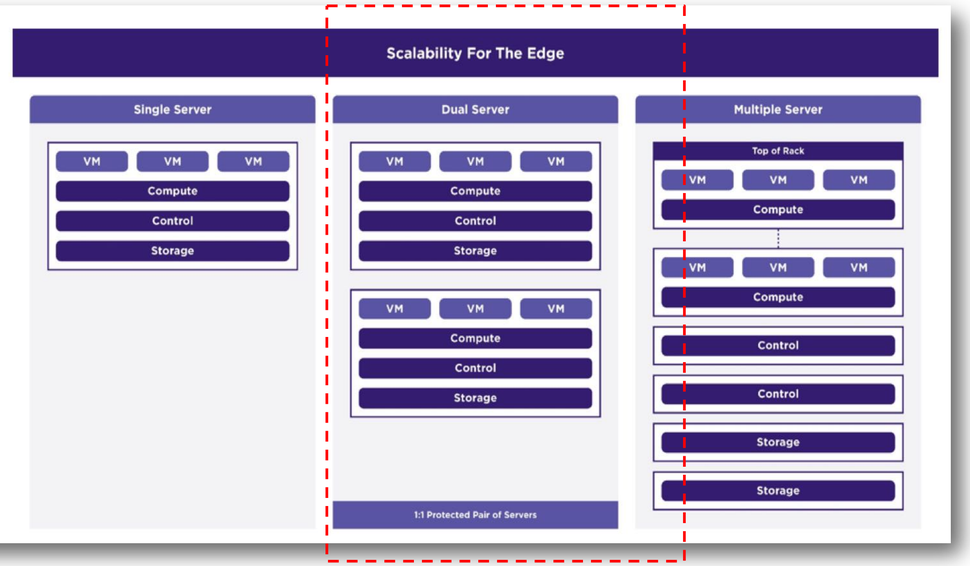
VM Restored in 34s (CentOS, 800M)

OS	Size	Restore Time
CentOS	800M	~30s
Cirros	12M	~20s

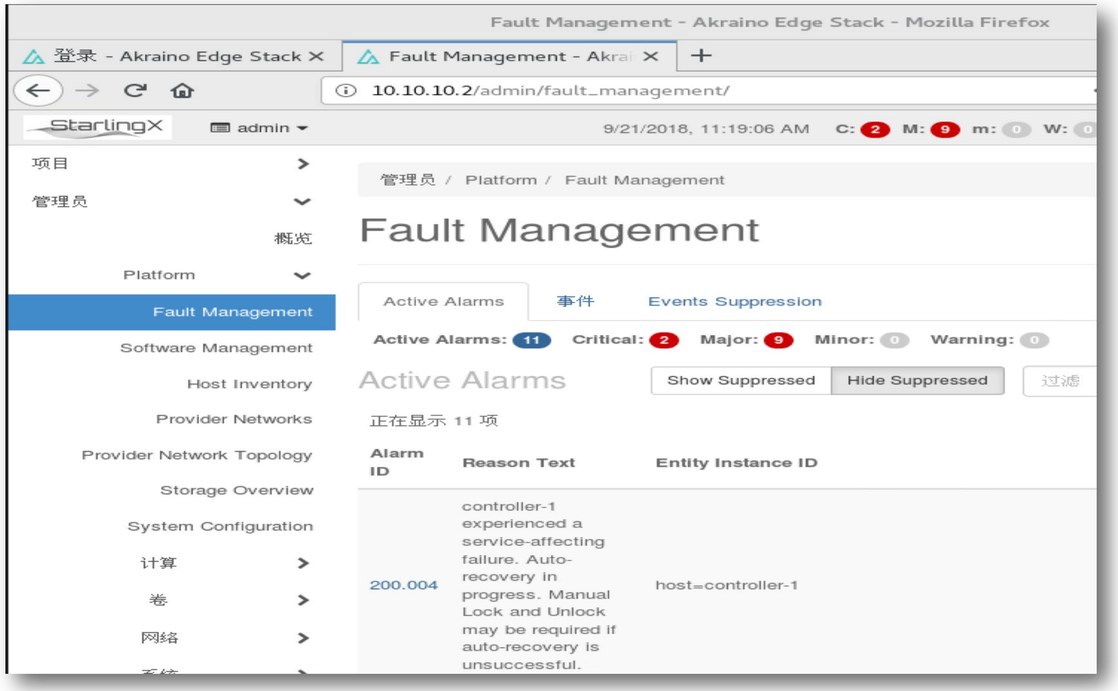
C/C++ codes in HA source code

StarlingX Deep Dive （Not ETSI Required but critical to Edge）
- Controller HA Optimization

- Single Server
  - Runs all functions
- Dual Server
  - Redundant design
- Multiple Server
  - Fully resilient and geographically distributable



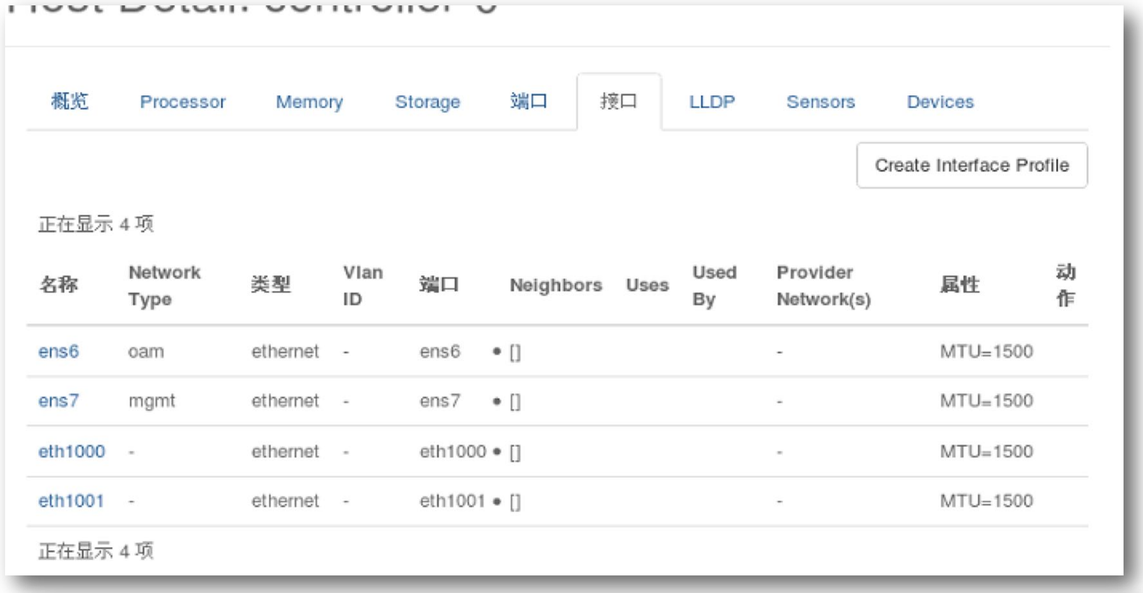
Test case	Platform Status	Restore Time
Stop 1 controller nova-compute	√ Running but w/ warining	1s
Disable 1 controller nova-compute	√ Running but w/ warining	15s
Shutdown1 controller Host	√ Running but w/ warining	Need manually start Neutron service

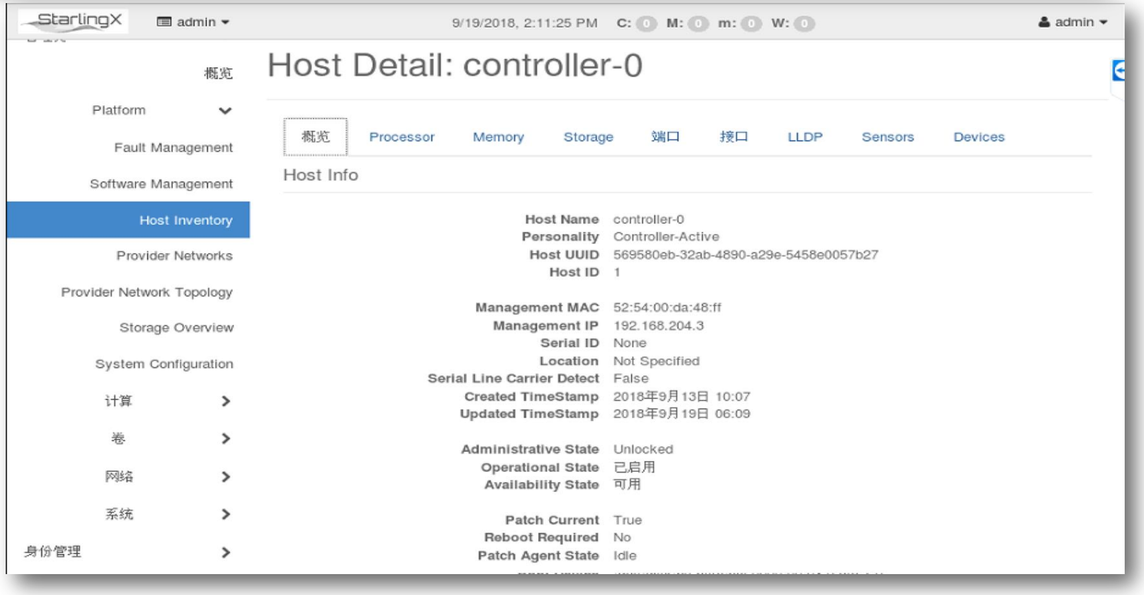


StstarlingX Deep Dive （Not ETSI Required but critical to Edge） - Inventory Management

Nodal Configuration

- Network Interfaces (DPDK)
- Inventory Discovery
- Physical NICs (# and bandwidth)
- H/W acceleration devices for edge networking (SR-IOV, SmartNIC etc.)





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Conclusion

- Among those three open projects, CORD & Akraino are more manture than vCO. CORD & Akraino are with real codes but vCO is only in PoC stage
- Between CORD and Akraino, CORD is with more scope in VNF opensource and white box hardware integration for central office re-arhiteture. Akraino is more focus on software level and with more ready-to-use edge infra and deployment approach
- According to China Unicom's roadmap, we will keep eyes on those three projects and start some pilot based on Akraino.
- Mapping to ETSI standard, even it is not a mandatory standard , based on the future China Unicom edge framework , we need put efforts to optimize in MEAO/MEPM modules and integration with VNF/PNF to get it ready for edge business
- StarlingX, the complete Edge stack, is **available now** to try out as a scalable solution with configuration, fault, service, software and host management to ensure high availability of user applications.

Q&A

Thank you!

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