



Edge Work Update – 10/23/2018

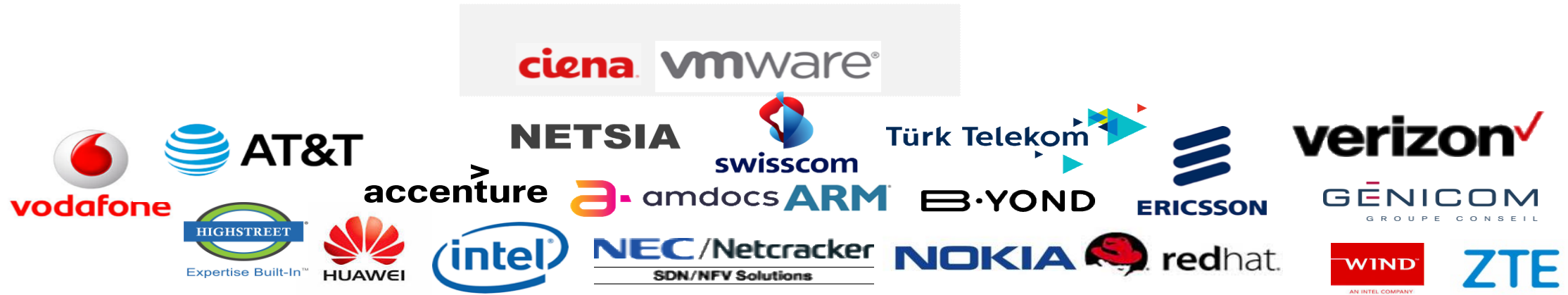
ONAP Edge WG

Wiki: <https://wiki.onap.org/display/DW/Edge+Automation+through+ONAP>

Meeting Date/Time: Wednesday, 4:00pm UTC - 5:00pm UTC

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ONAP Edge WG Participation



Agenda

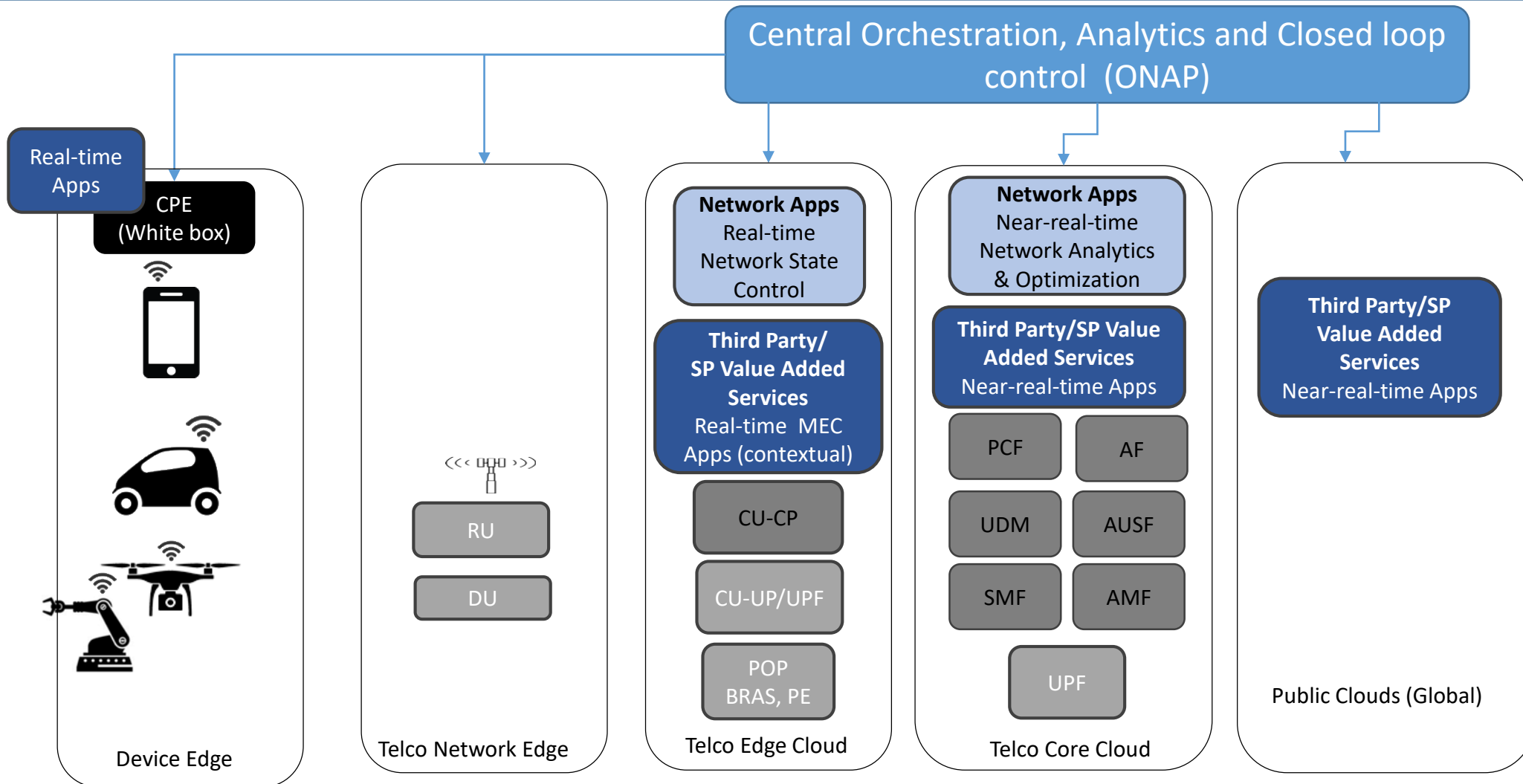
- Edge Network & Application Landscape – Exemplary Scenario
- Why Edge?
- Edge Infrastructure Profile Summary
- Edge Requirements Summary

- Akraino/Other Open Source Efforts & ONAP Positioning (Mapping Requirements)

- Suggested Dublin focus Areas - * Under Discussion *

- Architecture - API from Central ONAP to Edge - * Under Discussion *

Edge Network & Application Landscape – Exemplary Scenario



Note: Slide 13 provides additional details on various Network/Application Profile

Legend:

Network Function Data Plane

Network Function Control Plane

Network Apps

Third Party/SP Value Added Services

Adapted from Ref: https://wiki.onap.org/download/attachments/28379482/Edge_ONAP_WG_v7.pptx?api=v2

Why Edge?

Massive Data from/to large number of Devices/Apps/Networks – Data Reduction to Clouds

(Upstream : Drones, Autonomous vehicles, Factories, Networks, Network Functions
Downstream : 4K Streaming, AR/VR, Sports Casting, Live Gaming)

Real time App 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)

Real time Network Performance

(Closed loop control for networks and data plane network functions, On-demand compute for data plane network functions)

Adapted from Ref: https://wiki.onap.org/download/attachments/28379482/Edge_ONAP_WG_v7.pptx?api=v2

Edge Infrastructure Profile Summary

- **Distributed with Logically centralized control plane**
 - 1000's of edge locations of varying capacity
- **Performance-awareness**
 - GPU, FPGAs, SR-IOV etc.
- **Resource Isolation through fine-grained QoS**
 - Support both Latency-sensitive and General purpose applications
- **Security**
 - Workloads are often deployed in external (non-dc-type) locations and need HW security (TPM etc.)
 - 3rd party applications which need additional HW security (VM, Containers in VM etc.) and SW security (Inter-component TLS etc.)
- **Capacity constraints**
 - Very small footprint (few nodes per physical location), Medium footprint (10's of nodes per physical location), Large footprint (100's of nodes per physical location)
- **Configuration Diversity**
 - 5G Factory Automation, 5G General Mobility Services etc. – User Plane components (DU, CU-UP, UPF etc.)

Edge Requirements Summary

Scalability

(Ability to address large number of Distributed Edge Clouds with varying capacity and very large number no. of end points w/ config diversity)

Security & Regulations

(Infrastructure verifications, Securing secrets/keys, Keep Data local, GDPR)

Constrained Environment

(Platform-awareness, Data reduction across WAN, Lesser utilization of resources)

Performance/Isolation-aware Workload Placement & Mobility

(Workload placement & mobility across deployment/operation w/ closed loop control and several constraints – latency, isolation, HW profiles etc.)

Service Assurance (SA)

(Fault detection, root cause discovery, faster closed loop control, keep metering data local)

Zero touch provisioning (ZTP)

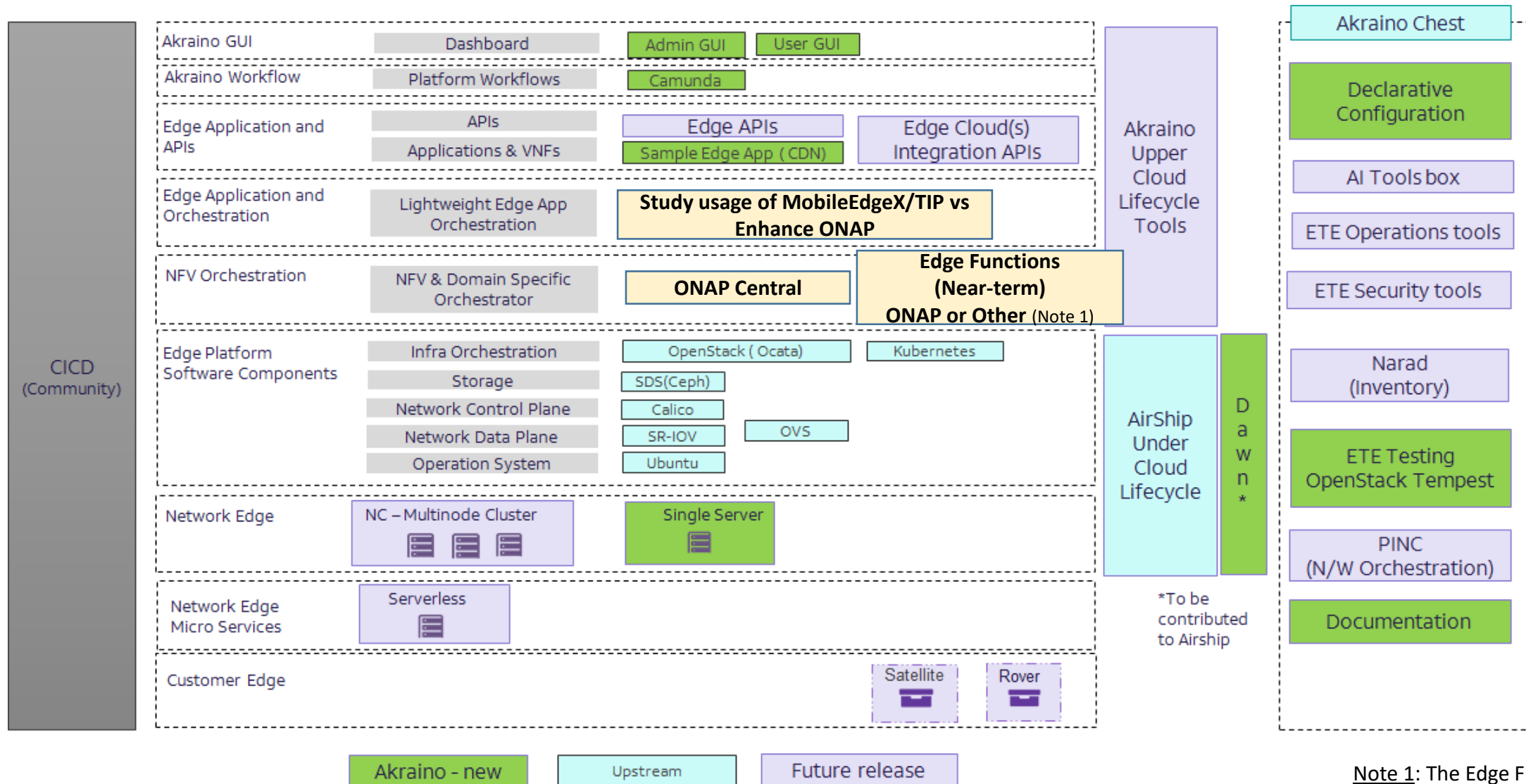
(Faster bring up of Edge Clouds, Easy upgrades)

Edge App provisioning

(Traffic Redirection, Providing contextual information, slice aware)

Adapted from Ref: https://wiki.onap.org/download/attachments/28379482/Edge_ONAP_WG_v7.pptx?api=v2

Akraino etc. & ONAP Positioning

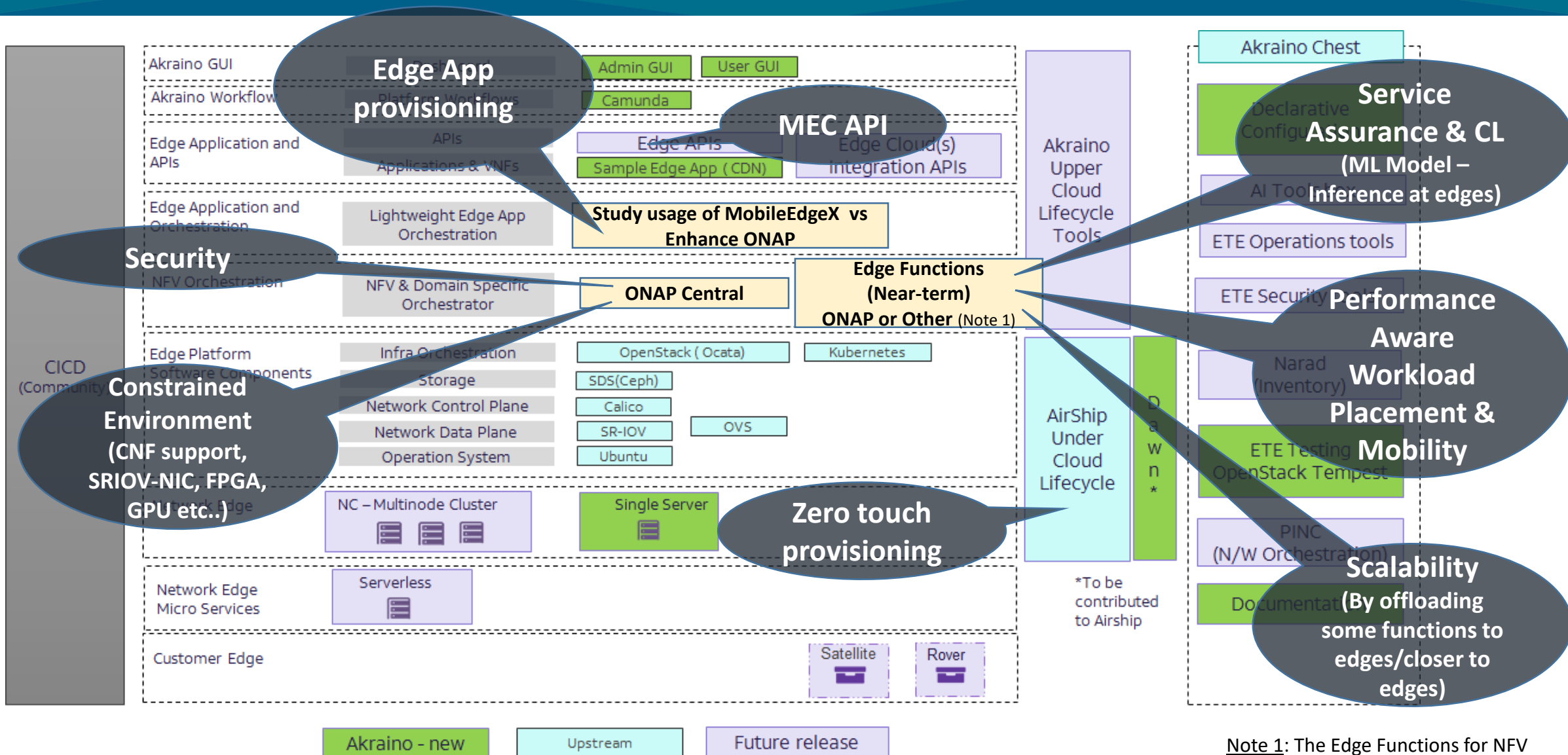


Adapted from Akraino Blueprint:

Link: https://wiki.akraino.org/display/AK/Akraino+Network+Cloud+Blueprint+-+Reference+Architecture?preview=/1147251/1147516/image2018-8-9_16-32-22.png

Note 1: The Edge Functions for NFV Orchestration could be provided by ONAP or other cloud solutions

Akraino etc. & ONAP Positioning (Mapping Requirements)



Adapted from Akraino Blueprint:

Link: https://wiki.akraino.org/display/AK/Akraino+Network+Cloud+Blueprint+-+Reference+Architecture?preview=/1147251/1147516/image2018-8-9_16-32-22.png

Note 1: The Edge Functions for NFV Orchestration could be provided by ONAP or other edge cloud solutions

Suggested Dublin focus Areas * Under Discussion *

Network Analytics closer to edges (Scalability, Constrained Environment, Service Assurance Reqs.)

- Bring up of Apache Spark + HDFS + Kafka framework from ONAP in multiple edge clouds.
- Bring Network analytics applications from ONAP-Central on various analytics instances.
- Machine learning model creation; Inferencing package at the edges

API from Central ONAP to Edge (Note 1)

Workload Placement & Mobility closer to Edges (Scalability, Performance/Isolation-aware Workload Placement/Mobility, Service Assurance Reqs.) [Ref. 1]

- Bring up several ONAP components (OOF etc.) edge clouds.

API from Central ONAP to Edge (Note 1)

Study of Edge Application Orchestration and various open source projects.

Leverage MEC APIs from ONAP workloads for Edge MEC Applications.

Note 1: API from Central ONAP to Edge provides the flexibility of using Edge Cloud Provider Solutions as an alternative to ONAP components in Edge

Ref. 1: <http://networks.cs.ucdavis.edu/presentation2017/WeiWang-02-10-2017.pdf>; http://www.ict-coherent.eu/coherent/wp-content/uploads/2016/08/Katsalis_MEC_CLOUD_2016.pdf; Important work item in <https://5g-ppp.eu/>

- ONAP MC provides generic abstraction layer for Edge Cloud Functions
- Edge Cloud Function (e.g. Closed Loop Service Assurance) Registration
 - The Edge Cloud function is discovered through ONAP Multi-VIM/Cloud (MC) and the capability/capacity details are registered in A&AI w/ appropriate cloud region(s) association
- Communication between ONAP Central and Edge Cloud
 - Different services providers for ONAP Central & Edge
 - Setup a private VPN using ONAP EXT API
 - Single service provider for ONAP Central & Edge
 - Private connectivity to Edge Cloud may already be available; If not, setup a private VPN using ONAP EXT API



ONAP

OPEN NETWORK AUTOMATION PLATFORM

Additional Material

Edge Network & Application Profile Details

Application Classification (RTT-based)	Network/Application Examples	Network / Service Behavior Type	Deployment Component	SP Edge Cloud	Third Party Edge Cloud	Edge Deployment Constraint (RTT-based)	Application Provider
1 Real-time (20–100ms)	Network Function Data Plane – e.g. 5G CU-UP, UPF	Network Data Processing	Cloud Edge	Yes	No	Hard	NF Vendor, Service Provider
2 Near-real-time (500ms and above)	Network Function Control Plane – e.g. 5G CU-CP	Network State Processing	Cloud Edge or Cloud Central	Yes	No	Soft	NF Vendor, Service Provider
3 Real-time (20-100ms)	In service path optimization applications which run in open CU-CP platform (also known as RAN Intelligent Controller, or SD-RAN controller).	Real-Time Network State Control	Open 5G CU-CP – VNFC	Yes	No	Hard	NF Vendor, Service Provider, 3rd Party
4 Near-real-time (500ms and above)	Slice monitoring, performance analysis, fault analysis, root cause analysis, SON applications, Optimization (SON Drive Test Minimization etc.), ML methodologies for various apps.	Network Analytics & Optimization	ONAP DCAE could be leveraged	Yes	No	Soft	NF Vendor, Service Provider
5 Near-real-time (500ms and above)	IoT Video Analytics/Optimization, Customer Geolocation information, Anonymized customer data etc.	Workload Analytics, Optimization & Context processing	Cloud Edge or Cloud Central	Potential	Typical	Soft	Typically 3rd Party, Emerging Service Provider
6 Real-time (10-20ms)	Third party applications that directly interacts with the UEs, like AR/VR, factory automation, drone control, etc.	Workload Automation/AR-VR/Content, etc.	UE or Cloud Edge	Potential	Typical	Hard	Typically 3rd Party, Emerging Service Provider

Deep Dive – SA + Workload Placement/Mobility

- Edge Application Placement/Mobility/Service Assurance Policy
 - “App to be bounded by a maximum RTT latency from a group of users w/ 99.99% availability”
 - This policy should be continuously met during operation besides initial placement
 - Note: Group of users map to specific physical DC in Cloud Edge
 - App Examples (from Network & Application Profile table) – 5G CU-UP, Drone Control, IoT Video Analytics
 - Initial focus on Network Functions

Deep Dive – SA + Workload Placement/Mobility for NFs

Edge Cloud Topology (single SP)	Key Edge Functions w/ ONAP Project Mapping
Single Edge site w/ Single Cloud Control Plane	Cloud Inventory (A&AI), Multi-Cloud Support (MC), Closed Loop Controller (APP-C), Closed Loop Policy (Policy), Closed Loop Analytics - infrastructure/application logs/events/metrics/faults processing (DCAE, MC, Logging), IPAM (part of SDN-C) (Note: Service Orchestration is deliberately omitted to avoid HA state Complexity)
Multiple Distributed Edge Sites (metro distance) w/ single Cloud control plane	Above + Initial Placement/Continuous Optimization (OOF) (Note: Service Orchestration is deliberately omitted to avoid HA state Complexity)
Multiple Distributed Edge Sites (metro distance) w/ multiple Cloud control planes	Above + All deployment and operation components including Service Orchestration (SO)