



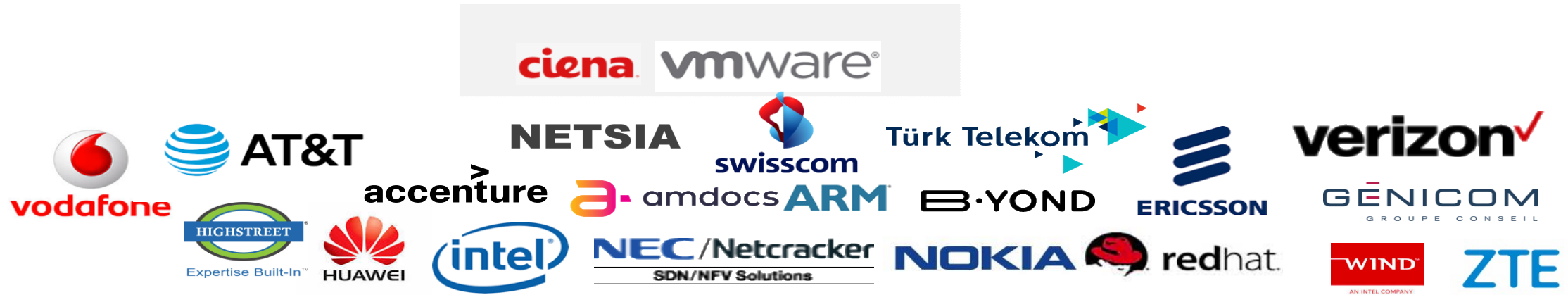
ONAP Discussion w/ OSM - ONAP Edge WG Focus

Date: 10-31-2018
Venue: OSM Meeting, Palo Alto
Presenter: Ramki Krishnan

ONAP Edge WG

Wiki: <https://wiki.onap.org/display/DW/Edge+Automation+through+ONAP>
Meeting Date/Time: Wednesday, 4:00pm UTC - 5:00pm UTC
Leads: Ramki Krishnan (ramkik@vmware.com) , Raghu Ranganathan (rraghu@Ciena.com)

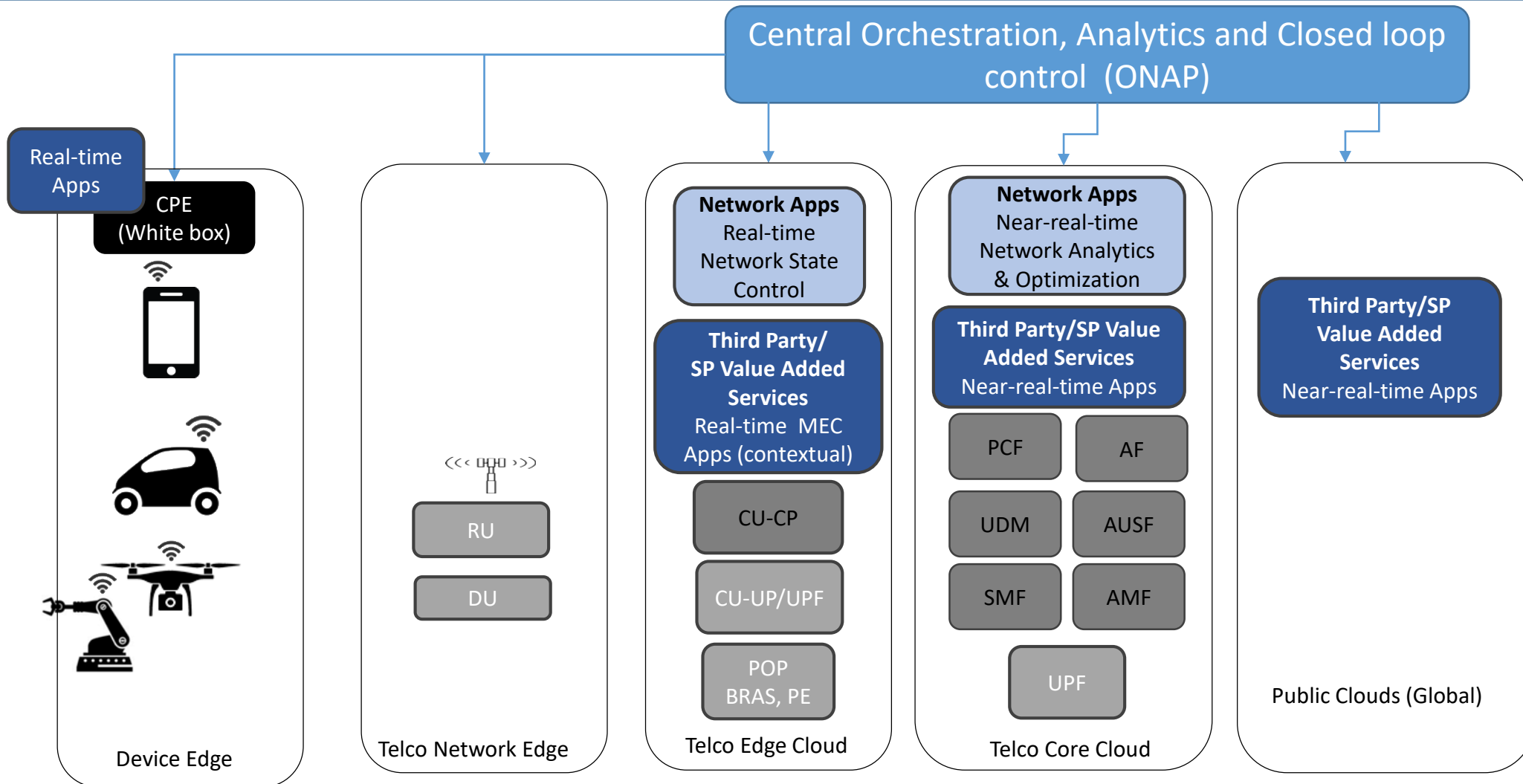
ONAP Edge WG Participation



Agenda

- Edge Network & Application Landscape – Exemplary Scenario
- Why Edge?
- Edge Architectural Approach
- ONAP/OSM/Other Edge Architectural Interactions
- Edge Architecture Impact Summary
- ONAP Edge Focus Areas w/ Release Alignment

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

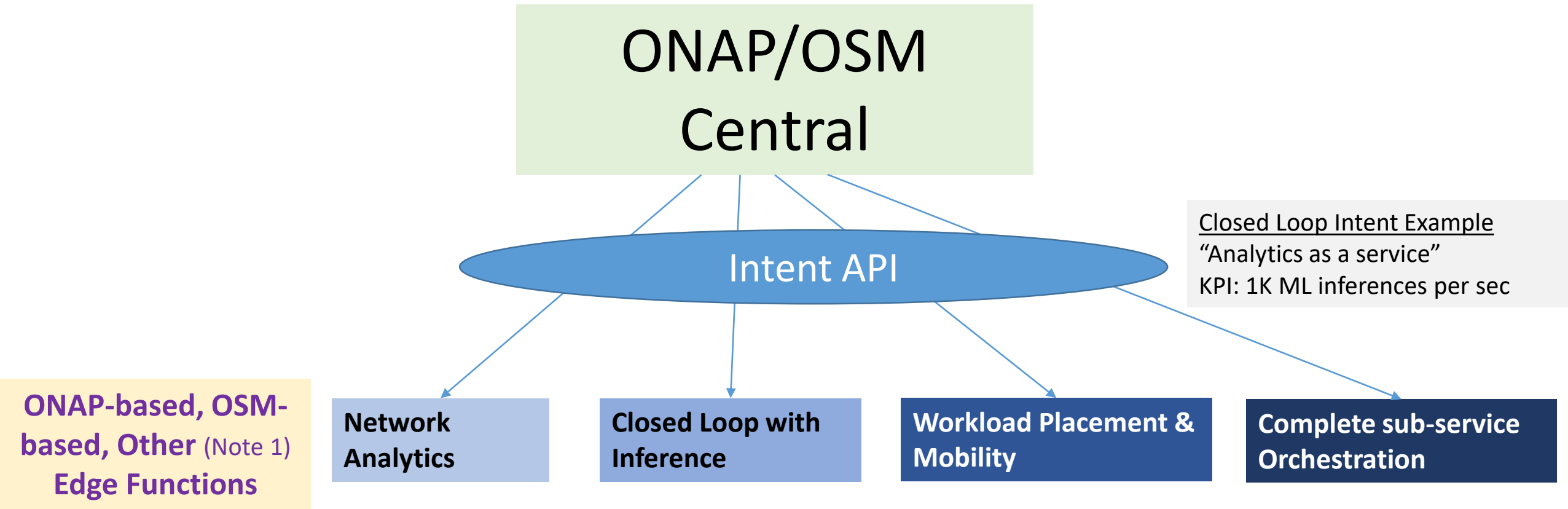
(Closed loop control for networks and data plane network functions, On-demand compute for data plane network functions)

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

Edge Architectural Approach

- “Edge Functions” to addresses differing network services and infrastructure profiles
 - Avoid one size fits all approach
 - Simplify operations by avoiding unnecessary state in the edge
- Some key edge functions (not an exhaustive list)
 - **Network Analytics**
 - Data Reduction to central Clouds
 - **Closed Loop with Inference (ML etc.)**
 - Real-time Network (also App) Fault Management
 - **Workload Placement & Mobility**
 - Real-time Network (also App) Performance
 - **Complete sub-service Orchestration**
 - Massive Scalability

ONAP/OSM/Other Architectural Interactions



Note 1: Other Edge Functions could be Cloud (OpenStack, K8S, etc.), 3rd party or Edge open source (MobileEdgeX etc.) implementations

Edge Architecture Impact Summary

- Edge Cloud Registration [Ref. Arch. Impact Details (1) – slide 14]
 - Automation of registration when scale (>100s)
- ONAP/OSM edge functions or 3rd party edge functions deployed at edge (e.g. Analytics, Closed Loop Control) [Ref. Arch. Impact Details (2) – slide 15]
 - Registration of the edge functions to ONAP/OSM central (**Intent**, capabilities, capacity) through Multi-VIM/Cloud
 - Closed Loop Control exemplary intent with KPI - “X percentile closed loop recovery time is Yms” where X could be 99.99 and Y could be 20. This example means your closed loop recovery time is less than 20ms 99.99% of the time under a defined observation interval.
- Deploy Network Services in an optimal way to the edges using edge/central functions [Ref. Arch. Impact Details (3) – slide 16]
 - Includes multiple VNFs on multiple edges/core which make a service
 - Cloud region (means one control plane) choice
 - Connect the service to the functions
- Networking of ONAP/OSM Central and edge functions [Ref. Arch. Impact Details (5) – slide 18]



ONAP Edge Focus Areas w/ Release Alignment

ONAP Dublin (Target May 2019) 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

Intent API from Central ONAP to Edge

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.

Intent API from Central ONAP to Edge

Study of Edge Application Orchestration and various open source projects.

Study Leveraging MEC APIs from ONAP workloads for Edge MEC Applications.

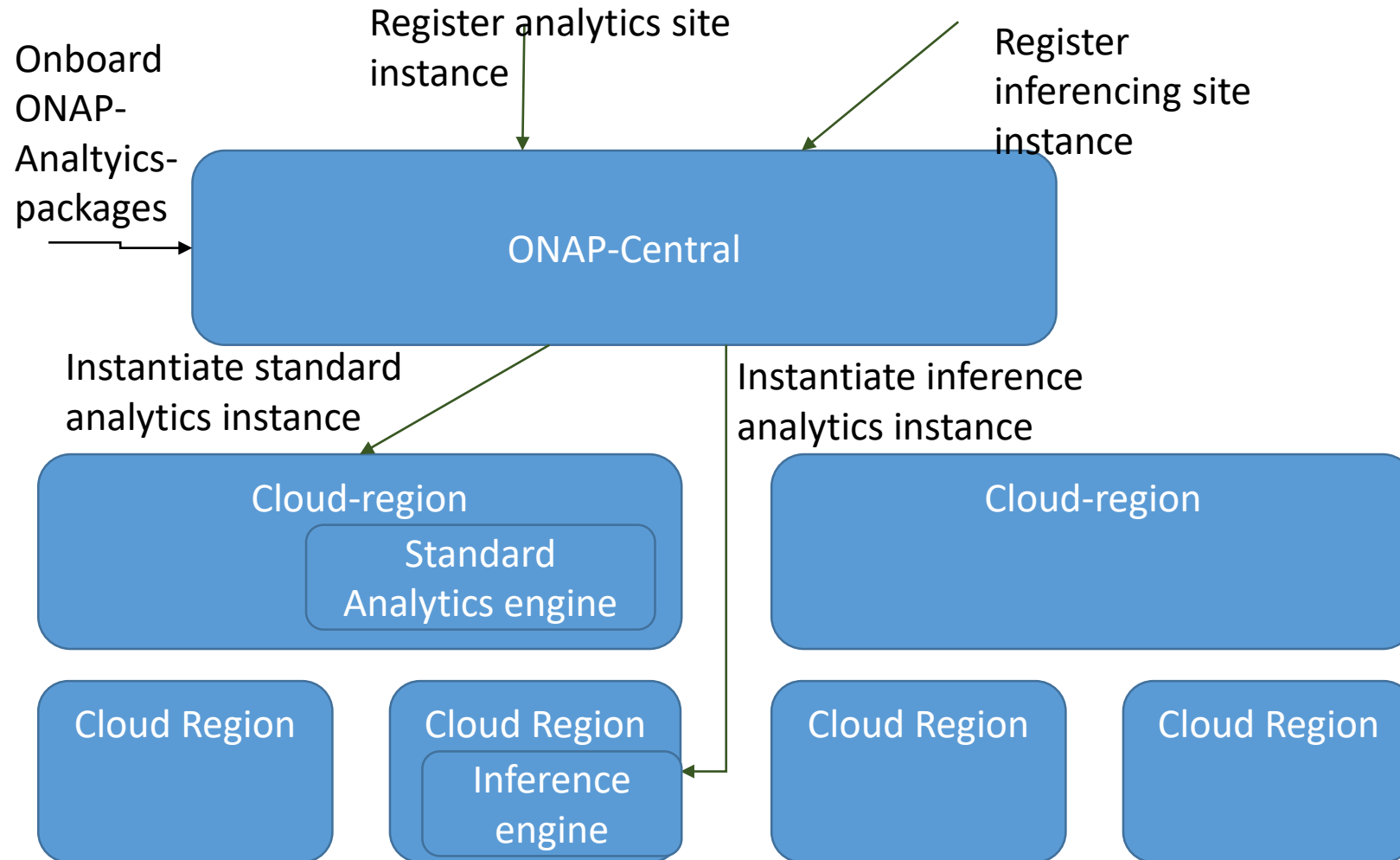
Ref. 1: <http://networks.cs.ucdavis.edu/presentation2017/WeiWang-02-10-2017.pdf>; http://www.ict-coherent.eu/coherent/wp-content/uploads/2016/08/Katsalis_MEC_CLOUD_2016.pdf; Important work item in <https://5g-ppp.eu/>

ONAP Beyond Dublin Additional focus Areas * Under Discussion *

Closed Loop (ML Model – Inference at edges) (Scalability, Service Assurance Reqs.)
Intent API from Central ONAP to Edge

Complete sub-service Orchestration in Edge (Massive Scalability Reqs.)
Intent API from Central ONAP to Edge

Analytics as a Service (An example)



- Using PNDA & Open source, create packages & helm charts
- Two packages
 - Standard package consisting of Apache Spark, HDFS, OpenTSDB, Kafka And ML packages including MLLib, spark-scikit-learn, spark-tensorflow
 - Inference package consisting of Kafka, Apache Spark
- Notes: Not shown, but standard package can be instantiated in ONAP-central and edges too



Additional Detailed Material

Architectural Impact Details (1)

- Preparatory Steps – Edge Cloud Region Registration in ONAP Central
- Edge Cloud Region Registration
 - Leverage current
 - Multi-cloud, ESR, A&AI registration mechanism
 - Gaps w.r.t to Edge
 - Handling dynamic capacity addition to edge cloud region
 - Add edge cloud region dynamically when ONAP is in operation
 - ONAP Project Impact: TBD

Architectural Impact Details (2)

- Preparatory Steps – Edge Function handling in ONAP Central
- Edge Function Examples
 - ONAP-based or 3rd Party Microservice(s) for e.g. analytics, closed loop service assurance, workload placement/mobility etc.
 - ONAP Multi-VIM/Cloud (MC) to provide generic abstraction layer for all Edge Functions
- Edge Function Packaging/Deployment Example
 - ONAP-based Cloud Native Analytics Microservice
 - On-boarding/Designing
 - Leverage current DCAE work?
 - SDC to select new model (e.g. ML)
 - Distribute new model (e.g. ML) to Analytics App in DCAE
 - Deployment Readiness
 - Leverage current DCAE work?
 - Supply model parameters through environment file
 - Create K8S Helm chart
 - Deploy ONAP-based/3rd Party Cloud Native Analytics Microservice in Edge Cloud w/ K8S support
 - Leverage current K8S cloud region work?
- Edge Function (e.g. ONAP-based/3rd Party Cloud Native Analytics Microservice) Registration
 - Gaps w.r.t to Edge
 - The Edge 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
 - ONAP Project Impact: TBD

Architectural Impact Details (3)

- Network Service Deployment - ONAP Central
- Deploy Network Service (e.g. vcpe) on edge cloud region which supports Edge Function (e.g. ONAP-based Cloud Native Analytics Microservice)
 - Predominantly Leverage current deployment method (SO, OOF, MC, Policy etc.)
 - Gaps w.r.t to Edge
 - Cloud Region Selection
 - Edge Function being there is also used in the cloud region selection process by OOF. The following properties of Edge Function are used for this purpose
 - capability/capacity details in A&AI
 - cloud region association in A&AI
 - network service type association in A&AI
 - intent in A&AI
 - Closed loop service assurance exemplary intent -- “X percentile closed loop recovery time is Yms” where X could be 99.99 and Y could be 20
 - The above example means your closed loop recovery time is less than 20ms 99.99% of the time under a defined observation interval
 - ONAP Project Impact: TBD
 - Network Service Association
 - Associate Network Service instance which is deployed in the edge cloud region to the selected Edge Function
- ONAP Project Impact: TBD

Architectural Impact Details (4)

- Network Service Operation - Edge
- Edge Function communicates with network service instance and the edge cloud region where the network service instance is deployed to gather various types of information (e.g. infra and app metrics)
- Gaps w.r.t to Edge
 - ONAP-based Edge Function
 - ONAP Project Impact: TBD
 - 3rd Party Edge Function
 - No ONAP impact

Architectural Impact Details (5)

- Network Service Operation – Edge to ONAP Central Communication
- Exemplary communication
 - “Network Analytics Service” - Aggregate infra metrics from Edge VIM and app metrics from Edge VNF
- Gaps w.r.t to Edge
 - ONAP-based Edge Function
 - Edge Function could directly communicate with ONAP Central (e.g. DCAE) or through MC
 - ONAP Project Impact: TBD
 - 3rd Party Edge Function
 - Edge Function communicates with ONAP Central only through MC
 - No ONAP impact

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