An exclusive exploration of ONAP's use cases

From Amsterdam to Dublin with focus on 5G

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Alla Goldner

Director, Technology, Strategy & Standardization, Amdocs ONAP's Use-Case Subcommittee Chair



ONAP releases calendar





Amsterdam

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Amsterdam use cases



Residential vCPE

- Reduce software management complexity
- Introduce new features faster without impacting GW architecture
- Simplify devices and connectivity troubleshooting

Leverage VNFs to deploy
 VoLTE services

 Policy driven configuration management using standard APIs

vVoLTE

• Efficient resources allocation, self healing



- Allow quick and easy demos without any infrastructure constrains
- vFW and vDNS VNFs lifecycle automation
- Closed loop service monitoring and operation

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vCPE use case — Amsterdam

ONAP is used to instantiate and operate the required vCPE in the access network as a cloud service



vCPE use case VNFs

All VNFs are open source, no physical components HEAT templates produced for all VNFs



Vector Packet Processing (VPP) + modifications



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Beijing

THEFT

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CIPERINAL LINE AND

Beijing use cases



Hardware Platform Awareness Enablement

- Enabling ONAP management and service orchestration to be aware of the underlying NFV-I hardware platform features
- Enabling acceleration and optimization of VNFs performance

Network Function Change Management

- Design, schedule and manage configuration changes
- Schedule and manage VNFs software upgrades
- Define and execute NF management workflows



- Provide the capability to scaleout VNF/NS on demand
- First step towards auto-scaling
- Dynamic per demand VNF resources allocation and scaling

Network Function Change Management

Change Management Scheduling & Conflict Avoidance

CM Schedule Optimiser

Create a schedule/plan for rolling out a change such that we minimize service disruption during the change within the specific completion time

Dependency modelling

- Conflict scoping
- Service Impact scoping
- Execution ordering



- 1. Send workflow, VNF list and time range to schedule optimizer
- 2. Request constraints for scheduling
- 3. Request data for optimal schedule
- 4. Identify CM schedule
- 5. Provide the schedule for approval
- 6. Once Approved, send the schedule to Change tracking/notification OSS
- 7. Push the approved change schedule for execution

Network Function Change Management

Change Execution

Orchestration Execution:

Execute the orchestration building blocks and use RESTAPIs to interface controller for software upgrade, or A&AI for updates to the CM flag

ONAP Portal:

- Track status of CM workflow execution success/failure status of each building block
- Intercept CM workflow execution pause/resume functions, and ability to inject new steps in the workflow

Pre/Post Analytics:

Performance analytics – pre/post performance comparisons, go/no-go decisions for network-wide deployment



- 1. Start execution based on schedule
- 2. Conflict check
- 2b. Check roll-out status
- 3. (Pre) health check
- 4. Update CM flag
- 5. VNF upgrade

- 6. (Post) health check
- 7. Pre/post impact analysis
- 7b. Fallback (possibly)
- 8. Update CM flag
- ** Status tracking and pause/resume execution at any/all times

Casablanca

Casablanca use cases



Cross Domain and Cross Layer VPN

 Utilizing ONAP for managing end-to-end inter-carrier international private line connectivity services Laying the foundations for 5G support

- Lifecycle management of physical network functions (PNFs)
- Represent PNFs in the TOSCA
 model, syntax and semantics
- Real-time performance monitoring and data collection



Platform enhancements

- VNF manual scaling enhancements and auto scaling support
- Change management
 capabilities enhancements
- Centralized Representation
 and Identification of Cloud
 Regions

CCVPN (Cross Domain and Cross Layer VPN) USE CASE

CCVPN by ONAP peering orchestration between service providers

The CCVPN blueprint addresses these use cases:

- vCPE with Tosca VNF
- virtual FW with hardware platform awareness (HPA) integration,
- automated scale out
- extension of change management



Laying the foundations for 5 support



Readiness for hybrid 5G networks

- Enhancements to deploy Edge PNF & Virtual Radio Network Functions
- Represent PNFs in TOSCA, define the mapping between PNF resources used in ONAP services and the physical devices themselves

*Carried over to Dublin



Performance Management

- Event driven high volume data delivery from xNF to ONAP/DCAE
- Event-driven bulk transfer of monitoring data from an xNF to ONAP/DCAE
- Support of 3GPP formatted measurement data

ONAP Optimization Framework enhancements

- OOF enhancement and Proof of Concept (POC) for Physical Cell ID (PCI) Optimization
- Demonstrate disaggregation of the PCI SON functionality, and the data flows needed to implement this in ONAP using OOF



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Dublin use cases



Use cases enhancements

- Enable ONAP to manage Edge
 resource and VNFs deployment
- E2E life-cycle management and assurance of Broadband Services
- CCVPN End-to-End service multiple sites creation and service change to include new location



Laying the foundations for 5G support

- 5G network slicing modelling
- Enhance NETCONF support in ONAP for 5G and other use cases
- PNFs Plug & Play resources
 registration



- Hardening and improving the HPA feature and capabilities
- Enhancement of Closed loop control and automated VNF scaling
- Virtualized and Containerized networking workloads deployment in Kubernetes based Cloud regions via MultiCloud/k8s plugin

End to End 5G network services management

(5G – An Edge computing enabler)



Edge Automation through ONAP

The Edge Cloud Infrastructure should support latency-sensitive, high-bandwidth network functions and applications driven by 5G, Edge Computing, VoLTE, Network Slicing use cases

Requirements:

| 1 | 2 | 3 | 4 | 5 |
|--|---|---|---|--|
| A single Cloud Region needs to be able to manage one or more distributed (typically Edge) physical DCs | Standardized representation of Multi-vendor Cloud Object Hierarchy (Cloud Region, VM, Container, CPU, Memory, Network etc.) | Standardized representation of Multi-vendor Cloud Analytics (Events, Alerts, Faults, Policies) | Near-real-time Streaming Data Management (Resource utilization metrics, Analytics) | Inter-Cloud workload (especially Data Plane) Placement/ Scheduling/Change Management decisions to leverage metrics and analytics information at an aggregate object level |

Analytics as a Service – use case example

Deploy Network Analytics Closer to the data source:

- Bring up analytics frameworks in multiple cloud regions
- Bring up analytics applications on the right location based on VNF/NFVI requirements



Source: https://wiki.onap.org/download/attachments/28379482/Distributed_analytics_v3.pptx?api=v2

ONAP Edge Work role

"ONAP Edge is not a single use case" It is an enabler across many use cases in ONAP



Edge Cloud Domain -- e.g. Akraino, MobileEdgeX, StarlingX ONAP <-> Multiple Edge Cloud Domains

K8S based Cloud-region support

Enable the support of

- Containerized workloads
- Containerized VNFs
- VMs and containers on same compute nodes (Bare-metal deployment)
- Multiple virtual networks
- Dynamic creation of Virtual networks
- Public cloud CaaS such as AWS EKS, GCP GKE and Azure AKS (Only containers, not VMs)



BBS Broadband Service Use Case (Dublin)

Customer

Establishment of a subscriber's HSIA (High Speed Internet Access) service

Designed and deployed using ONAP's capabilities Service activation is initiated via ONAP's external APIs and orchestrated and controlled by ONAP

Change of location for ONT devices (Nomadic ONT devices)



HSIA service subscription plan changes

Service modification (e.g. upgrade bandwidth) is initiated via ONAP's external APIs and orchestrated by ONAP

HSIA service assurance

The HSIA service health is monitored via ONAP's data collection, analytic and closed-loop capabilities





What is 5G





- Mainly for Mobile Broadband services
- Physical network + virtual core (vEPC, vIMS)
- Built on closed-architecture
 static network
 management with
 minimum agility to scale
- **Reactive** assurance
- Typically based on single-NEP equipment

- Broadband + massive IoT + low latency apps
- NR & network densification – small cells, fiber
- Hybrid networks Fixed & Mobile (FMC); Physical & Virtual (NFV/SDN); 4G & 5G (C-RAN, MEC, UP-CP separation); Cloud & Edge
- Distributed core, mesh connectivity, slicing – Dynamic network & service mgmt.
- **Proactive** assurance, automation and closedloop operations
- Open & multi-vendor



Support fully automated network management and autonomous operations



Readiness for hybrid 5G networks

PNF Plug & Play

- A method for registration of PNF resource instance in ONAP/A&AI
- PNF resource instances are correlated with service instance
- Infrastructure service instantiation flows calling controllers to configure the PNF instance

PNF Software upgrade Enable ONAP to update PNFs software versions



5G Network slicing support

NSSI CN-2

Core Network

Access Network

- Network Slicing enables provisioning different latency, reliability, availability, mobility, and bandwidth characteristics for 5G services
- ONAP has different models for different network slices and slice segments (e.g. RAN, Core, Transport)
- ONAP must support the complete lifecycle management of such network slicing
- A service instance is realized by one or more network slice instances (NSIs), that in turn may consist of network slice subnet instances (NSSIs



Every aspect of the network can be utilized differently

5G Network Slice Lifecycle Flow – Design Steps

SDC

Standardized Abstractions & Modeling (3GPP with some potentially extensions)

TOSCA Standard Models for:

- Radio Resource Description Leveraging 3GPP slice model
- Transport Abstraction: QoS, BW, resiliency, redundancy, etc.
- Complex services: Creating slice using slice segments, nested services, and E2E SLA / SLO specifications

Core / APN Abstraction Model

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• Resource reservation, entitlements, packet marking, etc.

Business Objectives / Requirements, Slice subnet & E2E Slice Profiles

- Define set of slice subnet and E2E slice templates / profiles
- Sub-slices/services within a broad slice (e.g. interactive video within MBB, etc.)
- Key attributes / SLO / Characteristics, Slice aware KPIs / Counters
- E2E Slice / Slice Segment network diagram
- Identify resources requirements (Radio, transport, core), reservation mode (shared, reserved exclusively, right to preempt)
- Handling overload and underload condition (i.e. dynamic scaling)

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Network Slice Lifecycle Flow – Instantiating Slice Subnet or E2E Slice

VID (or using APIs)

- Select E2E Slice Profile or Slice Subnet Profile / template to Instantiate
- Identify resources requirements (Radio, transport, core), reservation mode (shared, reserved exclusively, right to preempt, etc.)
- Expected capacity requirements (# devices, peak traffic volume, etc.)
- Scope of slice / Slice Subnet (registration areas, etc.)
- Slice / slice subnet instance name
- Other Parameters to be specified, as expected by the model

SO

- Executes Slice Subnet E2E Instantiation or modification
- Pass configuration specifications, as per abstraction standards, to RAN controller for radio slice segment creation
- Pass QoS, bandwidth, resiliency requirements for transport network to transport controller
- Configure NG Core
- Start data collection and SLA / SLO monitoring with right DCAE(s) for NEs in scope
- Update A&AI with slice / slice segment topology & state

Controller

A&AI

Maintain inventory of instantiated slice subnets, E2E slices, their states and their hierarchical relationship

Runtime Policy Framework

Support closed loop corrective action for Slice / slice subnet SLA violations

DCAE

Slice Aware KPI / Counter collection

- Compute slice / slice segment KPIs, Analytics
 application for slice / slice segment SLA / SLO
- Publish anomalous event when SLA / SLO violation occurs



Use Cases comparison between releases

| Use Case | Amsterdam R.1 | Beijing R.2 | Casablanca R.3 | Dublin R.4 June 2019 |
|---|---------------|--------------|----------------|-------------------------|
| vFW (CL) | √ | ✓ | \checkmark | \checkmark |
| vDNS | \checkmark | \checkmark | \checkmark | \checkmark |
| Volte | \checkmark | \checkmark | \checkmark | \checkmark |
| vCPE (Residential Broadband) | \checkmark | \checkmark | \checkmark | \checkmark |
| Change Management | | \checkmark | \checkmark | \checkmark |
| Hardware Platform Awareness (HPA) | | \checkmark | \checkmark | \checkmark |
| Scaling | | 🗸 (manual) | 🗸 (auto) | \checkmark |
| Cross Domain & Cross Layer VPN (CCVPN) | | | \checkmark | \checkmark |
| Deployment of the hybrid 5G network | | | \checkmark | \checkmark |
| Edge Automation - Analytics as a Service Closer to Edges (PNDA based) | | | | \checkmark |
| BroadBand Service (BBS) | | | | \checkmark |
| k8s based cloud region support | | | | \checkmark |

Thank you

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