Open Source Cloud Native Operations Management & Security: ONAP Perspective

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Agenda

• Use Cases – Edge → Core Deployment Profiles

• Cloud Native NFV/Edge Deployment Options

• NFV/Edge Deployment Options and Trade-Offs -- General/Management/Security

• ONAP Perspective
  - Introduction to ONAP Operations Manager (OOM)
  - OOM Deployment Architectural Vision
  - Multi-vendor Demo (Unconference session)

• Summary & Discussion
Use Cases – Edge → Core Deployment Profiles

Key Industries:
Telco (e.g. NFV, 5G, and IoT), Retail (e.g. IoT, Supply Chain)

Key Application Domains:
Surveillance (e.g. CCTV), Telematics, Enterprise Security

Micro Edge Device
• Remote Radio Head
• Remote Radio Unit
• CPE / set top box
Runs a single instance, instance changes infrequently

Small Edge Device
• Remote Radio Head
• Remote Radio Unit
• CPE / set top box
Multiple instances, instances change occasionally

Medium Edge Backhaul, **Critical Deployment**
• Cloud-RAN
• Big cell site
• National Broadband Network Point of Interconnect (NBN-POI)
Multiple instances, instances change daily

Medium Edge Backhaul, **Non-Critical Deployment**
• Big box retail
• Cloudlet
Multiple instances, instances change daily

Core Network
• Region DC
• IMS
• EPC Control Plane
Thousands of instances, instances changing constantly

* Use cases were identified in OpenDev 2017
Cloud Native NFV/Edge Deployment Options

Bare Metal (Small Scale) ➔ Hybrid (Medium Scale) ➔ CaaS (Hyper Scale)

NFV/Edge Use Case Mapping
Micro Edge/Small Edge

- BM Host n
  - vFW
  - vDNS
  - Wi-Fi QoE
  - APPS/VNFs

- BM Host n-1
  - A&AI
  - MC Mgr.
  - APPS/VNFs

- BM Host 1
  - VF-C
  - SDN-C
  - SO
  - ONAP

NFV/Edge Use Case Mapping
Medium Edge Backhaul

- BM Host n
  - VOD
  - STB
  - Wi-Fi QoE
  - APPS/VNFs

- BM Host n-1
  - A&AI
  - MC Mgr.
  - ONAP

- BM Host 1
  - VF-C
  - SDN-C
  - SO
  - ONAP

NFV/Edge Use Case Mapping
Core Network

- BM Host 1
  - vFW
  - vDNS
  - ONAP

- BM Host 2
  - vFW
  - vIMS
  - VNFs

- BM Host 3
  - vIMS

Legend:
STB – Set Top BOX; EPG – Electronic Programming Guide; VOD – Video On Demand; IMS – IP Multi Media Subsystem
BM - Bare Metal; VM – Virtual Machine; Hybrid – Mix and Match VM and BM hosts;
CaaS – Container Orchestration on VM Hosts;
Containerized ONAP components – A&AI, SDN-C etc.
**NFV/Edge Deployment Options and Trade-Offs (General)**

<table>
<thead>
<tr>
<th></th>
<th>Bare Metal (BM)</th>
<th>Hybrid (VM + BM)</th>
<th>CaaS (VM)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Base Architecture</strong></td>
<td>Everything over K8s over bare metal hosts</td>
<td>Containerized applications on K8s cluster over bare metal hosts; Rest on VMs</td>
<td>Everything over VMs, including K8s clusters</td>
</tr>
<tr>
<td><strong>Application/VNF Architecture</strong></td>
<td>All applications and VNFs have to be containerized</td>
<td>Support containerized and VM-based Applications and VNFs</td>
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<tr>
<td><strong>Mixed Workloads</strong></td>
<td>No Support for VM-based VNF/Application workloads</td>
<td>Supports containerized and non-containerized workloads</td>
<td>Supports containerized and non-containerized workloads</td>
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Note: VNFs can be potentially developed as native OS processes [NetBricks], but entails redevelopment of the entire stack and applications.
## NFV/Edge Deployment Options and Trade-Offs (Management)

<table>
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<tbody>
<tr>
<td><strong>Operational Simplicity</strong></td>
<td>Single panel of glass deployment for containers</td>
<td>Independent management of Bare Metal and VM hosts</td>
<td>Single pane of glass deployment for containerized and VM-based Applications/VNFs</td>
</tr>
<tr>
<td><strong>Mixed Hardware Portability</strong></td>
<td>No hardware-independent abstraction for normalized capability and capacity metrics</td>
<td>Partial support (limited to VM-based Hosts)</td>
<td>VM-based Hosts provide normalized capability and capacity metrics across mixed hardware</td>
</tr>
<tr>
<td><strong>Scalability</strong></td>
<td>Dynamic scalability for containers</td>
<td>Scaling across bare metal &amp; VMs requires major reconfiguration</td>
<td>Dynamic scalability of VM/Container workload capacity</td>
</tr>
<tr>
<td>Component/VNF Isolation</td>
<td>Bare Metal (BM)</td>
<td>Hybrid (VM + BM)</td>
<td>CaaS (VM)</td>
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<tr>
<td>Security only via physical HW topology isolation</td>
<td>Additional security for specific VMs possible</td>
<td>Native HW security for all components and VNFs</td>
<td></td>
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</tbody>
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<th>Security Attestation (e.g. TPM, image integrity, etc.)</th>
<th>Bare Metal (BM)</th>
<th>Hybrid (VM + BM)</th>
<th>CaaS (VM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cannot provide extra security for specific components/VNFs</td>
<td>Can provide extra security for VM based components/VNFs</td>
<td>Can provide extra security for any user-specified components/VNFs</td>
<td></td>
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<tr>
<th>Open Source Security</th>
<th>Bare Metal (BM)</th>
<th>Hybrid (VM + BM)</th>
<th>CaaS (VM)</th>
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<tbody>
<tr>
<td>Relies purely on software security (base K8s security)</td>
<td>VM layer provides additional hardware security for VM based components/VNFs</td>
<td>VM layer provides additional hardware security for all components/VNFs</td>
<td></td>
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</tbody>
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ONAP Operations Manager (OOM)

• ONAP on Containers (K8s)
• Supports Bare Metal or VM hosts
• Efficiently deploy, manage, operate the ONAP platform, its components, and infrastructure
  - Life-cycle Management
  - Hardware Efficiency
  - Deployment Speed
  - Cloud Provider Flexibility
• Deployment Speed & Hardware Efficiency (vs OpenStack deployment):
  - Memory: 200 GB vs 60 GB
  - Disk Space: ~ 1.3 TB vs 120 GB
  - Deployment time (US): 2 hours vs 1 hour
  - Deployment time (international): very high without mirrors
ONAP OOM selects Cloud Instance (OpenStack, VMware etc.) for creating ONAP deployment & Application VMs and deploys containerized applications using K8s on those VMs.

Selected Cloud Instance is made available to A&AI (ESR) ONAP Component enabling single panel of glass deployment.

VM-based VNFs use ONAP Multi Cloud (MC Mgr.) for Cloud Agnostic Deployment across Azure, OpenStack etc.

Legend:
STB – Set Top BOX; EPG – Electronic Programming Guide; VOD – Video On Demand
Host – VM or Bare Metal

Flexible Architecture
Support Bare Metal, Hybrid and CaaS deployment options
Multi-vendor Demo (Unconference session)

Multi Cloud Instance (MCI) Core (VMware VIO 4.0) - Core site with containerized ONAP component microservices deployed on VMs and vDNS VNF VMs
MCI Edge (Wind River Titanium Cloud) - Edge site with vFW VNF VMs

Admin deploys ONAP component microservices using ONAP OOM which leverages VMware VIO K8s running on VMware VIO VMs

CaaS - Simplifying Workload Management & Delivering Native Security
Single pane of glass deployment for Containerized Microservices and VM-based Applications/VNFs
Native HW security/isolation for all Components and VNFs

Pivotal Container Service

ONAP Multi Cloud
Cloud Agnostic VNF deployment across Wind River Titanium Cloud and VMware VIO

VMware VIO 4.0 CaaS

SMB

Edge Site
Wind River Titanium Cloud

ONAP

Core Site
VMware VIO 4.0 CaaS

VM 1
VF-C
SDN-C
SO

A&AI
MC Mgr.

VM n-1

VNF vDNS

VMn - vDNS
VM1 - vDNS
Summary & Discussion

• CaaS → Hybrid → Bare Metal
  - CaaS - Everything over VMs, including K8s clusters
  - Hybrid - Containerized applications on K8s over Bare Metal hosts; Rest on VMs
  - Bare Metal - Everything over K8s over Bare Metal hosts

• Balancing Tradeoffs
  - Single Pane of Glass Management
  - Native HW Security/Isolation
  - Need for Higher Performance

• Critical thinking needed before jumping in!

• More on Cloud Native VNFs and Security in the upcoming sessions!
  - Toward Container Support As VNF-based Cloud Infrastructure
  - Overview & Discussion: Security In The Modern Virtualized Data Center