AT&T’s SDN Controller Implementation
Based on OpenDaylight

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D2.0 SDN-NFV Realization
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Agenda

- The SDN+NFV Components & Common Use Cases
- Service Provider Use Cases – A Wish List
SDN in a Virtualized World

Service Orchestrator → Controller → Virtual Network Function → Physical Network Function

Cloud Orchestrator → VM Container (NFVi)
Controllers – How They Fit Together

Application/Service-aware
End-to-end Service Configuration & Global Resource Optimization Controls

SDN Local

SDN Local Overlay

SDN Local Fabric Switch ("Underlay")

SDN Local Access

SDN Local Optical

SDN Local MAN/WAN

SDN Global

Customer SDN

Adapter

Adapter

Adapter

Adapter

 Distributed Local Configuration Control

vS/vR

Fabric Switch

Access NEs

Optical NEs

MAN/WAN NEs (PNFs→VNFs)

Customer SDN

SP SDN

KVM

ESXi

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THE Controller?

- SDN Global
- SDN Local Overlay
- SDN Controller
- SDN Local Fabric Switch (Underlay)
Common Use Cases

Virtualize Function

Server Failover

Site Failover

Scale out/in/up/down VF – in one location or multiple locations based on time or traffic

Customer request causing VF spin up

Customer bandwidth on demand

Multi-tenancy to application
Agenda

- The SDN+NFV Components & Common Use Cases
- Service Provider Use Cases – A Wish List
High-Level View of ECOMP
(Enhanced, Control, Orchestration, Management, Policy)

Service Orchestrator
- Service Recipe
- YANG Definitions, Adapters & VNF Config.
- VNF Adapter
- Neutron Adapter
- Network Adapters
- Application Adapters

Controller Framework
- SDN-C
- APP-C
- Network Transport
- Application
- Service Logic

AIC Cloud
- OpenStack
- VNFs
- VM
- VM & Image Mgmt.

AIC Platform Orchestrator
- HEAT Templates & Service Recipes

Infrastructure Portal
- Service Definition, Distribution
- Instantiate Multi-tenant VNFs

OSS/BSS
- Service Orders
- HEAT Templates & Service Recipes

Net Ops
- Policy Mgmt.
- Discovery Design
- Service & Network Design

ASDC
- Catalog
- Service Recipe (TOSCA+) Distribution

A&AI
- D2 Inventory
- Registry

Policy Creation Framework
- Manual Fault & Performance Exceptions
- Distribution Collection
- Analytics

DCAE
- Fault, Performance, Usage
- Inventory Registry

OSS
- Manual Fault & Performance Exceptions

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Service Provider Use Cases

Working with cloud orchestration

- **Closed User Group Networks**
  - vCE to vPE network
  - vPE is an internal tenant
  - vCE is an external tenant per customer
  - The network between them crosses tenant boundaries
  - It’s not shared across all tenants that might be on that node
  - Need better support for sets of tenants that can access a shared network (a form of extra-net in our parlance)

- **HEAT templates are HOT for us !**
  - We already use HEAT templates for our controller NBI and are increasing the number and variety of HEAT resources we will use.
  - Beside Neutron ML2, we think there may need to be resources defined both within Neutron and outside of Neutron to meet our needs in advance of OpenStack releases.
Service Provider Use Cases (1)

Clustering
- Controllers will be in more than one site
- Local, Regional, National
- N-way cluster within a site is sufficient for HA but not disaster recovery
- Need cluster to cluster replication/synchronization

MD-SAL Utilities
- We have an application called the Service Logic Interpreter (SLI) that makes heavy use of MD-SAL and YANG Tools
- The SLI updates the config and operational trees depending on the service, feature and external system interactions (east/west).
- Need support for better “diff” and “merge” of the tree
  - Compare config to operational
  - Merge operational into config (sync from , synch to)
  - Merge this branch into the similar branch in another part of the tree
- Need support for “on data commit” so we can do things before the response goes back.
SDN Controller South-Bound Interfaces/Protocols

Traffic Routing Control with BGP & PCEP

- Use BGP/BGP-Flow-Spec for flow redirection (selection of egress point “BGP-Next-Hop” for a targeted flow) at ingress PE
  - Need extension of BGP Flow-spec for support of address families (AFI/SAFI) other than IPv4/v6
  - Need controller logic for support of multiple simultaneous “best paths” (BGP Add-Path)
- Use PCEP for optimal routing/re-routing of MPLS LSPs
  - Need extension for use with Segmented-Routing

Service Control with NETCONF

- Too stringent to use get-schema
- Need a lighter weight NETCONF integration when vendor supports Netconf but doesn’t have a YANG model
L3 Multi-Tenancy Models

**TODAY**

- VM
- OVS
- Neutron L3 Router
- L3 iPE WAN

**TARGET**

- OVR
- Neutron L3 Router
- V R F
- V R F
- V R F
- L3 iPE WAN
- V R F
L3 Hub-Spoke Model

Import Hub RT
Export Spoke RT

Export Hub RT
Import Spoke RT

L3 iPE WAN