Implementing OpenDaylight in a Carrier Network
Martin Foster  
Cloud Product Architect  
Telstra

Dmitriy Andrushko  
SDN Technical lead  
Mirantis
Who we are

• Largest subsea cable network in Asia Pacific, licences throughout Asia, Europe and the Americas and facilitate access to more than 2,000 Points of Presence (PoPs) in 230 countries and territories
• Telstra’s PEN: Pioneering the way with Software-Defined Networking (SDN) globally – built to power self-provisioned dynamic network services

• #1 PURE PLAY OPENSTACK® COMPANY
• #3 Contributor in OpenStack Kilo
• OPNFV Silver Member – BGS/Fuel
• Mirantis OpenStack product
• Evolving SDN/NFV practice
Topics

• PEN Platform
• PEN Demo
• Journey to OpenDaylight
• OpenDaylight: Service Assurance
• OpenDaylight DLux Demo
PEN Platform
The Telstra Network

- Asia-Pac & Trans-Pacific cable systems
What We Have Done

• SDN in the WAN
• Build on demand virtual cross-connects (VXCs) that leverage cable & DC assets
• Bring Cloud flexibility to the Network
• Reach: 25 POPs and growing
• Web Console & API Control
• Cultural shift to agile development and rapid innovation cycles in the telco space
PEN Platform Milestones

• 2013 launch: Point-to-Point Layer 2 Ethernet VXC service
  • Bandwidth: 1Mbps -> 10Gbps
  • Latency: Low, Standard, Best Effort
  • Contract: Hour, Day, Week, Month, Year

• 2014
  • Endpoint VLAN push/pop/modify == Telco NNI
  • Subordinate orchestrators: Tail-F & Openstack
  • Internet service: via Tail-F for Juniper & Cisco
  • NFV platform: via OpenStack
    • vRouter, vFirewall

• 2015
  • Orchestrate Layer1 transport: Infinera sub-sea via OTSv API integration
  • Cloud Provider connection automation: AWS via API integration
PEN Platform Demo

• PEN Console
• Point-to-Point Ethernet E-LINE
• NFV
OpenDaylight in PEN
PEN: OpenFlow based Ethernet VXC

Base product of PEN Platform is a Layer 2 Ethernet virtual cross connect (VXC) that forwards frames between any 2 endpoints on the network.

- Need to control & limit bandwidth: OF meters
- Need to develop a mechanism for “routing” the VXCs over the network
- Layer 2 Ethernet transparency
  - OpenFlow 1.0/1.3 lacks universal lightweight mechanism for L2 encapsulation
    - PBB, NVGRE: inconsistent vendor implementation
  - Centec Networks extension: MPLS-tag based encapsulation
    - Required OF plugin extension
    - Match inbound L2 frames regardless of ethertype -> encapsulate
  - Result: fully transparent, including tricky Ethertypes like LLDP
PEN & OpenFlow Controllers

• Started PEN with a commercial OpenFlow controller
  • PEN 1.0: multi-tenant interface, API & OSS/BSS integration over that controller

• Why commercial?
  • Working solution in 2013
  • It had a northbound API, which was key for integration
  • Operational support

• 2014: Search for additional controller
  • Idea
    • get end-to-end view of network services by placing OF devices at the edges
    • break telco 1:1:1 one platform, one NMS, one product
    • gain fine grained control over VXC path computation
  • Settled on OpenDaylight with Hydrogen release
OpenDaylight Objectives for PEN

• Focus on Operational support / service assurance capabilities
• Putting OpenDaylight in a carrier network allows us to get & display end-to-end service information from the network that is currently only available in proprietary black-box network management systems (NMSes):
  • Statistics Collection
  • Measurement Services
  • Path Computation
• Custom work: path computation logic
  • Exclude nodes: regulatory or customer requirement to not transit a jurisdiction
Global Scale Control Plane & OpenDaylight

• Challenge: Global scale network has inherent high latency, occasional hits as underlying circuits reroute
  • Control plane is global MPLS VPN:
  • route re-compute on reroute = OF switch disconnect from controller
  • Global control plane: not common OF use case, more metro & DC focus

• Goal: How can we use OpenDaylight to minimize impact on Data Plane?

• Develop global scale control plane fault mitigation strategies
  • Pre-installed virtual circuits
  • Data Path Validation mechanism
  • Learnings: OF switch software & ASIC sensitivity to high rate FLOWMOD events

• Future: looking at re-integrating control plane into data plane
OpenDaylight Journey

• Started with VTN
  • Fit initial use cases for multiple tenant control, network views
  • AD-SAL based
  • OpenFlow1.0 only

• Custom MD-SAL application
  • Full control on the roadmap and features to be developed
  • Easy to extend or update in case of change requests
  • Dependency on the Controller platform remains, i.e. certain aspects of the platform modified (for ex. SPF logic)

• Result: some minor contribution to upstream code
ODL DLux Demo

• Ability to establish end-to-end duplex connections on-demand (i.e. OF Proactive mode)
• Establish end-to-end bi-directional OF flows
  • Node Exclusion from the Path
• Stats
  • Port
  • Link
• Diagnostic features (next slides)
OpenDaylight: Control Plane Service Assurance

- Better experience by building in control plane issue mitigation strategies
- Control Plane at global scale – implemented solutions:
  - Route concept: multiple preinstalled forwarding paths, up to x#
  - Data Path Validation mechanism
OpenDaylight: Measurement Service

Data Path Validation
- Periodic bidirectional delay measurement for all installed Routes
- Control Route state
- Delete non-operational Route

Delay Measurement
- On-demand for circuits
  - One-way or two-way
  - Shows the list of switches in the used Route
- On-demand for two arbitrary switches
  - Bidirectional
  - Finds or create a route connecting two switches

KeepAlive/Heartbeat
- On-demand for two switches
- Verifies reachability of two switches accessible via any Route in UP state
Conclusions

After a year with OpenDaylight…

- Allows customized network behavior without writing entire controller
- Get network insight that was previously hard to garner from disparate NMSes
- Codebase takes a while to get used to 😊
Questions?
Thank You

#ODSummit