Thoughts on Transport SDN

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Life is for sharing.
Overview

- **Introduction**
- SDN Architecture Considerations
- Transport SDN Approaches and Applications
- SDN Implementation Examples
- Outlook
Introduction
SDN – one main Aspect

Orchestration

Processing

Storage

Transport
# Expectations of Carriers

## What carriers want

- **OPEX reduction:**
  - Lean, consistent IT-systems and data bases for converged view infrastructure, available products & solutions, policies, billing– real time OSS

- **CAPEX reduction:**
  - Fewer, more efficient devices to buy, operate and upgrade, or at least fewer different types
  - Use of standardized devices to not get trapped in proprietary solutions
  - Network Function Virtualization to realize Infrastructure Cloud Model (IaaS)

- **Gain agility, keep stability:**
  - Reducing time from innovations in physical and virtual switching to high-confidence deployment \(\rightarrow\) re-programming instead of re-architecting the network
  - Keep the network secure and stable despite multiple SW applications accessing controllers and NEs
Classical Network Appliance Approach

- Orchestrated, automatic & remote install.
- Fragmented non-commodity hardware.
- Physical install per appliance per site.
- Hardware development large barrier to entry for new vendors, constraining innovation & competition.

Network Virtualisation Approach

Independent Software Vendors

- Virtual Appliance
- Virtual Appliance
- Virtual Appliance
- Virtual Appliance

- Orchestrated, automatic & remote install.
- Standard High Volume Servers
- Standard High Volume Storage
- Standard High Volume Ethernet Switches

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SDN Architecture - Standardization

ITU-T, IETF, OIF
ASON / GMPLS
(G.8080 / G.771x,...)

ONF
OpenFlow Switch Spec. 1.3.1
OF Config. & Mgt Protocol 1.1

Mature

New
SDN Architecture - Principle

- **Service**
- **Orchestration**
- **Hypervisor**
- **Controller**
- **NMS**
- **Transport**

**Layers:***
- **Application Layer**
- **Control/NMS Layer**
- **Transport Layer**

**Notes:**
- New
- Mature
- Partly new

**Data Center**
SDN Architecture - Virtualization and Slicing

- **Application Layer**: Services
- **Control/NMS Layer**: Hypervisor, Controller, NMS
- **Transport Layer**: Hypervisor

- **Orchestration**
  - **New**
  - **Mature**
  - **Partly new**

- **Transport**: Virtual Machines, Data Center
- **Controller**
  - Flexible L1/2/3, VPN

- **Hypervisor**
  - Mature
  - Partly new
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SDN Application
Services for Residential Customers

- Mass market services are provided by applications hosted in DCs over IP- and TN
- Efficient network and DC infrastructure utilization and better customer experience with time varying traffic demands and stringent QoS requirements (IPTV, VoD)
- Apply variable resiliency schemes based on IP- and TN platform utilization and SLA
SDN Application
Services for Residential Customers – on Global Scale

- For supporting residential customer services in a multi-domain environment
  - Multiple IP-/transport domains must be interconnected
  - Multiple DC must be interconnected via transport networks
SDN Application
Data Center Coupling

- Required for content backup & synchronization, DC-maintenance/upgrades
- Very versatile demands: vastly differing BW, QoS, and timing requirements (scheduled/on-demand, duration), virtual topology (pair wise, tree, mesh)
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SDN Implementation Example
Virtual STB

Virtual STB innovation characteristics

- Project addresses a crucial pain point in IPTV infrastructure and operation: the STB
  → Re-location and virtualization of STB functionality to the Cloud
- Strategic decoupling of main IPTV system components via injection of vSTB component and openness of all interfaces
- Keeps investment in existing IPTV middleware low
- Quick and cost-efficient scaling, extension of media type deliveries and new services launches via virtualized vSTB components
SDN Implementation Example
TeraStream - A Cloud-enabled native IP Architecture

A cloud-enabled native IP architecture

- Reduce complexity
- Improve operational efficiency
- “From real-time OSS to a Software Defined Networks”

- Future steps
  - OF integration in cloud service center
  - OF in access
  - Hybrid
  - Evaluation in a pilot
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Outlook

Where are we, where do we go from here?

- Current implementations
  - Not carrier grade - single, well defined and separated network domains
- Medium term potential - Hybrid approaches likely
  - Re-use existing flexible transport network functionalities and installed Control Planes (IP-MPLS, ASON, GMPLS)
  - Provide OpenFlow IF from TN towards higher layer (Routers, Switches) SDN controllers
- Long term development - A clear Transport SDN architecture needs to be defined
  - Evolve SDN standards and specifications towards carrier grade multi-layer and multi-domain solutions without making them too complex to handle
    - Enhance OF for non-packet devices
    - Where will Application / Client / Network Control Functions, Flow Visor, etc. be allocated and implemented? Which target architectures are feasible?
  - How do these functions interact in a multi-domain network environment?
  - How do they relate to and communicate with existing NMS, ASON-Ctrl., PCE, EMS?
Thanks for your attention!