The Next Frontier for SDN: SDN Transport

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Changing Role of Transport Networks

A new kind of business customer
- Using both private and public clouds
- Elastic Compute and storage requires an elastic network with on-demand services

A new kind of Consumer
- Living in the cloud
- Applications are hosted in the cloud
- Shifting from download to streaming
- News events and new applications load the network in new ways
- Multi-device and multiscreen, any time anywhere

A new kind of service Provider
- Supplies SaaS, IaaS, PaaS
- Elastic compute and storage
- Multi-tenant

A new network is needed that supports
- Bandwidth on demand to match compute/storage on demand technology
- Multi-tenant
- Higher Utilization and greater efficiency
- Faster service deployment
Technology Trends

- Processor and Memory density continuing increase at exponential trend ~ Moore’s law.
- Processor Architecture and Capabilities Expanding - Memory/ IO bottlenecks disappearing.
- Transport costs not declining as rapidly as Processing costs.
- Increasing number of software implementations of network functions, running on commodity hardware.
  - Flow-based Traffic Routing, Content Filtering, CDNs, Analytics
  - IoT devices
The SDN and Virtualization Business Case

- **Virtualised environment**
  - Resources shared across services, reducing stranded capacity and reducing total cost of network build. (Build to average + margin across all services rather than to peak for each service).
  - Service reliability achieved at application level, without incurring hardware reliability costs. (1 for M vs. 1 for I)
  - Reduced power, cooling and other facility requirements.

- **Standard (COTS) hardware**
  - Large scale drives cost down (Economy of Scale)
  - One Spare holding SKU, drastically reducing the number of units needed.
  - Disaster recovery/business continuity can be simplified

- **Software Implementation of Network Functions**
  - Introduce new services quickly without deploying an entire network of new hardware. (Velocity)
  - New services can be inserted and withdrawn without loss of capital investment due to reuse of hardware. Easy to introduce service changes. (Flexibility)
  - Move workloads around the network to tactically handle capacity issues in specific geographical areas. (Adaptability.)
Why Does Transport Need SDN

- Optical and transport networks continue to be difficult and expensive to manage, with many manual processes and very long provisioning times.
- SDN and virtualization have the promise of simplifying optical transport network control, adding management flexibility, and allowing the rapid development of new service offerings by enabling programmatic control of optical transport networks and equipment.
- Can also reduce the cost of optical switches by moving control and management planes from embedded processors to general-purpose COTS hardware and virtualized software.
- Utilize centralized network-wide management and control to drive efficiency and speed.
SDN Promise

- **SDN advocates for greater programmability**
  - Provide new behaviors not considered by Standards, Vendor implementations

- **Facilitates Network application eco-system**
  - Seamless/Rapid relocation of endpoints
  - Abstracted NEs
  - Virtual Networks

Programmability and Application Awareness
SDN Architecture

- Diverse applications
- Open SW development environment
- Common NorthBound Interfaces to apps
- Controllers from Open Source SW
- Standard, programmatic SouthBound Interfaces

Application Layer

- Business Applications

Control Layer

- Controller Framework

Infrastructure Layer

- Network Services
- OpenFlow

Common APIs

Open Platform

Standard Interfaces
OIF Role and Expectations

- **SDN Reference Architecture**
- **Carrier SDN Requirements**
- **Meaningful demo and testing in carrier environment showing**
  - **Status of technology**
  - **Interfaces and interoperability**
  - **Operation tools needed**
  - **Pertinent use cases**

![Diagram of SDN components: Service, Orchestration, Hypervisor, Controller, Compute & Storage, Switches]
OIF/ONF Global Transport SDN Demo

- **Testing conducted in carrier labs over 7 week period August-September**
  - China Mobile, China Telecom, Deutsche Telekom, TELUS, Verizon
- **Participating vendors**
  - ADVA, Alcatel-Lucent, Ciena, Coriant, FiberHome, Fujitsu, Huawei, NEC America, ZTE
- **Consulting members**
  - China Academy of Telecommunications Research, KDDI R&D Laboratories, Orange
OIF/ONF Global Transport SDN Demo

- Goal - accelerate the deployment of practical, programmable transport networks that enable a new era of dynamic services

- Test prototype transport SDN technologies in real-world applications

- Application: Cloud bursting over optical networks

- Features:
  - Subset of OTWG OpenFlow Extensions (ONF lead)
    - CDPI and CVNI
    - Experimental encoding of extensions
  - Northbound Interface Protocols - Service Request and Topology network APIs (OIF lead)
  - Multi-domain controller hierarchy (OIF lead)
Cloud Bursting

- Cloud computing has increased demand on “East-West” interfaces
  - Google: 4+ times more traffic than North-South
  - Inter-cluster interface
    - VM Migration, Dataset synch/relocation
  - Duration needs to be as short as possible
    - High-bandwidth connectivity, short-lived connections
2014 Global Transport SDN Demo
Outcome

- Identified a lack of definition for how user applications interact with transport network applications and resource functions
  - The programmability of Transport SDN requires some of the internal interfaces used by ASON to become open
- Whitepaper jointly published by OIF and ONF
- OIF project started to develop API implementation agreements (IAs)
  - Build on Service Request and Topology APIs prototyped in the demo
  - Create IAs for Service Request, Path Computation, Topology and Link Resource Manager interfaces (identified as part of the OIF’s upcoming SDN Framework document)
- Framework doc is available (www.oiforum.com)
Considerations for Wider Deployment

Architecture Issues

- **How will Multi-Domain be handled?**
  - What is the relationship between controllers?
    - Peer or overlay

- **How will Multi-Layer be handled?**
  - E.g., location and triggering of adaptation

- **What is the relationship to Network Management?**
  - OF control vs. EMS/NMS control (mediation device)
High Level SDN/Data Center Reference Architecture with SDOs/Forums Focus

- ONF
- OIF
- IETF/IRT
- ATIS
- SW Infrastructure
- Docker/Kubernetes/Linux Foundation, MESOS
- OAM
- InterDC
- OpenStack
- ONOS
- ODL, NFV
- OPNFV
- OPEN SOURCE
- OIF (Transport)
- 3GPP
- BBF, MEF
- DMTF
- ATIS
- SDN Controller
- Northbound Interface
- Southbound Interface
- Data Center HW
- Transport
- DC Mgt
- OPEN SOURCE
- OPTICAL INTERNET WORKING FORUM

SDNs/Forums:
- DMTF
- OIF
- ATIS
- ONF (Transport)
- 3GPP
- BBF, MEF
SDN-related SDOs

- **ONF**
  - The SDO for OpenFlow standardization. Perceived as leader for SDN standardization
  - Started Open Source development community (ONOS) for software development as part of its efforts to speed commercial deployment of open SDN

- **IETF**
  - Broader scope than OpenFlow. Focus on extending protocols for SDN without OpenFlow

- **ETSI (NFV)**
  - Aligns with SDN objectives to use commodity servers and switches
  - May control the forwarding behavior of physical switches using SDN

- **ITU (Question 21 – a group for Future Networks)**
  - It is an established SDN group
  - Q 14 developing generic SDN framework for telecom carriers

- **OIF**
  - SDN Transport, Service APIs, Interop

- **BBF**
  - Some SDN related work started
Challenges

- Operational simplicity
  - On-board new clients rapidly
- Differentiated service delivery
  - Automate resource allocation on the fly
- Scalability
  - Support X transactions per hour
- Security
  - Service isolation and authentication per client
- Continuous Availability (Reliability)
  - Disaster avoidance / recovery
- Migration Path
- Many SDOs, Open source activities
- Common Information Model
Summary

- **SDN has great promise to improve transport control**
  - *Programmability*
    - Ability to deliver new behaviors not (yet) considered by standards, vendors, ...
  - **Simplified multi-layer control**
  - **Common behaviors in heterogeneous NE deployments**

- **Operational issues**
- **Reliability**
- **Role of SDOs**
- **Monetizing Network**
Thank You!

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