Outline

- Transport SDN - Trends and Business Drivers
- OIF Role and Structure
- Transport SDN Architecture & Requirements
- Goal of the OIF Transport SDN Framework Document
- ONF-OIF Transport SDN Prototype Demonstration 2014
- Summary
Trends

- Carrier environment has evolved and changed
  - All IP services
  - Changing traffic patterns
  - Need for new business models
- Network standardization environment has changed and there is increasing emphasis on
  - Virtualized environment
    - Separation of HW and SW
    - Separation of transport and control functions
    - Software implementation of network functions
  - Standard (COTS) hardware
  - Application aware routing
  - Programmable optical networks
- New forums – ONF, NFV, OGF, OpenDaylight, …
- SDN – an approach for optimizing networking
Business Drivers

• **Improved service availability** (Improved resilience and reliability)

• **Simplified operations and decreased OPEX** (Increased network automation, programmability and flexibility)

• **Faster service provisioning** for accelerated time-to-market/revenue and ROI, improved QoS/QoE

• **Application aware networking**
Orchestration - One main Aspect of SDN

Orchestration

Processing

Storage

Transport
What is the OIF?

• Since 1998 OIF has brought together industry groups from the data and optical worlds

• Mission: To foster the development and deployment of interoperable products and services for data switching and routing using optical networking technologies

• Our 100+ member companies represent the entire industry ecosystem:
  • Carriers and network users
  • Component and systems vendors
  • Testing and software companies
Where we fit

IETF
ASON A
ITU-T
IEEE
ONF
NFV
TMF
MEF

GMPLS Protocols
ASON Architecture & Requirements
OTN/Optical Interfaces
100G Interfaces
100G Interfaces
Ethernet Alliance
100G Interfaces
Infiniband Trade Assn
Common Electrical Interfaces
Ethernet Services
CP management

Interop Testing
Implementation Agreements

OIF OPTICAL INTERNETWORKING FORUM

Electrical Interfaces
Fibre Channel T11
How OIF is organized

- Board of Directors
- Technical Committee:
  - Carrier WG
  - Networking & Operations WG
  - Physical & Link Layer WG
  - Interop WG
- Implementation Agreements
- Interop Demonstrations
- Implementations Agreements

*PLUG: Physical Layer User Group

Optical Internetworking Forum
Transport SDN Use Cases

- Internal working document - not for publication
- Used to distill carrier requirements for Transport SDN
- Examples:
  - DC-DC Interconnect
  - BoD
  - TaaS
  - Multi-layer NM
  - Network aware server load balancing
  - Cloud Box
  - PoD for Hybrid Cloud IaaS/STaaS
  - Bandwidth Exchanges
  - Virtualized IMS
  - Workload Migration
Carrier Requirements on Transport Networks in SDN Architectures

Requirements on Transport SDN

• Document is based on contributions of major carriers worldwide

• Comprises requirements on Transport SDN
  • Orchestrator (transport network relevant part)
  • Control and management planes
  • Data plane

• Being used as guidance within OIF but also communicated to other SDO and forums
SDN Reference Architecture

Components of Transport SDN

- **Application Plane**
  - Orchestrator

- **Mgt- & Control-Plane**
  - Mgt
  - TN Controller

- **Transport Network**
  - Data Center

- **Data Plane**
  - Transport

**SDN northbound:** OGF NSI, ...

**SDN southbound:**
- OF, XML, SNMP, PCEP, ...
- (could be NE-internal)

**Orchestrator**

**DC Mgt/Controller**

SDN Architecture - Standardization

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

ONF
OpenFlow Switch Spec. 1.4.0
OF Config. & Mgt Protocol 1.1

MP – EMS/NMS

Control Plane

L1/L2 Transport NEs

MP – CLI/GUI

OF – Controller

OF Packet Switches
General Requirements

• Requirements are not aimed at a particular (set) of protocols, HW and SW implementations
  • Packet & circuit switching
  • Centralized & distributed control instances
  • Allow multiple protocols
  • Modular SW and HW (COTS)
  • Decoupling of network layers

• Guarantee interoperability among different vendor implementations, carrier network domains, data center functions, …
  • Well defined interfaces for increasing level of interoperability

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• **TN Controller Decomposition**
  - How does ASON Architecture apply to TN Controllers?
  - What components exist with a controller?
  - What APIs need to be exposed by a controller?
  - How can component replacement be facilitated?
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  - How does ASON Architecture apply to TN Controllers?
  - What components exist with an **O**?

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TN Controller

- Service Level
- SNC
- Reroute
- Service

PCE

- Path Computation
- Connect Control
- Controller

- TAP
- RSVP
- LRM
- Topology
- Directory

OF CDI

ENNI

CVNI

OGF NSI
```

- What APIs need to be exposed by a controller?
- How can component replacement be facilitated?
Putting the Pieces Together
OIF Implementation Agreements and Interoperability Demos

OIF Implementation Agreements

UNI 1.0 signaling
UNI 1.0r2/ E-NNI 1.0 signaling
E-NNI 1.0 UNI 2.0 signaling
ASON/GMPLS Interworking
E-NNI 2.0 signaling
E-NNI 2.0 routing
E-NNI ML AM
UNI2.0 Ext.


SUPERCOMM Draft UNI 1.0 signaling
OFC Draft E-NNI 1.0 signaling + routing
SUPERCOMM UNI/E-NNI 1.0 SONET/SDH + EoS data plane
SUPERCOMM Draft EPL over SONET/SDH + BW mod
SUPERCOMM Draft EPL over SONET/SDH + EVPL data plane
ECOC EPL over SONET/SDH + BW mod
Worldwide EVPL over transport + restoration
OFC-NFOEC Ethernet services over OTNv3

Joint ONF-OIF Cloud bursting over optical networks

OIF Networking Interoperability Demonstrations
Joint OIF/ONF Prototype Demonstration 2014

• Application: Cloud Bursting over optical networks
  • Short lived, high-capacity between Data-centers
  • Implemented using OTN connections created via central interface
  • Ethernet service over OTN as the dataplane

• Protocol Features: Subset OTWG Extensions (ONF Lead)
  • CDPI and/or CVNI – level of interoperability tbd
  • Experimental encoding of extensions

• Potential additional features: Controller NBIs (OIF Lead)
  • Multi-domain (E/W or Controller hierarchy)
  • Network application interfaces (PCE, Topology)
Vision: Inter-Domain Interworking

• On-demand services are provisioned, based on ASON/GMPLS control plane functions: Multi-domain, Multi-layer, Multi-technology

• OIF control plane follows ASON multi-domain architecture and allows UNI, E-NNI protocol separate from domain operation

• Interworking with SDN domains is ensured

Domains can use different control technologies internally: NMS, OF, PCE, ASON/GMPLS

Domains can use different data plane technologies internally
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
  - Application awareness

- **OIF is providing guidance to accelerate deployment**
  - Use cases and architecture
  - Carrier requirements
  - Framework document
  - Demonstrations
Thank you for your kind attention!

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