SDN in the transport network

Customer Empowered Fibre Workshop
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Agenda

• SDN in GÉANT – background
• Transport SDN use case
• Infinera’s Open Transport Switch
• Multi-layer SDN
• Multi-domain SDN
SDN in GÉANT
SDN drivers in R&E networks

What is of interest in Research Networking?
• Optimizing end-to-end performance
• Supporting large science flows
• Giving control over the network to researchers
• Solving the multi-layer and multi-domain challenges

What is less interesting?
• Cost reduction
• Billing

Is there a role for SDN in optical transmission?
GN3Plus Project - activities

<table>
<thead>
<tr>
<th>JRA1: Network Architectures for Horizon 2020</th>
<th>SA1: Core Backbone Services</th>
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<tbody>
<tr>
<td>JRA2: Technology Testing for Specific Service Applications</td>
<td>SA2: Testbeds as a Service</td>
</tr>
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<td>JRA3: Identity &amp; Trust Technologies for GÉANT Services</td>
<td>SA3: Network Service Delivery</td>
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<td>SA4: Network Support Services</td>
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<td>SA5: Application Services</td>
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<td>SA7: Support to Clouds</td>
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<tr>
<td>SA6: Service Management &amp; Operation</td>
<td></td>
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</tbody>
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<tr>
<th>NA1: Management</th>
<th>NA2: Communications &amp; Promotion</th>
<th>NA3: Status &amp; Trends</th>
<th>NA4: International &amp; Business Devpt</th>
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Connect | Communicate | Collaborate
Objectives of JRA2:

- Evaluate SDN controllers and other open source software
- Define common SDN environment and API for R&E
- Carry out SDN experiments – Open Calls
- Develop new SDN based services
Two generations of SDN testbed

- **Generation 1**
  GÉANT Open Flow Facility (GOFF)
  SDN focused testbed based on Xen hypervisor, a full mesh of Open vSwitches coordinated using the Ofelia Control Framework

- **Generation 2**
  GÉANT Testbed Service (GTS)
  Low level Testbed resources are allocated via UI. Open Stack is used for the VMs and OF enabled switches are interconnected via NSI enabled BoD service.
Transport SDN use case
Support the Traffic Growth

Network needs to scale to meet the traffic growth

Graphs showing traffic growth over time with data points for current, average, maximum, and peak values for both inbound and outbound traffic.
SKA network data volumes

Antenna

Correlator

Super Computer

Regional Centre (tbd)

SA
SKA1-MID

AUS
Low

AUS
Survey

~200km

23Tb/s

100Gb/s

~1000km

27Tb/s

59Tb/s

Up to ~25,000km

100Gb/s

100Gb/s

User Groups

User Groups

User Groups

User Groups

Internal to the instrument
Transport SDN use case

- MEF type EVPN-LAN
- pool of provisionable OTN B/W
- Pay as you grow B/W
- OTS REST API to allow experimenter’s applications to manage connectivity
Infinera’s Open Transport Switch
Open Transport Switch (OTS)

- Infinera are developing the OTS for the DTN-X
- Initial version will be REST based as transport OpenFlow has not been defined yet by ONF.
- Later versions will also support a standard ‘wire-line’ Open Flow interface for provisioning.
- This version defines a semantic usage of existing bits/bytes in Open Flow so that it will do OTN provisioning.
- ONF compliant version of OpenFlow dependent on standardization process.
Open Transport Switch
Light-weight Virtual Transport Switch

- Vanilla OpenFlow 1.0 protocol for provisioning
- REST/JSON API for configuration, discovery, & management
- Runs on NE or in cloud
- Leverages virtualized transport abstraction
- Interworks with (but doesn’t require) GMPLS

OTS enables open interface & network virtualization for Carrier
Implicit and explicit models

Explicit (Direct) Model

- Centralization of all network control
- Individually controlled NE’s
- Hop-by-hop provisioning

Implicit (Indirect) Model

- Network abstraction per domain
- Multi-domain orchestration
- Leverage existing control plane
Ethernet services: PXM card

- Packet Switching Module
  - R11 16x10GE or 16x1GE
  - R12 1 x 100GE

- 200G Packet Switch on a card
  - Enables QoS
  - Traffic Management

- MEF services
  - Point-to-point services EP-LINE, EVP-LINE
  - Multipoint services EP/EVP-LAN, EP/EVP-TREE
SDN: solving the Multi-layer challenge
Multi-layer SDN: OpenFlow at transport and service layers

- Multi-domain and multi-layer orchestration
- SDN applications have visibility of both the transport and packet layers
- Makes express bypass possible
Multi-layer SDN: OpenFlow at transport and service layers

- Application has the choice to forward flows on the MPLS layer
- Large flows or aggregated flows can be directed over the Transport layer
SDN: solving the multi-domain challenge
1. “Network Service Interface” is a framework for inter-domain service coordination

Examples:
- **Connection Service (NSI-CS)**
- **Document Distribution Service (NSI-DDS)**
- **Monitoring Service**
- **Protection Service**
- **Verification Service**
- **Etc.**
2. Designed for flexible, multi-domain, service chaining

Supports **Tree** and **Chain** model of service chaining

Fits in well with Cloud/Compute model of provisioning as well as Network/GMPLS model
3. Principles of Abstraction applied – to network layers, technologies and domains

Service Termination Points (STPs)

Service Demarcation Points (SDPs)

Are both abstract and technology independent
How does NSI fit into SDN?

NSI for multi-domain path negotiation

Diagram:
- uRA
- AG
- uPA
- OF controller/FlowVisor
- OTS
- NRM
- OF controller/FlowVisor
- Host A
- Host F
- Host
**SDN and NSI integration**

- GÉANT sees the NSI protocol as a key component in delivering multi-domain SDN services in the R&E networks.
- Work is ongoing in the MOTE GÉANT Open Call to integrate NSI into the SDN environment. Aims to add Open Flow constructs to the NML topology description.
- This will bridge the intra-domain operations of OpenFlow with the inter-domain provisioning in the NSI.
Thank you!