Investigating new Services for GÉANT using ONOS

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GÉANT key facts

• Pan-European service provider
• Interconnects 38 National Research and Educational Networks (NRENs)
• 50 million users
• High capacity backbone (up to 8Tbps)
• Different customers and services:
  • Connectivity (IP, VPN, P2P, Open)
  • Trust Identity and Security (eduroam, eduGain, ...)
  • Cloud
  • Testbed
  • Management and monitoring
GÉANT Interconnections

- Extensive connections to:
  - North America
  - Latin America
  - Africa
  - Middle East
  - Asia and Asia-Pacific

- GÉANT receives about 1.5PBytes of data per day on Global and Virtual Private Networks (L3VPN) interfaces

- External peers interconnected through **26 POPs**, located all over Europe, and **2 Open eXchange Points (OXPs)**
• Activities carried out under the JRA2 GN4 project
  • Design and requirement collection
  • Development
  • Testing and integration

• Several partners involved (NRENs, universities, research centers, vendors, ...)

• Three main topics using ONOS:
  • Multi-domain Bandwidth on Demand
  • Software Defined Internet Exchange Point
  • Packet-Optical integration (Transport SDN)
Multi-domain Bandwidth on Demand service provisioning

- SDN BoD creates **L2 services** with **QoS**

- It runs as **ONOS application**

- Provides **multi-domain BoD services** involving **heterogeneous transport technologies**

- Through **NSI-CS** protocol, it interacts with the legacy GÉANT BoD service (AutoBAHN)

- Enforces **QoS constraints** such as rate limiting

- Enhances current BoD services with **failure recovery** mechanisms and automated **network topology discovery**
Benefits for GÉANT

- Automation of service provisioning, reducing the manual configuration and the operational costs
- Optimization of network resources’ utilization, increasing the service request acceptance ratio
- Migration to SDN technologies while keeping the strategic multi-domain connections
- Support for failure recovery mechanisms
Software Defined Internet Exchange Point

• Use SDN in GÉANT Open eXchange Points (OXPs) as evolution of the GÉANT Open service.

• GÉANT SDX is a hybrid environment that provides both L3 and L2 connectivity services:
  
  • **SDXL3** ONOS app: provides **IP transit** service via BGP to customers (IXP)
  
  • **SDXL2** ONOS app: creates **L2 tunnels** between MAC/VLAN endpoints, tagged with VLAN/MPLS
Developed functionalities: SDX – L2

- Abstraction of virtual SDXs
- Implemented as a service that can be called by other subsystems within ONOS
- Monitoring and statistics (IPFIX export)

Based on MAC addresses, VLAN encapsulation, MPLS encapsulation (implemented in ONOS core)

SDX L2 app

Tunnel modes

CLI and GUI implementation
Developed functionalities: SDX – L3

Dynamic peer administration

SDN-IP improvements

- Same-subnet BGP peers configuration
- Internal speaker can act as route server
- Direct communication between peers (via modified ProxyARP app)

Extended app (SDX L3)
SDX deployment

- **SDXL3** - extends SDN-IP app and enables an SDN network to be operated as the IXP infrastructure

- **SDXL2** – allows automated provisioning of L2 tunnels between SDX customers

- **IP Flow Information Export (IPFIX) protocol** - used for transmitting Traffic Flow information over the network to the Collector process.

- **Pica8 switches** – OpenFlow-enabled switches used for data-plane communication
Benefits for GÉANT

• **Direct control** over packet-processing rules
• Support for **high availability**
• **Vendor agnostic** environment
• **Rapid application development**
• **Custom route selection** process
• **Application-based** peering
Transport SDN

- Based on ONOS packet-optical integration
- CORSA switches as L2-L3 devices

Infinera OTSv plugin

New driver to interact with the INFINERA control plane
Thank you