GÉANT BoD Service Evolution
Introducing SDN capabilities in backbone

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• Current Implementation of BoD Service in GÉANT
• Role of Technology Proxy
• DynPac Framework
  • Path Computation Element
• SDN based BoD Architecture
• Work in progress
Current implementation of BoD Service

It is a repository for data regarding the network topology which is loaded into Autobahn at startup.
Current implementation of BoD Service

A request comes in thru the user’s interface to BoD
Current implementation of BoD Service

1. BoD Portal
2. Autobahn instance
3. Technology Proxy
4. JunOS Space

Translate SOAP requests received from the Autobahn DM into REST requests for JunOS Space APIs.

The feasibility of the request is evaluated against the topology information acquired from cNIS. If accepted the request is then sent to the Technology Proxy.
Current implementation of BoD Service

Controls and configure the devices in the network.
Current implementation of BoD Service

A cluster of 2 JunOS Space J1500 appliances pushes configuration changes to the Network Elements.
Current implementation of BoD Service

A cluster of 2 JunOS Space J1500 appliances pushes configuration changes to the Network Elements.

An L2 circuit is configured in between two VLANs/Interfaces.

GEANT MPLS Core
The role of the Technology Proxy

The Technology Proxy is responsible for communicating with our Operation Database, Cacti and for informing us via email should an issue be encountered.
DynPaC: Dynamic and Adaptive Traffic Engineering for SDNs

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PhD Assistant Professor in the University of the Basque Country
The DynPaC Framework

GÉANT Connectivity Services

Bandwidth on Demand
BoD is the world’s first and only multi-domain service for automatic bandwidth provisioning. It enables NRENs to deliver flexible, customised connectivity to serve their users’ data transmission needs.

How can we improve this service?
The DynPaC Framework

• Objectives:
  • Efficient use of the network capacity:
    • Flow relocation.
    • Flow disaggregation.
  • Resiliency in case of a link failure with quick recovery times:
    • Pre-computed backup paths.
    • Two types of services: regular and gold.
  • Reduction of the operational costs of the service management:
  • Improvement of the network monitoring by gathering real-time information.
The DynPaC Framework

Dynpac GUI Manager

Monitoring

Dynpac ARP Handler
Avoiding install of unnecessary rules

Dynpac Service Manager
Service provisioning
Scheduling

PCE

Traffic Pattern Analyser

SERVICE REQUEST

Dynpac Rules Manager
Path2rules
Install flows

Services and associated paths
Services and alternative paths
Path precomputation for fast recovery
The DynPaC Framework:
DynPaC Service Manager

• DynPaC Service Manager:
  • The CORE of the DynPaC framework.
  • Acts as the coordinator.
    • Orchestrates the interaction between the modules of the framework.
    • Listens to topological and monitoring events to react upon changing conditions.

• Manages the introduction of new services in the network. If necessary...
  • Moving ongoing flows to alternative paths.
  • Asking for the disaggregation of ongoing services.

• Provides resiliency and fault recovery:
  • Keeping track of the services and the links they are using.
  • When a link goes down, it identifies the affected services and commits the backup path.

• Performs the scheduling of the services.
  • By defining network snapshots.
The DynPaC Framework:
Path Computation Element

• Path Computation Element:
  • Obtains the network physical topology and computes the shortest path between two network points:
    • ODL topology and switch manager modules are used for this purpose.
    • It takes into consideration bandwidth constraints and scheduling information.
  • Provides a primary path and a pair of auxiliary paths.

DynPaC Service Manager asks the PCE for a path between the source and destination nodes, accordingly with the available bandwidth and topology.
The DynPaC Framework: Path Computation Element

**Path Computation Element:**
- When a new service request cannot be provided with the current flow distribution:
  1. **RELOCATION of flows:** The DynPaC Service Manager implements an algorithm which evaluates all possible flow distributions for all the snapshots affected by the new service request.
  2. If the relocation algorithm does not provide a positive outcome for all the affected snapshots: *Traffic disaggregation.*

**Traffic disaggregation:**
- Attempt to split flows according to the information provided by the Traffic Pattern Analyser.
- Try to accommodate the resulting more granular sub-flows in the network.
- The algorithm prioritizes solutions that minimize the number of split flows.
The DynPaC Framework

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The DynPaC Framework
The DynPaC Framework: GUI

Procedure to request a new service
SDN based BoD Architecture
SDN based BoD Architecture

Overview

A set of SDN/DF enabled switches will be deployed at GÉANT PoPs. The switches will be connected on the client side to the GÉANT local router and on the line side with multiple links to the Infrastrara transmission platform. Lamidas will be provisioned in between switches at different PoPs in order to obtain a partial mesh. The mesh will need to have enough links to makes sure that any client to client port service can be configured without contention; this may mean some services have to be moved and will take less than optimal paths. The SDN controller will take care of routing services in between client ports and will re-route services in order to make space for other services if needed.

NRENs will access the F2P guaranteed services through their main connection to GÉANT. This is terminated to a GÉANT router port, a set of VLANs from this port will be switched across the router to the SDN switch, this will be pre-configured. A set of VLANs (e.g. 1-100) will be statically configured for access to the SDN BoD environment.

Customers will be able to provision services in between any access port to the SDN switching environment the services will be rate limited up to the access port speed and VLAN translation will also be available. Any service provisioned in the environment will have full bandwidth guaranteed as it will use dedicated pipes through the GÉANT transmission environment.
Work in Progress

• DynPac GUI and Interface
• DynPac Migration to ONOS
• Topology Exchange
• Working with On.Lab, CORSA and Infinera to test these frameworks and develop new features
• Developing DynPac Framework / APP for ONOS Controller
• Developing REST API plugin for Infinera OTSv
Thank you and any questions