AutoBAHN
Provisioning guaranteed capacity circuits across networks

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AutoBAHN is…

• … a research activity for engineering, automating and streamlining the inter-domain setup of guaranteed capacity (Gbps) end-to-end paths in an environment with no inter-domain control plane/signaling capabilities

• … a Joint Research Activity of the GN2 project
  • GN2 is an European Commission-funded project, with all the European Research and Education networks (NRENs) as partners
The problem area
Multiple data plane technologies
AutoBAHN approach

- Control and provisioning has to be **distributed**
- **Business-layer** related interactions include AA, policies, advance reservations etc.
- **Privacy and control** of intra-domain resources must be safeguarded
Data plane technologies

• Layer 2 switched circuits
  – Native Ethernet
  – EPL, EVPL over NG-SDH
  – MPLS VLL
  – STM-x

• Layer 1 switched circuits
  – Optical wavelengths
  – OTU-x
AutoBAHN at a glance

- **Definition of an architecture**
  - Distributed
  - Inter-Domain manager (IDM): **inter-domain technology-agnostic functionality**, inter-domain interfaces for peering
  - Domain manager (DM): **intra-domain functionality**, topology information, resource availability information, signaling to the data plane
  - Interfaces

- **Reference implementation** including business layer and control plane functionality
A distributed approach
Intra-domain solutions

• Management plane solutions
  – The Alcatel NMS ISS interface used for EPL/EVPL provisioning over GEANT

• Control plane solutions
  – DRAC: Surfnet-NORTEL solution for the provisioning of lightpaths

• CLI-based tools
  • BLUEnet (HEAnet)
  • ANSTool (GRNET)
  • PIONIER L2 MPLS VLL configuration tool
AutoBAHN is …

A multi-domain glue for local provisioning systems

• The AutoBAHN architecture requires each domain to:
  – Deploy the AutoBAHN system as a controller for inter-domain operations
  – Contribute with the development of a technology proxy between the AutoBAHN DM and the local provisioning system
Inter-Domain Manager

- Addresses:
  - domain independence for resource usage policies and data plane technologies
  - service and network abstraction schema to describe implementation over heterogeneous domain
  - advance reservation
  - multi-domain path finding
  - multi-domain monitoring
  - authentication and authorization
Domain Manager

- Intra-domain operations:
  - Data plane topology handling and abstraction
  - Reservations handling
  - Intra-domain pathfinding
  - Intra-domain monitoring
  - Interface towards Technology Proxy

- The Domain Manager is designed to support modularity

- Complements the missing functionality of the underlying management plane for the operations of AutoBAHN
• Technology proxy between AutoBAHN and the data plane
  – WS-based interface
• Vendor proxies for:
  – NEs
  – Control/ Management plane
  – Provisioning system
Technology proxy interface (1)

- Exchange of **topology/resource availability** information between the data plane and the AutoBAHN DM
- **Communication/signaling requests** from the AutoBAHN DM to the data plane
- **Notifications/errors** from the data plane back to the AutoBAHN DM
- **Modular design** of DM:
  - Parts of the DM functionality can be substituted by management/control plane functions
  - e.g. Intra-domain pathfinder, Topology abstraction
Technology proxy interface (2)

- Main methods:
  - `addReservation(resID, links, params)` – create new circuit reservation
    - `resID` – unique reservation identifier
    - `links` – list of links to be used for this reservation (intra-domain links, defined from ingress to egress port of a domain)
    - `params` – additional reservation parameters, including capacity to reserve
  - `addReservationResponse()` – confirms creation of circuit
  - `removeReservation(resID)` – remove circuit associated with given reservation ID
    - `resID` – unique reservation identifier
  - `removeReservationResponse()` – confirms removal of circuit and release of resources

- More methods related to failures and exceptions
Installation guide

• AutoBAHN server setup
  – Hardware
  – Software
  – Port configurations
• Control plane configuration (AutoBAHN server communication channel setup)
• AutoBAHN IDM and DM installation
• Technology proxy interface documentation & technology proxy development guidelines
Some use cases...
AutoBAHN over the GÉANT2 testbed

Integrating the Alcatel NMS interface with AutoBAHN
Overview
GÉANT2 technology proxy

- Developed in DANTE for AutoBAHN
- Employs ISN interface to NMS
  - A TL1 like command line interface
  - North bound control of functions including topology recovery, path building and alarm reporting
- Technology proxy interface requests are converted to ISN commands:
  - addReservations / reserveResources
  - removeReservation / releaseResources
Implementation issues

• Rollback function ensures clean recovery from fault conditions
• Exception handling ensures that ISN error states are correctly handled and reported back to the DM
• Heartbeat function keeps interface to ISN alive
• Concurrent requests accepted and correctly queued
• Investigating adding smoke ping monitoring of WS interface to improve service maintainability (http://perfsonar.acad.bg/status/nmdm/)
• DANTE is working with Alcatel to provide path building to 10GE interfaces
AutoBAHN in GRNET

Integrating the intra-domain provisioning tool with AutoBAHN
GRNET ANStool

- ANStool: Advanced Network Service tool
  - A WS-based application used to provision GRNET QoS and VPN services
  - CLI-based
    - Produces router configuration to be committed asynchronously by the network administrator
  - Acts as the AutoBAHN technology proxy
- ANStool’s workflow was slightly adjusted to conform to the AutoBAHN model (check-then-reserve)
  - ANStool maps each call from the AutoBAHN DM to its internal functions and returns the appropriate result to the DM over the technology proxy interface
Overview
BLUEnet integration with AutoBAHN

Another intra-domain provisioning tool integrated with AutoBAHN
BLUEnet tool

- HEAnet’s tool for provisioning of port or VLAN mode links over native Ethernet and L2 MPLS VLL clouds
  - Using GRNET’s ANStool
  - HEAnet internally developed workflow and GUI
  - User request through webpage
  - Includes monitoring tools (Cricket and Nagios)
  - Speed of creating/deleting p2p links: minutes
Integration with AutoBAHN

• Abstraction of HEAnet topology by BLUEnet
  – The topology exported to the AutoBAHN DM consists of a cloud with edge ports among which port or VLAN mode links can be provisioned

• Delegation of most functions to BLUEnet NMC system
  – The DM is responsible only for management of reservation, timing (start and stop) and resources used
  – BLUEnet must be aware of particular path and physical resources used

• Introducing AutoBAHN in a domain does not mean changing the approach to network management
  – BLUEnet has physical access to network equipment
  – AutoBAHN performs as a client for BLUEnet
Overview
AutoBAHN in PIONIER

Integration with the intra-domain provisioning tool
PIONIER tool

• The PIONIER data plane consists of Foundry Network XMR8000 switches
  – Configuration is done through CLI
  – Circuits are built using L2 MPLS VLL

• A scripting tool has been developed for the PIONIER data plane to be controlled by AutoBAHN
Current AutoBAHN cloud

- FCCN is just about to join
- More NRENs are interested
**IDC protocol**

- A Web-Services based protocol for inter-domain negotiations between different BoD systems
  - Topology exchange
  - Resource scheduling
  - Signaling
- Different implementations from
  - GN2, Internet2, ESnet, Nortel …
AutoBAHN is IDC-compatible
E-VLBI use case

• In collaboration with the SCARLe project
  – Software Correlator Architecture Research and Implementation for e-VLBI
• Reproduction of an e-VLBI observation where data from radio telescopes across Europe (or across the globe) is sent to a cluster running the SFXC VLBI software correlator in order to be correlated in real-time
• Why is AutoBAHN needed?
  – AutoBAHN functionality is needed to ensure integrity of data transfers from the telescopes to the correlator.
  – The European VLBI Network (EVN) only operates as a VLBI network during a few weeks a year
    • Most telescopes have their own observation programs
    • It is possible to arrange VLBI observation outside the regular sessions for observing so-called transients (Gamma Ray Bursts, flares).
  – The telescopes that actually participate in a VLBI experiment are variable (depending on observation frequency, source brightness, source structure and availability of the telescopes).
  – Since the software correlator can in principle be run on many clusters, the location of the correlation center is no longer fixed
Use-case overview

- Astronomic data over AutoBAHN circuits
Standardization efforts in OGF

• OGF 23
  – Similarities between the GNI BoF and the GNI and DMNR proposals led to an agreement to agree to form a single WG with input from both the BoFs: NSI (Network Services Interface) WG

• OGF 24: Inaugural meeting for NSI WG

• AutoBAHN is participating and contributing to NSI WG
  – Use case documents (Deliverable 1)
    • End user interface
    • Network to network interface
  – Architecture document
The AutoBAHN team

Thank you!