NSI: The common interface towards network services

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http://forge.gridforum.org/sf/projects/nsi-wg

Slides Credit: NSI-WG contributors
Talk Overview

- Need for common Network Service Interface
- History and Status of the NSI-WG
- Network Services Interface Overview
- NSI Use Cases
- NSI-WG architectural considerations
Need for common NSI interface

• High performance networks offer advanced network services to end users with differing requirements.
• The user/application/middleware may request network services from one or more network service providers through a network service interface.
• The network service setup then requires configuration, monitoring and orchestration of network resources under particular agreements and policies.
NETWORK SERVICE INTERFACE: Interoperability-Issue

Users

Globus Middleware

Any Service Prov. System

Resources

gLite Middleware

Applications

UNICORE Middleware

Interface A

Interface B

Interface C

Interface D

Interface E

NRPS

ANY

NRM

GMPLS CP

MPLS (L1/2/3 VPN)

Network Resources

Wrapper

Wrapper

Wrapper

Wrapper
NETWORK SERVICE INTERFACE: Interoperability-Aim

NSI: The common interface towards network services
History and Status of NSI-WG
History and Status of NSI-WG

- 2 BoFs were held in OGF 23 (June 2008 - Barcelona)
  - GNI-BoF (by Phosphorus and G-lambda) and
  - DMNR-BoF (by Internet2 DICE and GEANT2 AutoBahn)

and many others (Carriocas, Nortel, Alcatel-Lucent, KDDI, NTT, NiCT, 3TNET, etc.) were involved.

- The GNI and DMNR merged into NSI-WG.
- Inaugural NSI-WG meeting in OGF24 (Sept. 2008 - Singapore)
- Chairs: Guy Roberts (Dante), Tomohiro Kudoh (G-Lambda), Inder Monga (Nortel)
- Currently there are initial drafts of 2 deliverables:
  - Use Case Document (Editors: Eduard Escalona, Georgios Zervas)
  - Architecture Document (Editor: John Vollbrecht)

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Network Service Interface Overview
The NSI-WG aims to provide the recommendation for a generic network service interface that can be called by a

- network external entity such as end users or middleware (vertical)
- other network service providers (horizontal)

in order to provide interoperability in a heterogeneous multi-domain environment.

The recommendation will define the information exchange, the required messages and protocols, operational environment, and other relevant aspects.

The WG will consider user authentication/authorization, service negotiation agreements, and information exchange to describe advanced network services.

The NSI WG recommendation will allow any user and network service to interoperate by using a common naming and message definition.
Network Service Interface

- Defines Protocol between agents

- Requestor might be
  - Host, middleware, network provider

- NS agent/Resource might be
  - Home net
  - Campus net
  - National infrastructure provider
  - Communication link provider
NSI functionalities

- Resource management
  - Scheduling
  - Reservation
  - Instantiation
  - Negotiation
- Resource Information
  - Service discover / network capabilities
  - Topology exchange
  - Monitoring
  - History
  - Security
Network Service Definition I
Connection Oriented networking

- Controlled by a NS agent
- Provides Connection segments between edge points
- Two types of NS connection resource
  - Network
    - Can provide segments between edge-points of the network in response to a service request
    - Can adapt segments between edge-points
    - Can cross connect segments at edge-points
    - Owns adaptation and edge points
  - Link
    - Provides segments between edge points on different Networks (passive)
Network Service Request

- A Network Service Request consists of
  - Route
  - Attributes
- Route
  - Ingress Endpoint
  - Intermediate points (optional)
  - Egress Endpoint
- Attributes of a segment
  - Edgepoint attributes [e.g. VLAN id, color]
  - QoS parameters [protection, resiliency, TTR]
  - Performance attributes [e.g. bandwidth, jitter]
  - Time attributes [duration, extendability, minimum]
  - User attributes [e.g. requestor id, originator group]
  - Other?
Use Case Deliverable
Use Case deliverable objectives

- Study of current use case solutions
- Provide requirements and desired functionalities
- Show how specific use cases deal with these functionalities
Use Case Questionnaire (I)

Contributors

- edutain@grid (Alexander Ploss)
- Alcatel-Lucent Bell Labs France (Bela Berde)
- Phosphorus-G2MPLS (Bartosz Belter)
- KDDI (Takahiro Miyamoto)
- Internet 2 (John Vollbrecht)
- i2CAT (Pedro Lorente)
- SARA (Freek Dijkstra)
- BUPT (Hui Li)
- 3TNET (Weiqiang Sun)
Use Case Questionnaire (II)

- Centralized management or Distributed Control Plane
- Large Bandwidth
- Multiple granularity
- Multipoint-to-multipoint
- Advance Reservations
- Network monitoring
- Security support
- Heterogeneous transport technologies
- Topology exchange
- Failure detection
Interfaces for interoperability between different Provisioning systems in Phosphorus

NSI: The common interface towards network services
NSI-WG architectural considerations
NSI-WG architectural considerations

- **Naming and modelling**
  - Naming of network objects and data modelling of these objects.

- **Connection calls, scheduling and job control**
  - NSI calls/scheduling support by NSI and associated job control flows.

- **Environments and scenarios (tree/chain)**
  - NSI implementation environments

- **Topology sharing**
  - Topology exchanged over the NSI interface.

- **Future considerations:**
  - Service Discovery / Network capabilities
  - Path computation
  - Authentication / Authorization / Accounting
  - Failure detection
  - Monitoring
Naming and modelling

Connections – network and user views

• What is the data plane service delivered?
• Understanding customer network requirements
• Defining customer categories

NSI environments

• Context for implementations of the NSI interface
• Network centric vs. user centric

• Aligning NSI naming with Network Markup Language (NML-WG)
The problem

- An NSI service request should provide sufficient information to the network service agent for it to be able to build a circuit that meets the service requirements of the user.
- How much technical detail is really needed to do this?
- Is it sufficient to simply nominate edge points and a bandwidth?
- Or do technology-specific parameters need to be specified?

Type of requests

- Designate request
  - A request of specific physical resources

- Abstract request
  - A request of resources with specified capabilities (attributes).
  - Mapping to physical resources required.
The target service

The successful ETE connection will connect the end devices in a connection oriented way with a performance that meets the user needs in terms of:

- Throughput: bandwidth, packet loss ratio
- Timing characteristics: reordering, latency, jitter
- The transparency to client protocols
- …
Types of reservations

- **Bandwidth on Demand**
  - If the request is an abstract request, mapping of physical resources is done.
  - If the resources are available, the resources are allocated
  - If the resources are not available, the request is simply denied.
  - Usually, the requester can use the allocated resources as long as it wants. The end time of the provisioning is not determined at the time of provisioning.

- **Instant reservation**
  - If a reservation request requests immediate allocation of resources, the request is called “instant reservation”.
  - Different from the *pure* “on-demand” the end time of a provisioning is determined at the time of scheduling.

- **Advance reservations (book ahead)**
  - A request is processed by a scheduler, and the scheduler finds a period when the requested resources are available for the requested duration.
  - The resources are reserved during the reservation period, and when the reservation period begins, the resources are allocated to the requester.
  - Scheduling is done when a request is issued. In addition, re-scheduling may be done when availability of resources is changed.
Chain vs. Tree Model

- Chain model assumes that nodes/domains are allowed to communicate only one-by-one, passing message from one to another.

- Tree communication model does not introduce “reachability” limitations, thus any node/domain can contact directly any other (despite if they are adjacent), also in simultaneous way.
## Chain/Tree Comparison

<table>
<thead>
<tr>
<th></th>
<th>Chain</th>
<th>Tree</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Node order</strong></td>
<td>Visited nodes has exactly defined order</td>
<td>There is no predefined order of reaching nodes</td>
</tr>
<tr>
<td><strong>Request update</strong></td>
<td>Next nodes along path may have access to previous nodes information (as request may be updated by them)</td>
<td>All information exchange between nodes needs to go through central point (request sender) or be independent messaging process between adjacent nodes</td>
</tr>
<tr>
<td><strong>Failure</strong></td>
<td>Less flexibility in case of failure (chain break needed if intermediate node is down)</td>
<td>Flexibility in case of failure (can simply avoid not responding node)</td>
</tr>
<tr>
<td><strong>Delivery time</strong></td>
<td>Message delivery depends on number of hops between nodes</td>
<td>Immediate message delivery independent from nodes distance (hops) – theoretical</td>
</tr>
<tr>
<td><strong>AAI</strong></td>
<td>AAI consideration may base on neighbor trusts</td>
<td>AAI infrastructure needs to allow any-to-any communication</td>
</tr>
<tr>
<td><strong>Flooding and Loops</strong></td>
<td>Ordered messaging process allows to control messages loops and flooding</td>
<td>Flooding possible in one-to-many communication</td>
</tr>
</tbody>
</table>
Topology Information Sharing

• Questions to address (network owner/controller centric):
  
  • What? → the object (or passive subject)
  • How?  → the action
  • When? → the time factor
  • Who to? → the indirect object (or action receiver)

Questions above should map in the information to be carried in the NSI

• In terms of topology information sharing, the requestor agent and the NS agent are homologous entities.
NS Agent Interactions satisfying a connection request

Requestor agents

NS Agents (middle, also requestors)

NS Agents (leaf)
Challenges/next steps

- Coordination with networking standards – (e.g. IETF, ITU-T)
- Monitoring
- Aligning NSI naming with NML
- Topology exchange
- Authorization and authentication
- Service discovery/Network capabilities
- Aligning web service implementation to OGF reference implementations for deliverable 3
THANKS!

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