NSI: The common interface towards network services

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

Slides Credit: NSI-WG contributors

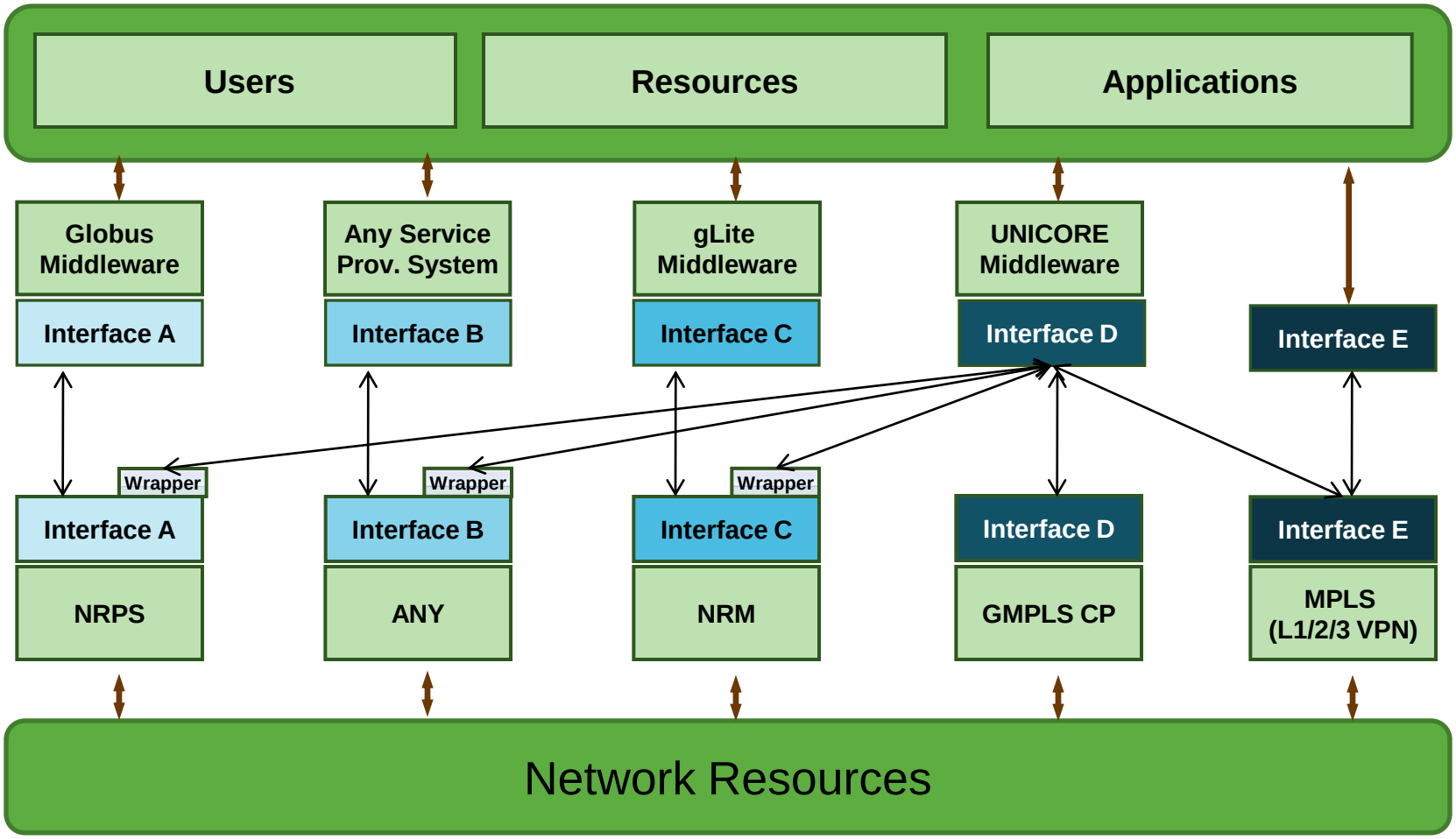
Talk Overview

- 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

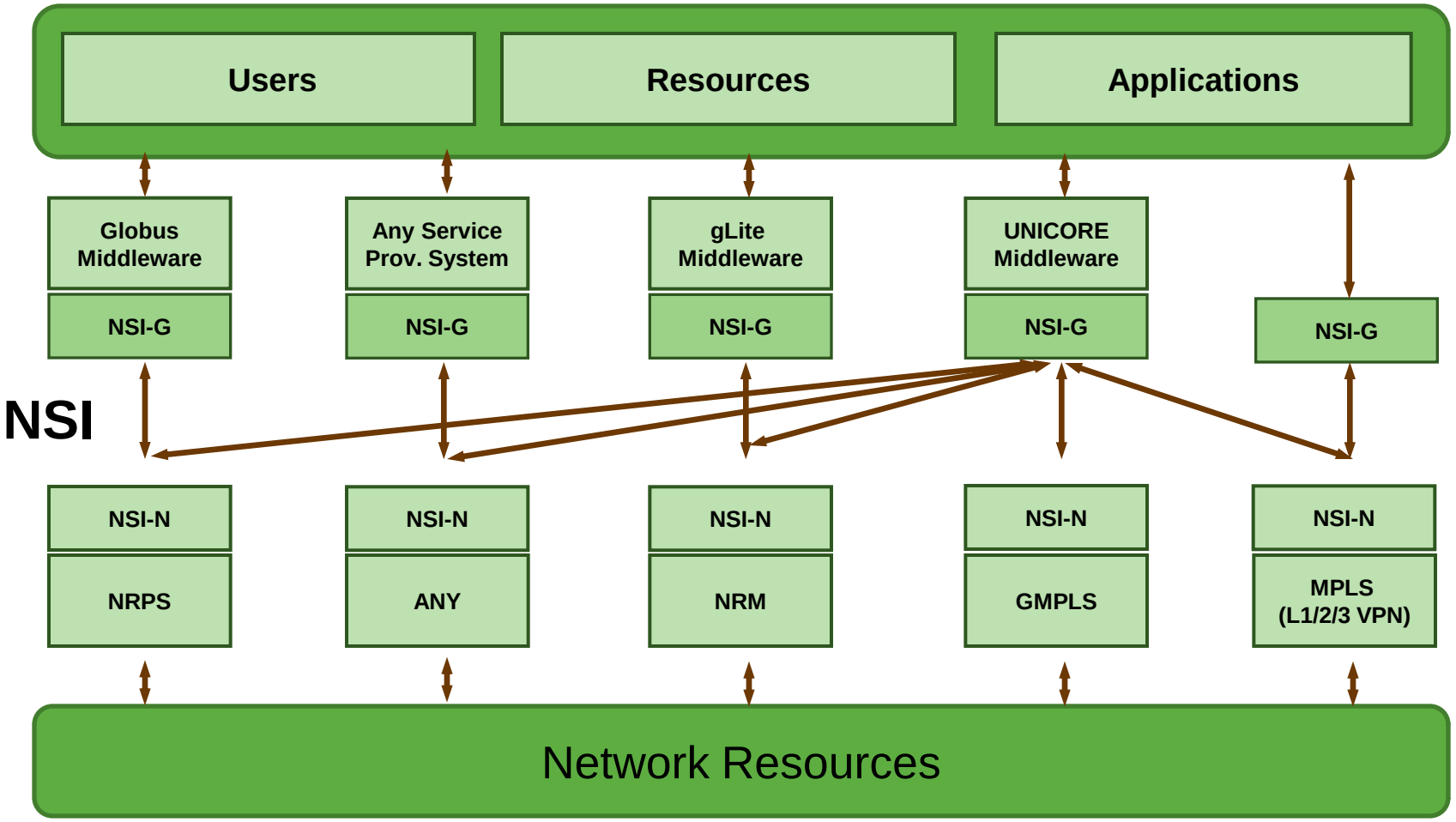
- High performance networks offer advanced network services to end users with differing requirements.
- The user/application/middleware may request network services from one or more network service providers through a network service interface.
- The network service setup then requires configuration,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

NETWORK SERVICE INTERFACE: Interoperability-Issue



NSI: *The common interface towards network services*

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

Network Service Interface WG (NSI-WG)

- 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.

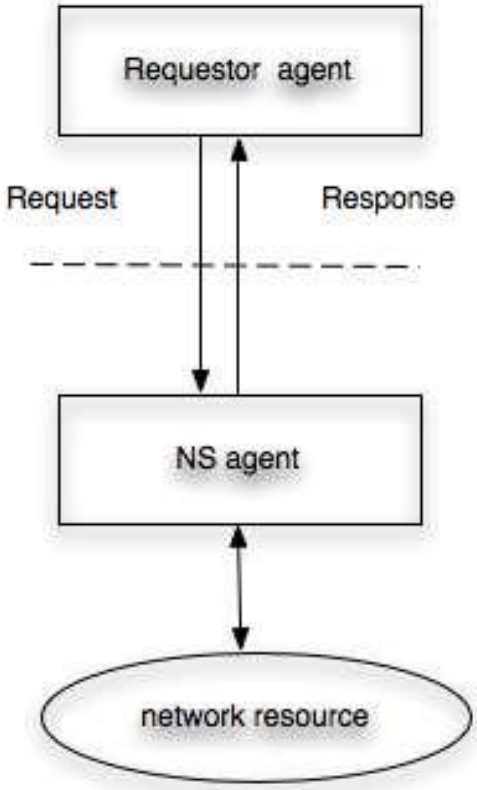
- The recommendation will define the information exchange, the required messages and protocols, operational environment, and other relevant aspects.

- 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

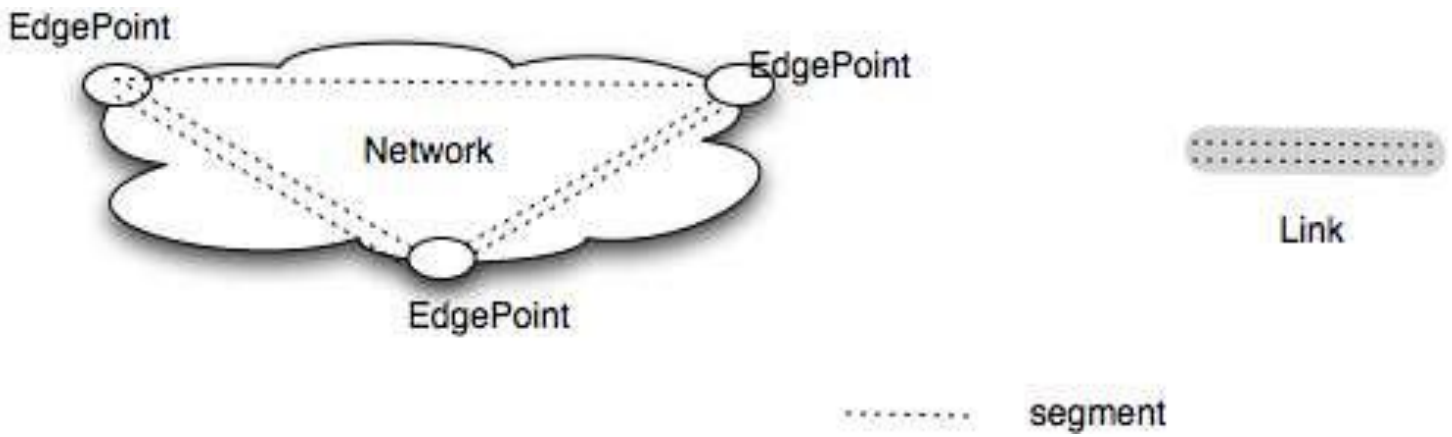


NSI functionalities

- 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)

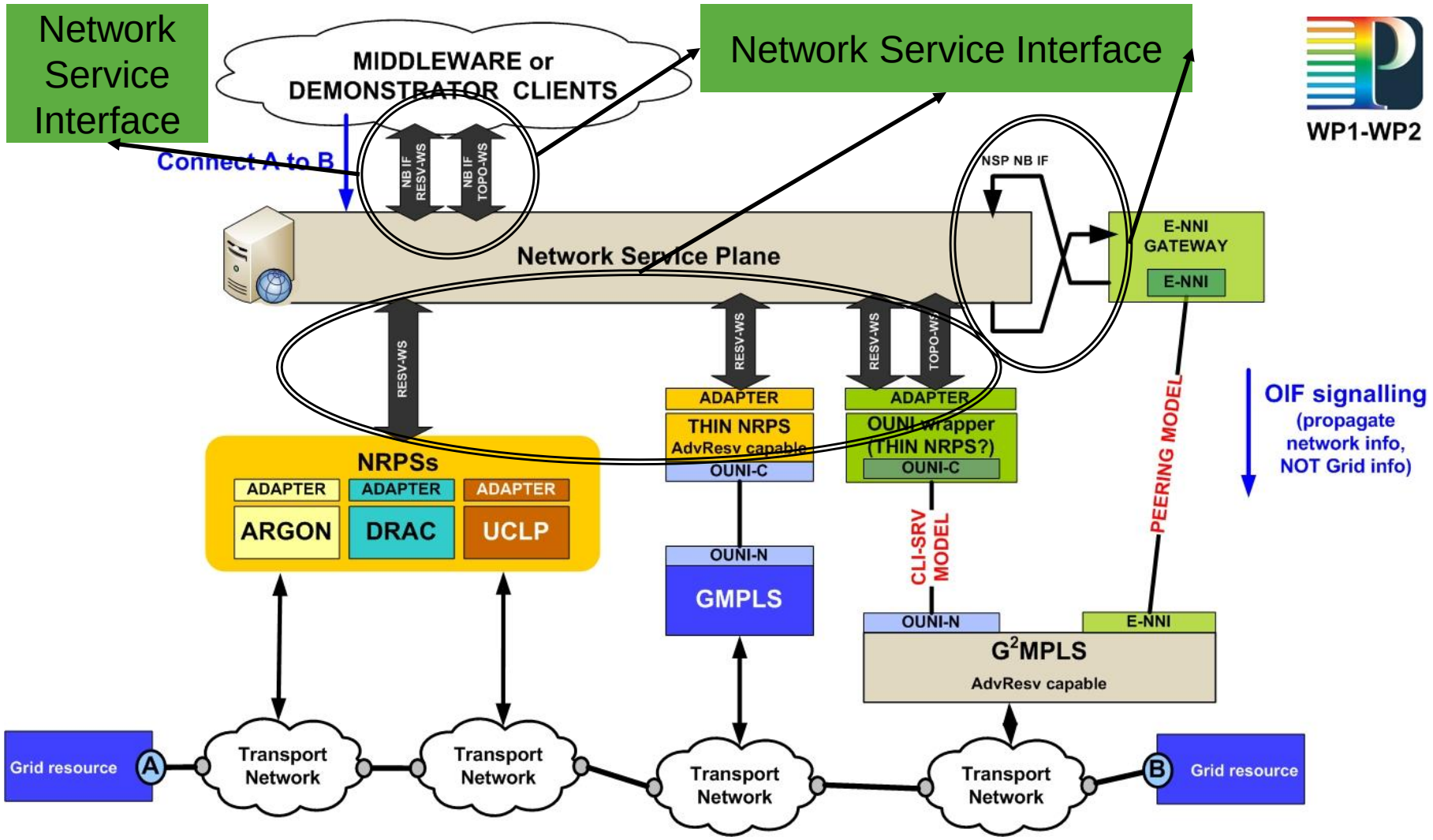
Contributors

- 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 Dijstra)
- 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-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)

Type of requests:
Abstracted vs. Technology-Specific Attributes

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?

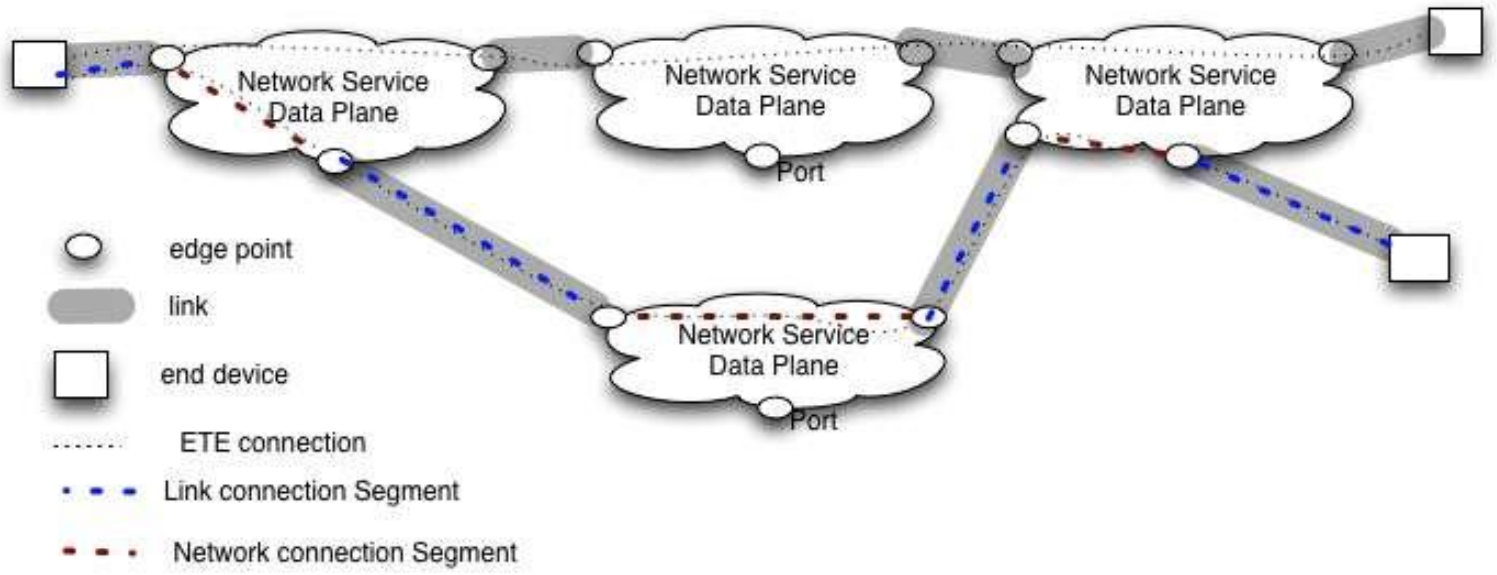
Type of requests

- 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
- …



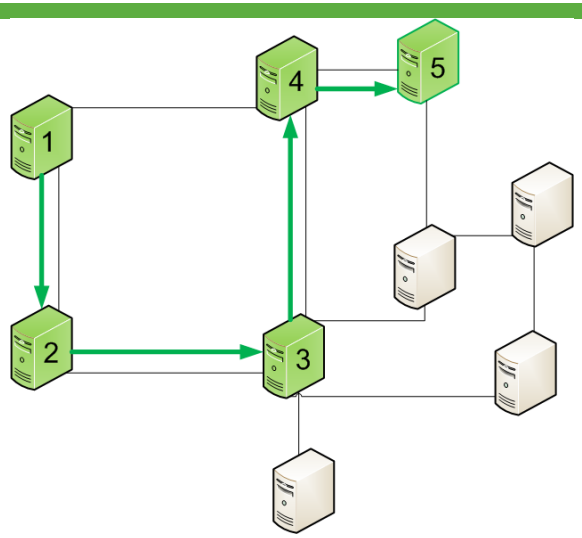
data connections crossing multple Network Services

Types of reservations

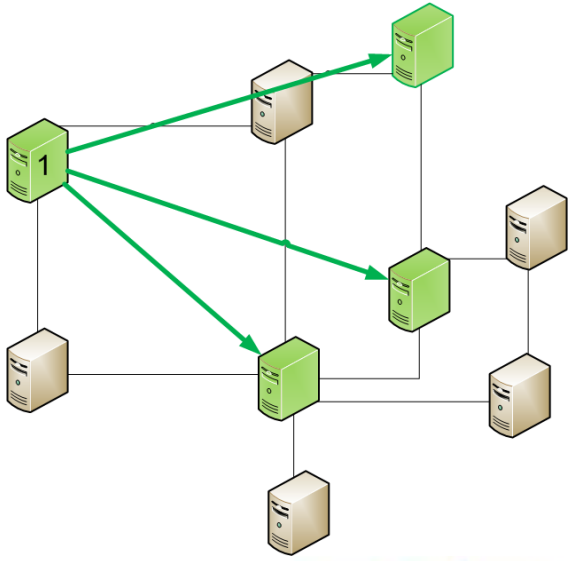
- Bandwidth on Demand
  - If the request is an abstract request, mapping of physical resources is done.
  - If the resources are available, the resources are allocated
  - If the resources are not available, the request is simply denied.
  - Usually, the requester can use the allocated resources as long 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

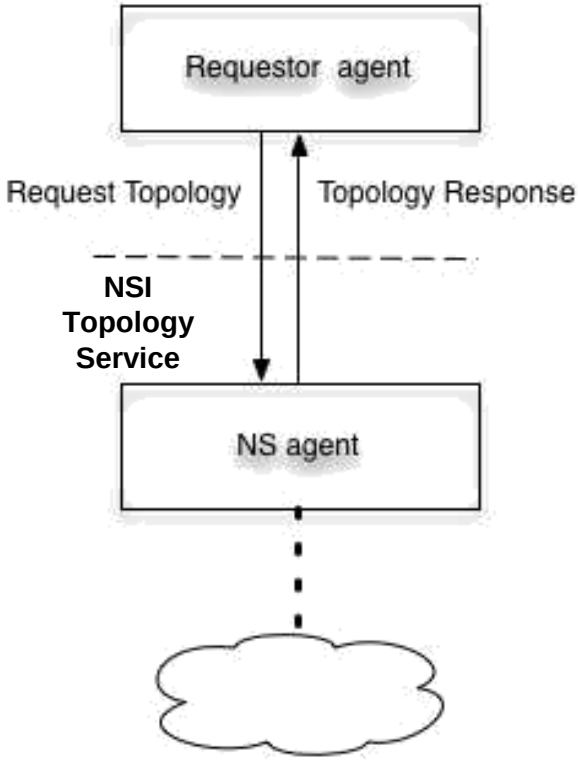
	Chain	Tree
Node order	Visited nodes has exactly defined order	There is no predefined order of reaching nodes
Request update	Next nodes along path may have access to previous nodes information (as request may be updated by them)	All information exchange between nodes needs to go through central point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

Topology Information Sharing

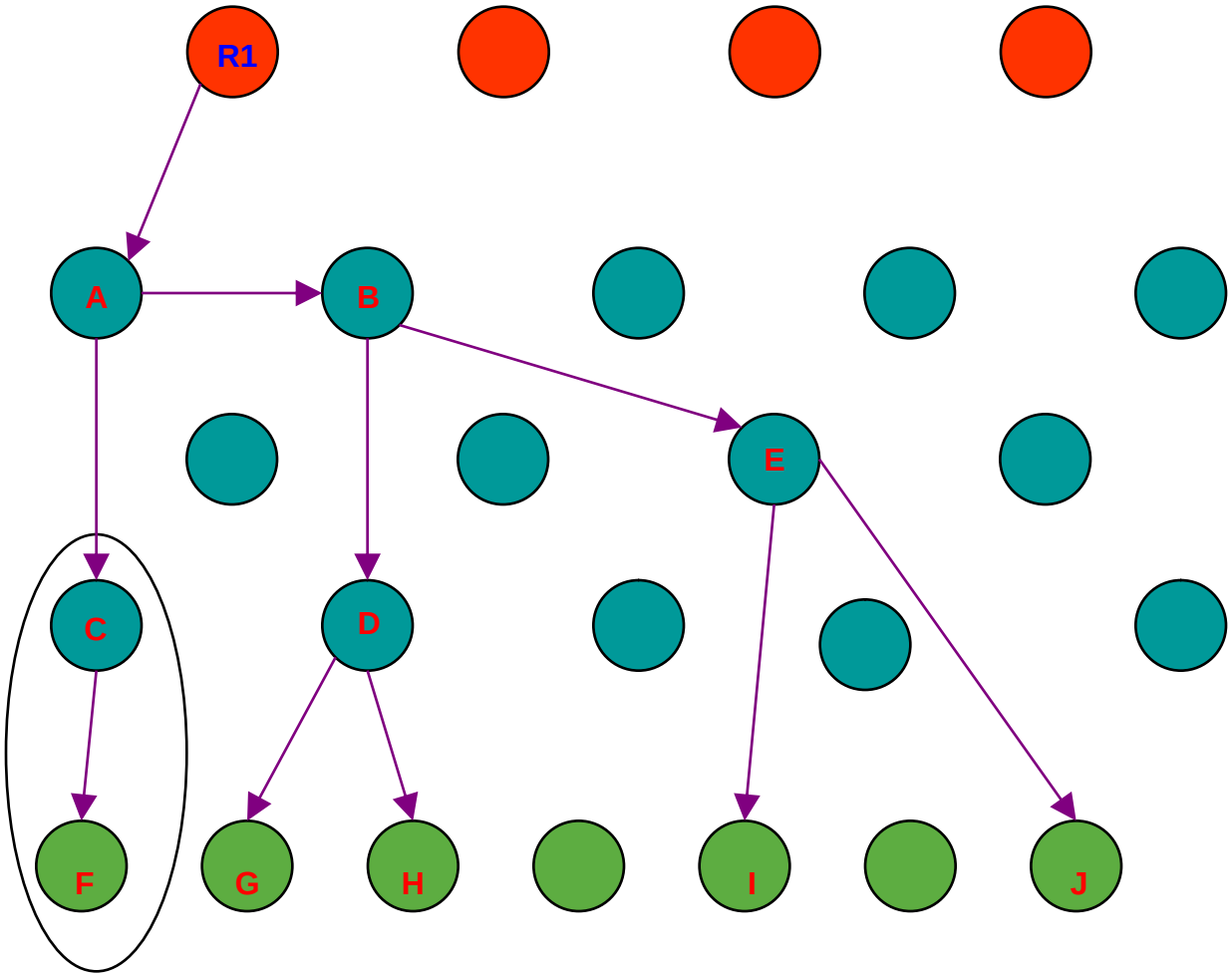
- Questions to address (network owner/controller centric):
  - What? → the object (or passive subject)
  - How? → the action
  - When? → the time factor
  - Who to? → the indirect object (or action receiver)

  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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