NM-WG/perfSONAR Topology Schema

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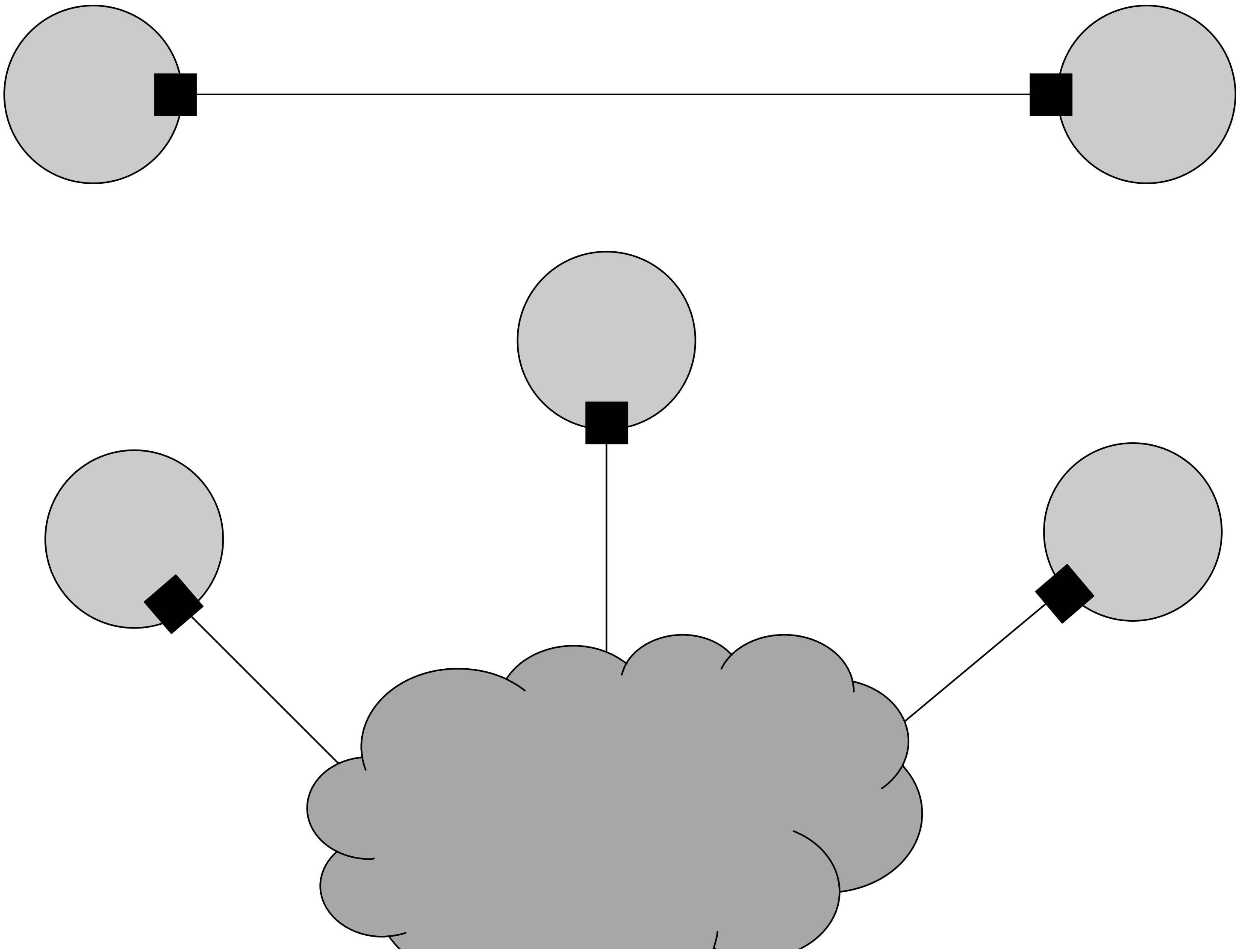
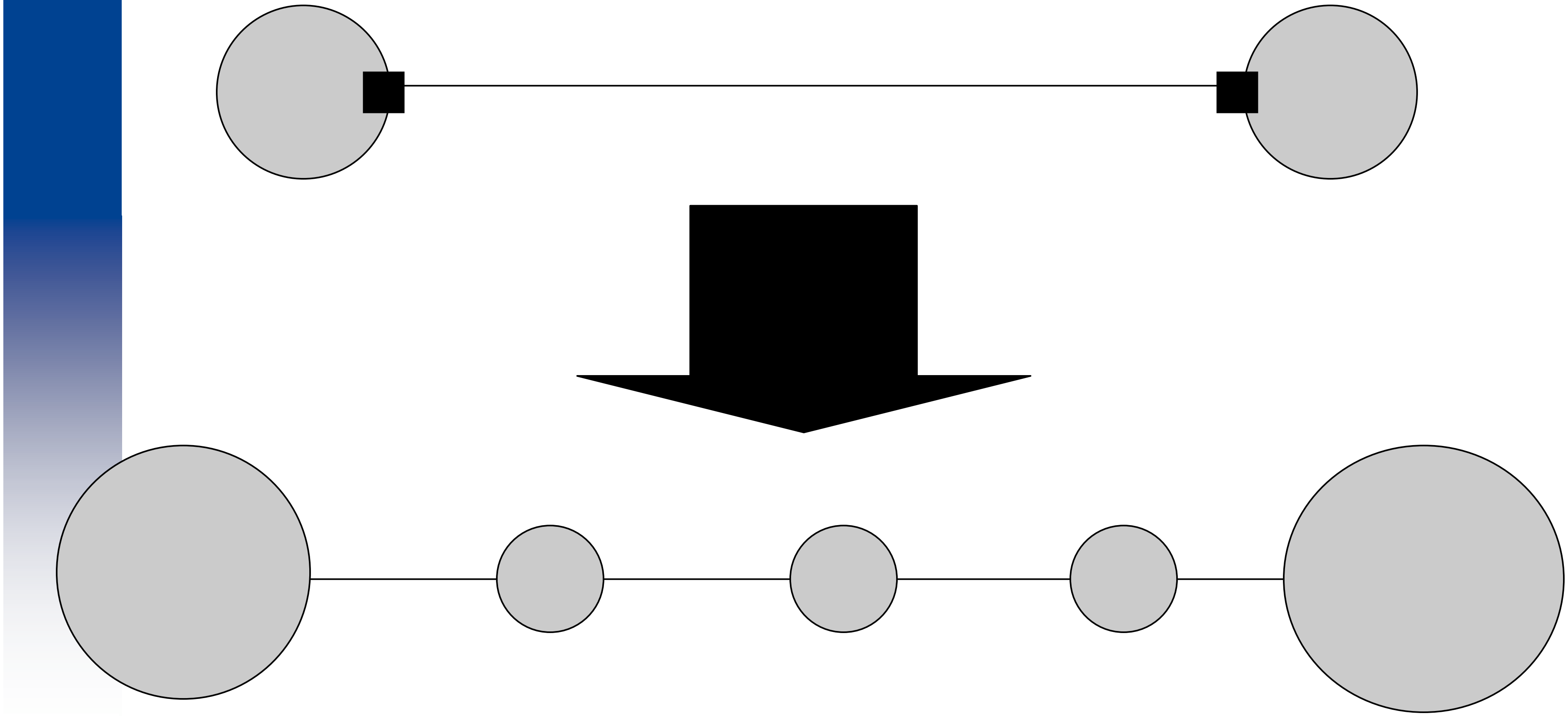
Topology Schema

- Topology schema grew from network measurement schema from the NM-WG in the OGF (the basis of perfSONAR)
  - Reusable “Subject” elements for common cases
    - Also reduces redundancy
  - Relationships between measurement Subjects
- Same basic structure at all layers
  - Networks are *graphs*
- Key elements:
  - Node
  - Port (renamed from Interface)
  - Link
  - Network
  - Path
  - Relation
    - New element replacing ID/IDREF structure

Topology



Topology - Recursive Links



Version 3 Topology Schema

- Structured by layers and the same elements recurring there
- Varied by namespaces
  - Reuse visualization logic, etc.
  - Validate layer- or technology-specific attributes
- 4 Layers: Base (both abstract and L1), L2, L3, L4

```
<?xml version="1.0" encoding="UTF-8"?>
<nmwg:store xmlns:nmwg="http://ggf.org/ns/nmwg/base/2.0/"
   xmlns:nmwgt="http://ggf.org/ns/nmwg/topology/20070828/"
   xmlns:nmwgtl3="http://ggf.org/ns/nmwg/topology/l3/20070828/"
   xmlns:nmwgtl2="http://ggf.org/ns/nmwg/topology/l2/20070828/">
```

Hierarchy of Namespaces

- Recent work
- Use technology-specific namespaces
  - http://ogf.org/ns/nmwg/topology/l2/sonet/20070828/
  - http://ogf.org/ns/nmwg/topology/l2/sdh/20070828/
  - http://ogf.org/ns/nmwg/topology/l2/ethernet/20070828/
  - http://ogf.org/ns/nmwg/topology/l3/ipv4/20070828/
  - http://ogf.org/ns/nmwg/topology/l3/ipv6/20070828/

Relationships between Elements

- Elements at the same layer have relationships
  - A layer2 link is related to its layer2 interface
- Elements of the same sort have relationships between themselves at different layers
  - A Layer 1 Interface (physical NIC) can have one or more Layer 2 Interfaces, which can each have one or more Layer 3 Interfaces
- Node is special
  - Since a Node doesn’t really have any higher-layer characteristic independent of its Interfaces

Relationships between Elements

- Recursive definition of links
  - Logical links consist of physical links
- A path is an ordered list of elements
  - Can be similar to above but we need to introduce an Index attribute
- Networks
  - Physically consist of links but that is not always the most convenient logical view
  - Special element to which Domains, Nodes, Interfaces or Links belong

Current Status

- Document for Version 3/3+ schema is (nearly) ready
- The Network Markup Language WG (NML-WG) in the OGF should take up this effort
- The topology schema has been extended to support topology exchange and pathfinding
  - The Internet2, GEANT2 and Esnet are using this schema
  - Ideally, this facilitates a close tie between dynamic services and monitoring
- Unification of monitoring and control schemata

Network Element Identifiers

- A scheme for identifying network elements
- Each network element gets a unique identifier
- This identifier will be included with any measurement associated with that element.

Network Element Identifiers

- Use Case:
  - A client would use a topology service to look up the identifier for a network element and then would query a lookup service using the identifier to find the measurements associated with that element.

Network Element Identifiers

- Identifiers use URN notation
  - Prefixed with “urn:ogf:network:”
  - Consists of name/value pairs separated by colons
  - Possible field names: domain, node, port, link, path, network
  - Set of rules defined for each field to keep identifiers compact and finite

Network Element Identifiers

- Examples
  - urn:ogf:network:domain=Internet2.edu
  - urn:ogf:network:domain=internet2.edu:node=packrat
  - urn:ogf:network:domain=internet2.edu:node=rtr.seat:port=so-2%2F1%2F0.16
  - urn:ogf:network:domain=internet2.edu:node=rtr.seat:port=198.32.8.200
  - urn:ogf:network:domain=Internet2.edu:node=packrat:port=eth0:link=1
  - urn:ogf:network:domain=internet2.edu:link=WASH to ATLA OC192
  - urn:ogf:network:path=anna-11537-176

Network Element Identifiers

- Current Users
  - DICE Control Plane groups
  - perfSONAR

Topology Service

- Provides a queryable repository for obtaining topology information about a domain
  - Can obtain the entire network
  - Xquery interface allows the construction of arbitrarily complex queries about the network

Topology Service

- Current Deployments
  - Internet2 Link Status (part of the GEANT2 E2E-MON
- Planned Deployments
  - Internet2 DCN
  - SLAC (PingER Topology Information)

Link Status Measurement Archive

- Provide access to up/down status information about layer2 links
  - Data stored in a SQL database
  - Database schema allows for storing time ranges during which a link had a certain status
    - Minimizes storage costs for rarely changing links
- Collector
  - Can use SNMP, Scripts or simply Constants
  - Can store results directly into a database or into a remote Measurement Archive
- Links identified by their “network element identifier”

Link Status Measurement Archive

- Current Deployment
  - Internet2 Network
  - HOPI (in2p3 circuit)
- Planned Deployment
  - SLAC

Circuit Status Measurement Archive

- An e2emon-compatible service
  - Integrates with the Link Status MA to provide the information stored in MAs
    - Can work with local MAs directly or with remote MAs
  - Can use the Topology service to obtain necessary information about nodes
  - Can use a Lookup Service to lookup the MA containing information on each link

Circuit Status Measurement Archive

- Current Deployment
  - Internet2 Network
  - HOPI (in2p3 circuit)
- Planned Deployment
  - SLAC

perfSONAR-UI Plugin

- Obtains Topology information from a Topology service and graphs it
- Looks up the Link Status MA for each link from the Lookup Service using the link identifiers
- Obtains the status of each link
- Graphs the Topology and colors each link depending on its status

NML-WG

- Extensible namespace-based ontology rendered in a neutral format
- This could allow short-term rendering into both NDL and NMWG “styles”
- We have worked on translations between from NDL to NMWG
  - Interesting proof of concept
- In some sense, making that easy and unambiguous is a good first step