Optical Networking & Network Descriptions

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Outline

1. **Optical Networking**
   - SURFnet
   - Global Lambda Integrated Facility
   - Setting up a lightpath
   - Setting up multiple lightpaths

2. **Semantic Web**
   - Introduction
   - Resource Description Format

3. **Network Descriptions**
   - Network Description Language
   - Example Scenario
   - Application of NDL
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About SURFnet

- Dutch National Research and Education Network
- Provides high-quality connection
- Constant innovation and improvement
- New network every 4 years
SURFnet 6: Hybrid Network

- Based on dark fiber
- Service determined by hardware
- Users can request lightpaths
Different Internet Users

A. Home users, many to many
B. Business, several to several
C. Science, few to few
Different Internet Users

A. Home users, many to many
B. Business, several to several
C. Science, few to few

Total Bandwidth

100 Gb/s

Bandwidth requirements

40 Gb/s

30 Gb/s

GigE

ADSL
Hybrid Infrastructure

**IP Router**
(L3, €70.000/port)

**Ethernet Switch**
(L2, €7.000/port)

**Optical Switch**
(L1, €1.000/port)
Different Colours

Different lightpaths using the same fibre:
Global Lambda Integrated Facility

- Group of co-operating research networks & institutions
- Make lightpaths available globally
- Sharing their research and knowledge
Global Lambda Integrated Facility
Setting up a lightpath

In 5 easy steps:

1. Determine start and end nodes
2. Contact provider to set up lightpath
   - Provider does (social) path discovery
   - Forwards request to other domains
   - Sets up local path
3. Configure end nodes
4. Fault detection
5. Hope for the best
Convention: iGrid 2005

- ‘Small’ research convention
- About 50 demonstrators from 20 countries
- High-speed, high-bandwidth networks
- Testbed for new applications
- Knowledge exchange
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Universal descriptions

- We need descriptions readable by both *humans* and *computers*

- Problem: Computers still have no common sense.

Example

- ‘A is connected to B.’
- ‘There is a connection between A and B.’
Universal descriptions

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- **Problem**: Computers still have no common sense.

**Example**
- ‘A is connected to B.’
- ‘There is a connection between A and B.’
Resource Description Format

- Resource Description Format (RDF) is a Semantic Web technique.
- RDF is a lightweight ontology system
- RDF describes things using triplets:

Example

```
Document 1
```

```
dc:creator
"Jeroen van der Ham"
```
Example

“This document is written by Jeroen van der Ham”
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Network Description Language

- Location
- Device
- Interface
Network Description Language

- **Location**
- **Device**
- **Interface**

- locatedAt
- hasInterface
- connectedTo
- description
- name
- switchedTo
Example Scenario

Example

Rembrandt3 eth0 Glimmerglass port3

J. van der Ham (UvA & TNO)
Example of NDL

```xml
<ndl:Device rdf:about="#Rembrandt3">
  <ndl:name>Rembrandt3</ndl:name>
  <ndl:locatedAt rdf:resource="#Lighthouse"/>
  <ndl:hasInterface rdf:resource="#Rembrandt3:eth0"/>
</ndl:Device>
```
Example of NDL

```xml
<ndl:Device rdf:about="#Rembrandt3">
  <ndl:name>Rembrandt3</ndl:name>
  <ndl:locatedAt rdf:resource="#Lighthouse"/>
  <ndl:hasInterface rdf:resource="#Rembrandt3:eth0"/>
</ndl:Device>

<ndl:Interface rdf:about="#Rembrandt3:eth0">
  <ndl:name>Rembrandt3:eth0</ndl:name>
  <ndl:connectedTo rdf:resource="#Glimmerglass:port3"/>
</ndl:Interface>
```
Example of NDL

```xml
<ndl:Device rdf:about="#Rembrandt3">
  <ndl:name>Rembrandt3</ndl:name>
  <ndl:locatedAt rdf:resource="#Lighthouse"/>
  <ndl:hasInterface rdf:resource="#Rembrandt3:eth0"/>
</ndl:Device>

<ndl:Interface rdf:about="#Rembrandt3:eth0">
  <ndl:name>Rembrandt3:eth0</ndl:name>
  <ndl:connectedTo rdf:resource="#Glimmerglass:port3"/>
</ndl:Interface>

<ndl:Interface rdf:about="#Glimmerglass:port3">
  <ndl:name>Glimmerglass:port3</ndl:name>
  <ndl:connectedTo rdf:resource="#Rembrandt3:eth0"/>
</ndl:Interface>
```
Application of Network Descriptions

- Overview of resources
  - Easier path discovery
  - Simple problem detection
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- Overview of resources
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Application for TNO

- Network part of NetForce
- Common Warrior Interoperability Demonstrator
- Naval Fire Support scenarios
- ...
Thank You!

More information:
http://www.science.uva.nl/~vdham/research/ndl/