OTN3-2006: Very Dynamic LightPath Applications in DAS3 & StarPlane.

Cees de Laat

SURFnet

BSIK

EU

University of Amsterdam
DAS = Distributed ASCI Supercomputer

- Project DAS-1 started in 1997 by Andrew Tanenbaum
- To prove distributed clusters were as effective as super...
- 4-5 clusters connected via high speed links
  - DAS-1 -> 6 Mbit/s full mesh ATM
  - DAS-2 -> Gbit/s L3
  - DAS-3 -> StarPlane
- DAS-1 ran BSD, changed to Linux (Andrew... :-)
- DAS-1 and 2 uniform architecture, not so in DAS-3
- Over 200 users, 25 Ph.D. theses
- http://www.cs.vu.nl/das/
SURFnet6 Architecture discussions 2001-2002

• photonic backbone
• (L2 and) L3 services
• NORTEL
• Static
• Summer 2004 K&C
• NWO-GLANCE
• StarPlane
• PHD-PD-SP
• Start 1-feb-06, Li Xu, Jan Philip Velders, Jason Maasen
  – Henri Bal, Paola Grosso, Herbert Bos, CdL, SN-folks.

ref: cdl-2002-01-18-UCL-opt.ppt
StarPlane Approach

- StarPlane is a NWO funded project with major contributions from SURFnet and NORTEL.

- The vision is to allow part of the photonic network infrastructure of SURFnet6 to be manipulated by Grid applications to optimize the performance of specific e-Science applications.

- StarPlane will use the physical infrastructure provided by SURFnet6 and the distributed supercomputer DAS-3.

- The novelty: to give flexibility directly to the applications by allowing them to choose the logical topology in real time, ultimately with subsecond lambda switching times.
GRID-Colocation problem space

Extensively under research

New!
In The Netherlands SURFnet connects between 180:
- universities;
- academic hospitals;
- most polytechnics;
- research centers.
with a user base of ~750K users

> 6000 km comparable to railway system
Subnetwork 1: Green

Subnetwork 2: Dark blue

Subnetwork 3: Red

Subnetwork 4: Blue Azur

Subnetwork 5: Grey

Common Photonic Layer (CPL) in SURFnet6 supports up to 72 Lambda’s of 10 G each 40 G soon.
QOS in a non destructive way!

• Old QOS:
  – have a link or $\lambda$
  – set part of it aside for a lucky few under higher priority
  – rest gets less service

• New QOS:
  – have a $\lambda$
  – add other $\lambda$‘s as needed on separate colors
  – move the lucky ones over there
  – rest gets also a bit happier!
DAS-3 Cluster Tender

http://www.clustervision.com/pr_das3_uk.html

10 Gbit/s Ethernet lanphy

NORTEL

1 Gbit/s Ethernet

Local interconnect

85 compute nodes

Fast interconnect

MYRINET

To SURFnet

10 Gbit/s Ethernet lanphy

To local University

head node (2)

UvA-node

10 Gbit/s Ethernet
What makes StarPlane fly?

- Wavelength Selective Switches
  - for the “low cost” photonics
- Sandbox by confining StarPlane to one band
  - for experimenting on a production network
- Optimization of the controls to turn on/off a Lambda
  - direct access to part of the controls at the NOC
- electronic Dynamically Compensating Optics (eDCO)
  - to compensate for changing lengths of the path
- traffic engineering
  - to create the OPN topologies needed by the applications
- Open Source GMPLS
  - to facilitate policy enabled cross domain signalling
Traffic engineering
Application - Network interaction

App 1

App 2

App 3
Workflow based App.

App 1

App 2

App 3
Workflow based App via grid.
Key issue #1: how to describe such networks?
UvA/SARA LightHouse
A joint network research lab of the University of Amsterdam and SARA.
Connects end resources to NetherLight.
Proof of concept e.g. tier 0/1, webservices, GSP
Another path-finding problem
“a universal medium for the exchange of data where data can be shared and processed by automated tools as well as by people”

The Resource Description Framework (RDF) uses XML as an interchange syntax. Data is described by triplets:
NDL - Network Description Language

A way to describe network resources using RDF. Parser can use the data to:
- generate network maps
- provide information to schedulers

```xml
<ndl:Device rdf:about="#Vangogh3">
  <ndl:name>Vangogh3</ndl:name>
  <rb:isOfType>ComputingElement</rb:isOfType>
  <ndl:locatedAt rdf:resource="#Lighthouse"/>
  <ndl:hasInterface rdf:resource="#Vangogh3:eth2"/>
</ndl:Device>
```
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    xmlns:ndl="http://www.science.uva.nl/research/air/ndl#">
    <!-- Description of Netherlight -->
    <ndl:Location rdf:about="#Netherlight"/>
    <ndl:name>Netherlight Optical Exchange</ndl:name>
    <!-- TDM3.amsterdam1.netherlight.net -->
    <ndl:Device rdf:about="#tdm3.amsterdam1.netherlight.net">
        <ndl:name>tdm3.amsterdam1.netherlight.net</ndl:name>
        <ndl:locatedAt rdf:resource="#amsterdam1.netherlight.net"/>
        <ndl:hasInterface rdf:resource="#tdm3.amsterdam1.netherlight.net:501/1"/>
        <ndl:hasInterface rdf:resource="#tdm3.amsterdam1.netherlight.net:501/3"/>
        <ndl:hasInterface rdf:resource="#tdm3.amsterdam1.netherlight.net:501/4"/>
        <ndl:hasInterface rdf:resource="#tdm3.amsterdam1.netherlight.net:504/1"/>
        <ndl:hasInterface rdf:resource="#tdm3.amsterdam1.netherlight.net:504/2"/>
        <ndl:hasInterface rdf:resource="#tdm3.amsterdam1.netherlight.net:504/3"/>
        <ndl:hasInterface rdf:resource="#tdm3.amsterdam1.netherlight.net:504/4"/>
        <ndl:hasInterface rdf:resource="#tdm3.amsterdam1.netherlight.net:501/2"/>
        <!-- all the interfaces of TDM3.amsterdam1.netherlight.net -->
        <ndl:Interface rdf:about="#tdm3.amsterdam1.netherlight.net:501/1">
            <ndl:name>tdm3.amsterdam1.netherlight.net:POS501/1</ndl:name>
            <ndl:connectedTo rdf:resource="#tdm4.amsterdam1.netherlight.net:5/1"/>
        </ndl:Interface>
        <ndl:Interface rdf:about="#tdm3.amsterdam1.netherlight.net:501/2">
            <ndl:name>tdm3.amsterdam1.netherlight.net:POS501/2</ndl:name>
            <ndl:connectedTo rdf:resource="#tdm1.amsterdam1.netherlight.net:12/1"/>
        </ndl:Interface>
    </ndl:Device>
</rdf:RDF>
Current status: NDL

NDL - Network Description Language - an RDF based model for hybrid network descriptions.

It leverages all the semantic web tools, to provide:
- graphs and visualization of connections and lightpaths
- lightpath provisioning support at inter and intra domain level.

Latest developments will be presented at the GLIF meeting in Sep. ‘06.
Key issue #2: how to policy enable optical networks?
Simple service access

Pitlochry, Scotland - Summer 2005
Three Easy Steps:

1. Click the START button
2. Insert money...
   - $0.25 per minute...
   - Example:
     - $1 = 4 minutes
     - $5 = 20 minutes
   - No change is provided!
3. Surf the web!
Use AAA concept to split (time consuming) service authorization process from service access using secure tokens in order to allow fast service access.
Conclusions

• We try to go for fast (subsecond) Lambda setup and teardown, that is different from most other initiatives

• We need to work on GMPLS, webservice, RDF, AAA, supporting tools to make this happen

• We need to stress the current control loops and procedures to get there

• Workflow systems and/or applications need to become network aware.
Questions?

Credits: some slides from Paola Grosso or Henri Bal