

## Control Plane Developments

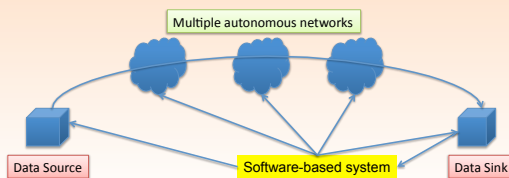
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## Abstract

- This talk will review recent developments in control plane technology and highlight the deployments of dynamic provisioning in research and education (R&E) networks.
- The talk is targeted at members of the JANET community who expect to make use of these technologies in their own network or campus, or may just want to keep up to date with developments.

## In Reality.

- Strong focus on R&E community.
  - Multi-domain provisioning of bandwidth.
  - How do we use the Control Plane to do this.



## JANET Optical Briefing.

- The JANET Optical Briefing took place at the IOP in London on February 8, 2010.
- It brought together experts in optical networking from both the academic and commercial sectors to provide a fascinating peek at the future for the education and research community.



## Generic Functions of the CP.

- The generic functions of the control plane are
  - Discovery.
  - Connection/teardown.
  - Maintenance/operation.
  - Protection and restoration.

We shall come back to this.

## Commercial Motivation (1/2).

- Commercial providers are driven by the need to make a profit in a highly competitive industry.
  - Networks are coming to a situation where costs and delays are due to human intervention, and there is a clear need for autonomous operation.
  - Focus for commercial providers on the protection and restoration within the Network. Fast restoration (< 50 ms) depends on utilizing the control plane.

## Commercial Motivation (2/2).

- A key point was the observation that network engineers are loath to give up manual control.
  - However, when engineers begin to make use of control plane technologies, it works well.
- Measurement and monitoring is the key, i.e. engineers need to see it is doing what it is supposed to do.



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## Functions of the Control Plane.

- Discovery.
- Connection/teardown.
- Maintenance/operation.
- Protection and restoration.
- Measurement and Monitoring



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## R&E Activities.

- Network provisioning within the research and education community has a different emphasis.
- The requirements for control plane system also include: Fast provisioning of bandwidth on demand, scheduled reservations, automatic resilience, and automatic topology discovery.
- Part of our involvement with Géant.

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## Service Requirements of the CP in a R&E Network

- Discovery.
- Fast Connection/teardown.
- Scheduled Reservations.
  - Multi domain
- Maintenance/operation.
- Protection, automatic and rapid restoration
- Measurement and Monitoring.

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## Control Plane Projects in the R&E Community.

- Autobahn (Géant)
  - Autobahn is the multi domain glue for local provisioning systems.
- The activities of Dante, Internet2, Canarie, ESNET (DICE) – the research and education networks for Europe, the US and Canada.

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## Dynamic Circuit Networking in the R&E Community.

- Autobahn (Géant)
  - Greek-Irish NRENs over Géant2 in 2007.
  - <http://www.glif.is/meetings/2007/plenary/sevasti-autobahn.pdf>
- ION (Internet2)
  - OSCARS + DRAGON
  - <http://www.internet2.edu/presentations/jt2009jul/20090720-robb01.pdf>
- ESNET Science data Network
  - OSCARS
- GLIF Optical Lightpath Exchange – GOLE.
  - The GOLEs are infrastructure, not software.

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### Applications

- Data-Intensive Science has been the traditional driver behind advanced networking
  - High Energy Physics (HEP), especially LHC.
  - Radio Astronomy, especially eVLBI

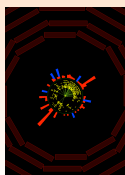
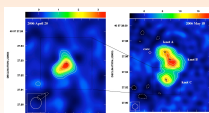


Image from <http://www.fnal.gov/gallery/images.html>

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### Applications

- Arts is starting to appear as a driver for more advanced services.
  - Cinegrid
  - Super High Vision and 3D Visualisation – JANET UHD SIG

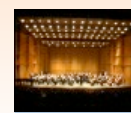
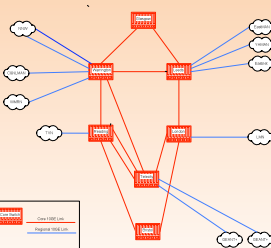


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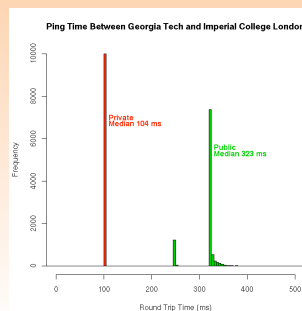
### JANET Activities.



- UK Light No Longer Exists.
  - STM-64 (10 Gbps) circuits between POPs
  - Reliable but expensive
- JANET Light Paths
  - Juniper MX-960
  - 10 GE LAN-PHY
- Manually maintained by JANET NOC.



### Lightpath Performance



Important point is the consistency. We can't guarantee the lower latency.

### New JANET Activities.

- Building Test Bed to gain experience of control plane.
- Initial work will look at intra-domain control (DC).
- Understand Inter-domain control (IDC).
- Assessing potential and plans. Currently a development activity.

### Future Work

- Collaboration
- Deployment over JANET Lightpath service?
  - Not touching the Lightpath production equipment.
- What is the Feasibility and Demand?
- Access Control

Any Questions?

