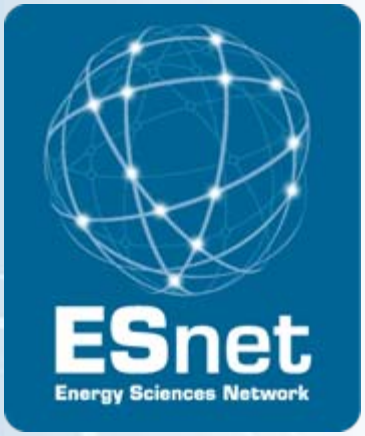


Virtual Circuits Landscape

Summer 2010 ESCC Meeting

Columbus, OH

Evangelos Chaniotakis, ESnet Network Engineer

Lawrence Berkeley National Lab

Context and Goals

- Guaranteed bandwidth services are maturing.
- The installed footprint is expanding at a good pace.
- More and more places are deploying these services and managing them via network automation tools

ESnet wants to help the sites:

- Understand not only SDN but also the global infrastructure
- Inform their users where they can connect to with VCs
- Use and utilize SDN and the OSCARS service

The usual questions

- What is OSCARS good for?
- Where can I connect to?
- What do I need to do?

The usual questions

- What is OSCARS good for?
- **Where can I connect to?**
- What do I need to do?
  - A *really* good subject for a future presentation :-)

Parenthesis:

OSCARS: an ESnet Production Service

- **<u>50% of all ESnet traffic is now carried over OSCARS VCs</u>**
- Operational Virtual Circuit (VC) support
  - As of 6/2010, there are 32 production VCs instantiated
    - 25 VCs supporting HEP: LHC T0-T1 (4x Primary and 2x Backup) and 19x LHC T1-T2
    - 3 VCs supporting Climate: GFD and ESG
    - 2 VCs supporting Computational Astrophysics: OptiPortal
    - 1 VC supporting Biological and Environmental Research: Genomics
    - 1 VC supporting Soudan Mine
  - Short-term dynamic VCs
    - ~5000 successful VC reservations from 7/2009 till 6/2010, initiated by TeraPaths (BNL), LambdaStation (FNAL), and Phoebus.
- ESnet won the Excellence.gov “Excellence in Leveraging Technology” award based on OSCARS and the ESnet4 network.
- And, we also got an InfoWeek award.

OSCARS growth

Long-term production circuits: +**50%**

- July 2009: 21
- July 2010: 32

Reserved bandwidth: +**60%**

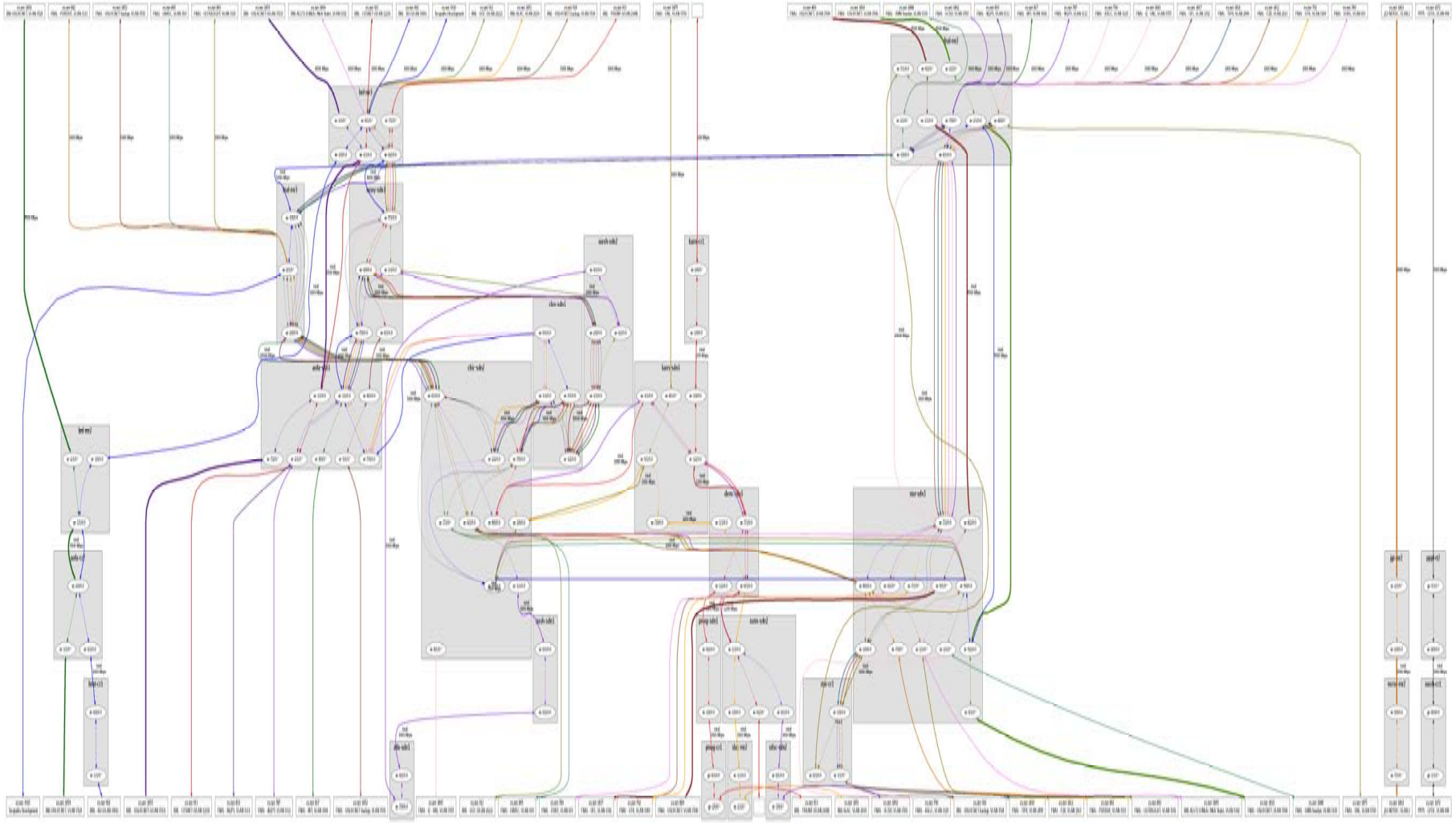
- 2009: ~45 Gbps
- 2010: ~70 Gbps

Audience: **x4**

- July 2009: Single application – LHC
- July 2010: Several more use cases in a variety of disciplines

ESnet Circuits diagram

(may cause eyes to water)



.. close parenthesis.

Back to: “Where can I connect to?”

- Other ESnet sites are easiest
  - They generally have SDN connections
- “VC-enabled” places
  - And, a lot of R&E networks are “VC-enabled” in some way or another.
- OSCARS can even help you reach other places – i.e. the LBL-Google cloud thing.

VC-enabled Networks: North America

- ESnet SDN
- Internet2 ION
  - Internet2 regionals
- NLR FrameNet
- USLHCNET
- CANARIE
- MANLAN
- StarLight

- Planned: IRNC transatlantic links
- Potential: LHC T2, T3s (over 50 IDCs)

VC-enabled Networks: Europe and Asia

- GEANT AutoBAHN
  - HEAnet (Ireland)
  - GRnet (Greece)
  - FCCN (Portugal)
  - PIONIER (Poland)
  - GARR (Italy)
  - CESNET (Czech)
  - CARNet (Croatia)
- NORDUnet (Scandinavia)
- SURFnet (Netherlands)
- NetherLight, NorthernLight, CzechLight

- JGN & NTT, Japan
- KISTI & KRLight, Korea

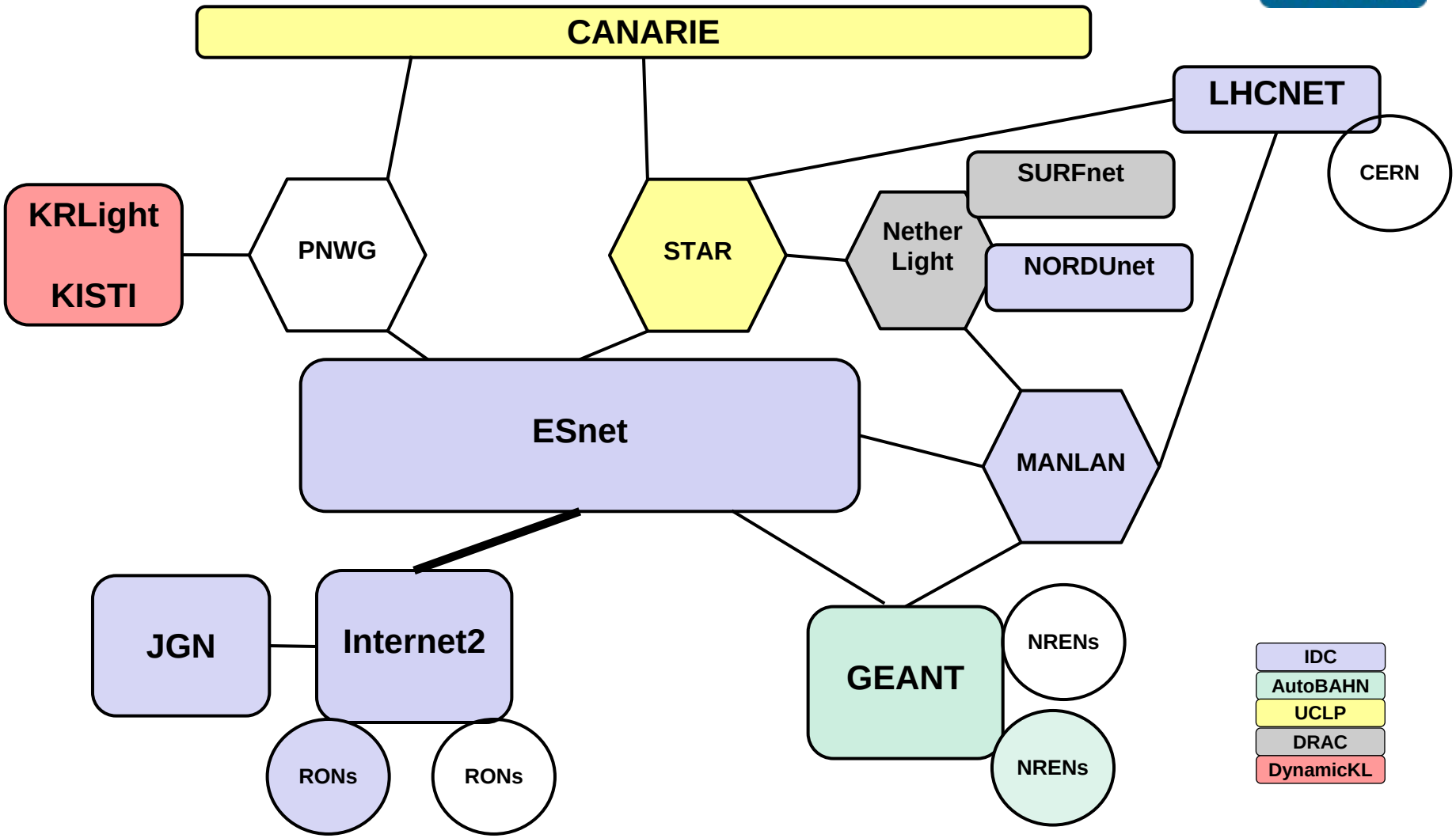
ESnet VC Connectivity

- Other ESnet sites – all the big customers have at least one SDN drop.
- Internet2 ION at AofA (soon at Chicago & Sunnyvale)
- GEANT at AofA
- CANARIE at Starlight, PNWG
- USLHCNET at AofA, Starlight
- GEANT at AofA, Washington
- KRLight at PNWG
- Starlight
- MANLAN
- Potentially: NetherLight @ MANLAN – gets us SURFnet and NORDUnet.

Is it really that easy?

- Yes and no. :-(
- Some networks aren't VC-enabled.
- Many of the ones that are VC-enabled use automated tools that can't talk to one another.
- On the other hand, ESnet engineers are in pretty close contact with our peers.
- We have been very successful in getting things done the hard way (emails and phone calls).
- One way or another, we will get your VC through.

An ESnet-centric View



Are we fixing this?

- **Yes!**

- ESnet is leading the pack in interoperability and standardization efforts.
- Chin is co-chairing the OGF ISOD BoF.
- Evangelos is chairing the GLIF GNI API Task force, and leading the Fenius interoperability effort,
- Inder is a chair in the OGF NSI working group
- We’re very optimistic & will do interop demos this fall.

Direct IDC Interoperability

- Organizations with systems which are compatible with the DICE IDCP:
  - ESnet (OSCARS/SDN)
  - Internet2 ION (OSCARS/SDN)
  - GÉANT (AutoBAHN)
  - SURFnet (OpenDRAC)
  - USLHCNet (OSCARS/DCN)
  - NYSERnet (OSCARS/DCN)
  - LEARN (Texas RON) (OSCARS/DCN)
  - LONI (Louisiana RON) (OSCARS/DCN)
  - Northrop Grumman (OSCARS/DCN)
  - University of Amsterdam (OSCARS/DCN)
  - MAX (OSCARS/DCN)
  - SCinet (OSCARS/customized)
- The following “higher level service applications” have adapted their existing systems to communicate using the DICE IDCP:
  - LambdaStation (manages and aggregate site traffic) (FNAL)
  - TeraPaths (manages and aggregate site traffic) (BNL)
  - Phoebus (University of Delaware) (TCP connection reconditioner for WAN latency hiding)

Interoperability venues and ESnet collaborators

- DICE strategic collaboration
  - DANTE
  - Internet2
  - CANARIE
  - ESnet
  - USLHCNET
- GLIF
- OGF
- Indiana University NOC
- NORDUnet
- University of Amsterdam / SARA / SURFnet
- i2Cat (Portugal)
- Inocybe (Canada)

Conclusions

- OSCARS has a solid, growing user base.
- It is a tried and true technology that can easily and quickly interconnect ESnet customers,
- But we can bring your users to a lot of other places as well.
- We are working hard on standardizing and automating the processes
- We're looking forward to more participation from more sites.

Remember: http://fasterdata.es.net/ will help you get data, faster! :-)