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Advanced Scientific Computing Research Program

High Performance Networks & Associated Research

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301-903-6767

ASCAC Meeting: March 15-16, 2006

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Networks Support Science Mission

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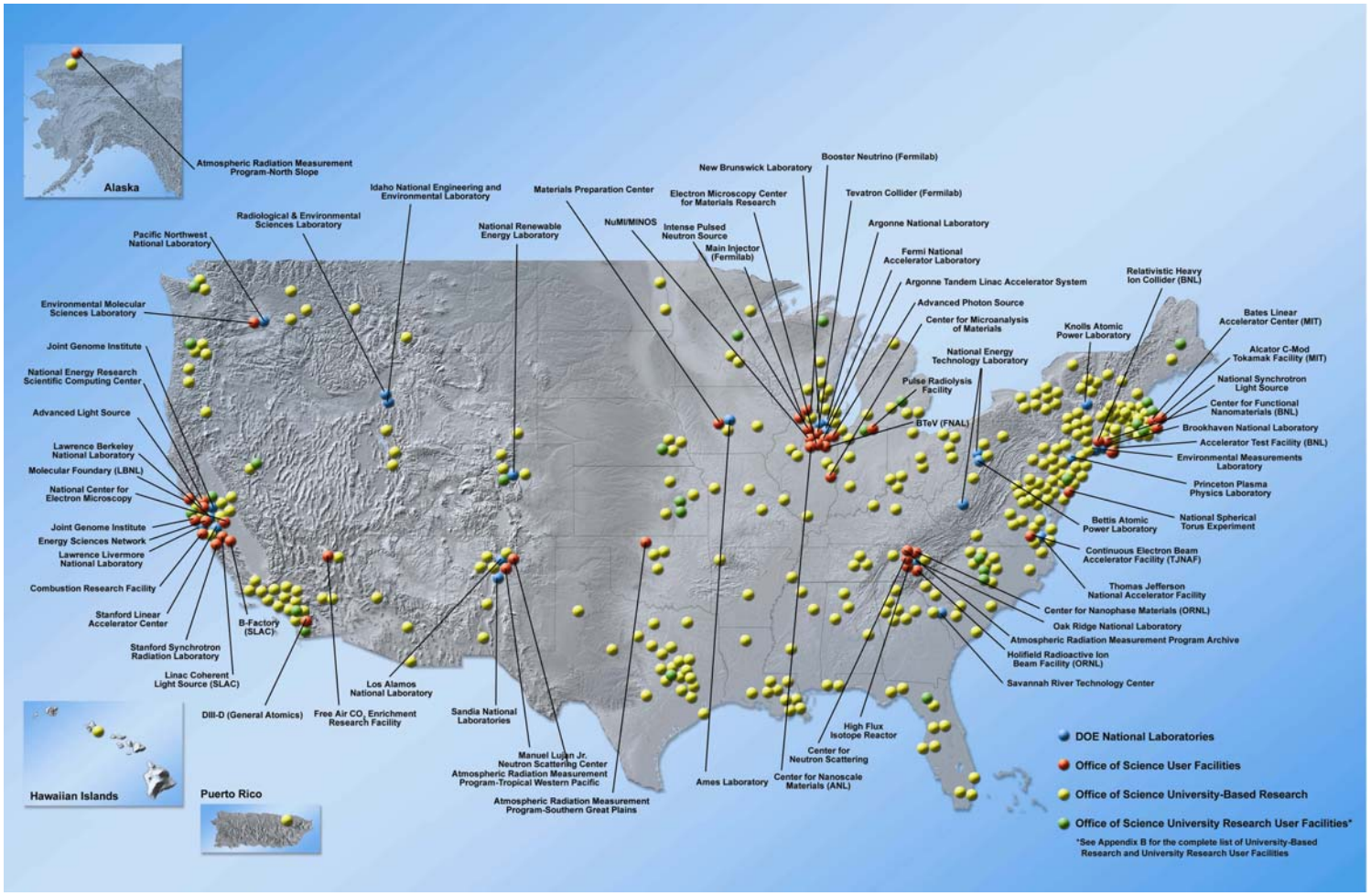

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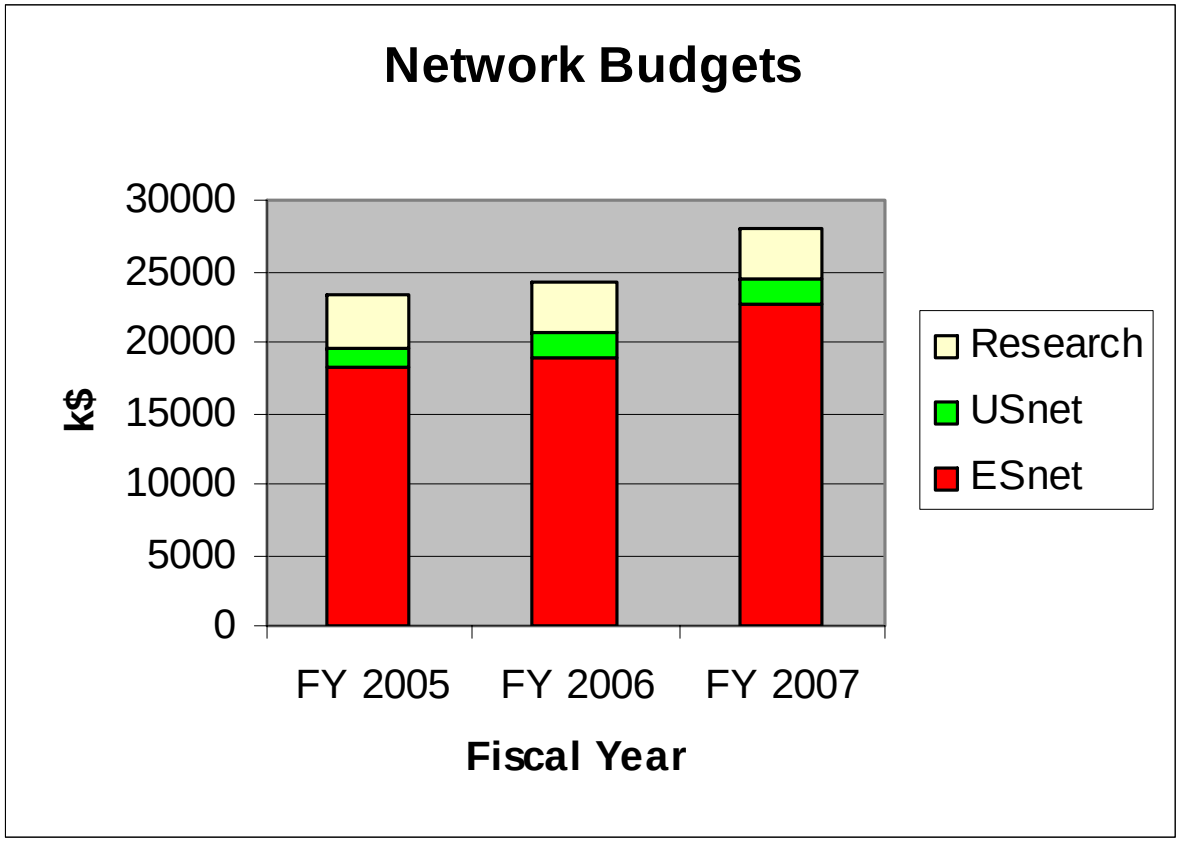
FY 2007 Budget Request Supports Office of Science

Advanced Scientific Computing Research Program



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Networking Workshops

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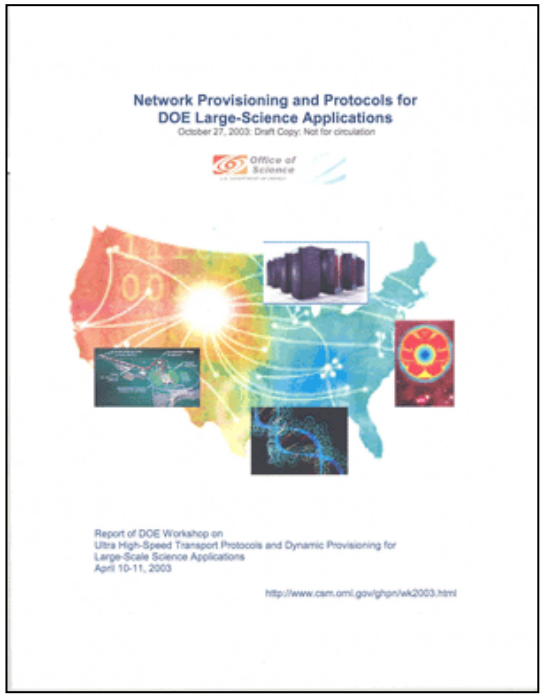

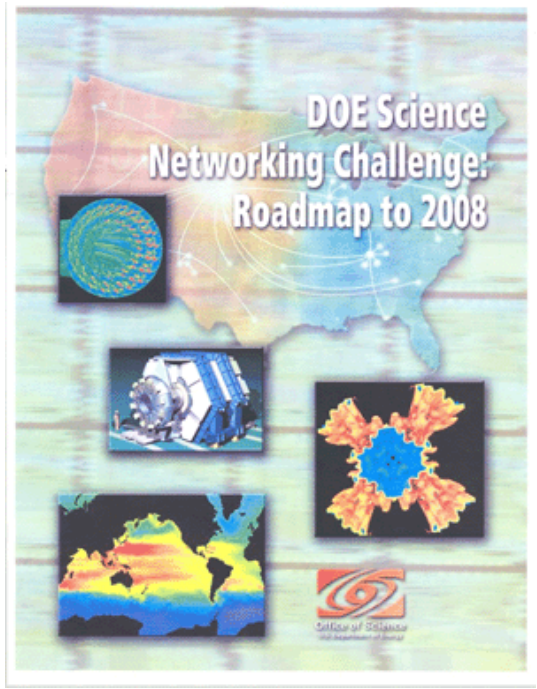

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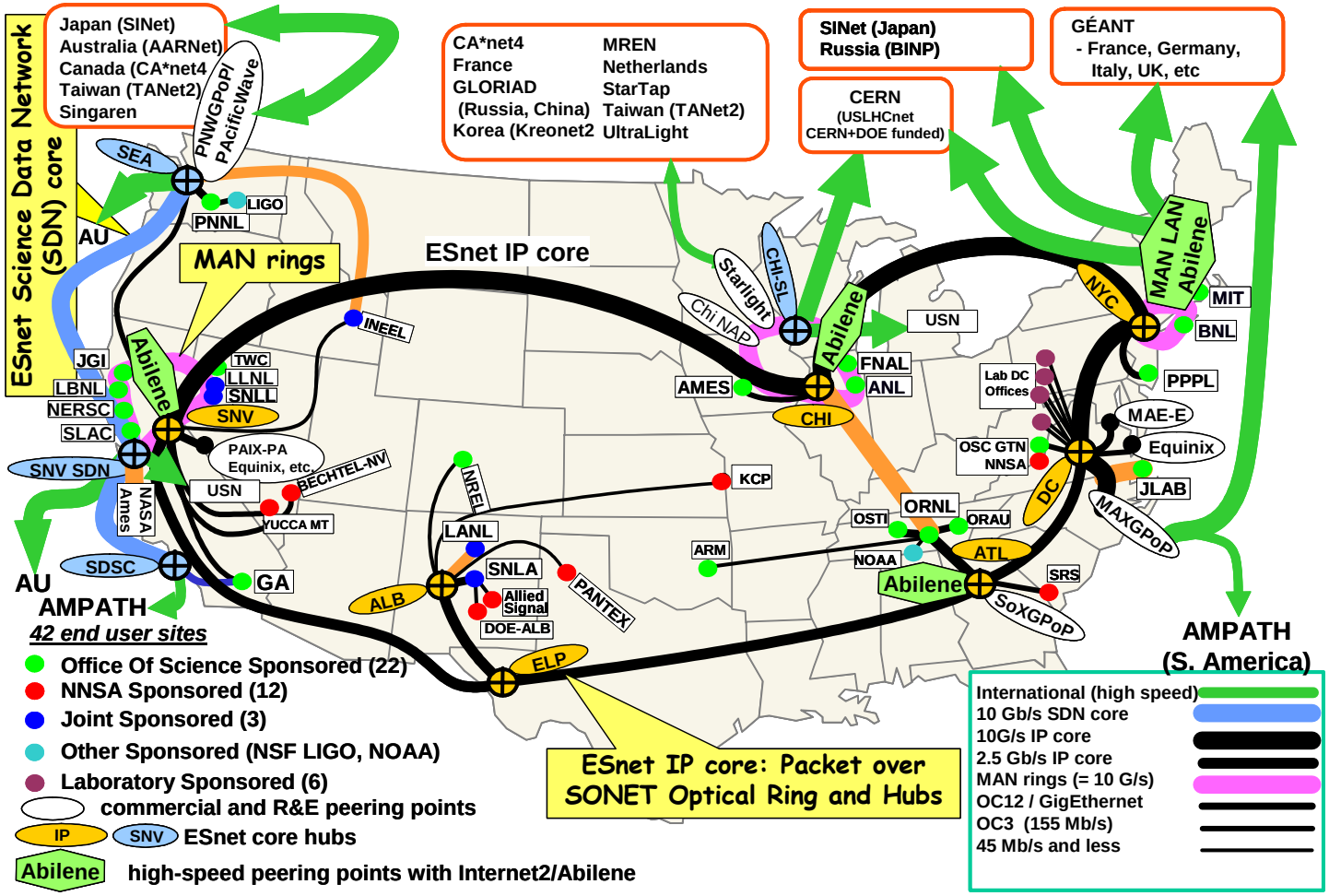
ESnet Connects SC Assets to Scientists worldwide (since 1987)

Advanced Scientific Computing Research Program



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Ultra Science Net
Ultra High-Speed Network Testbed

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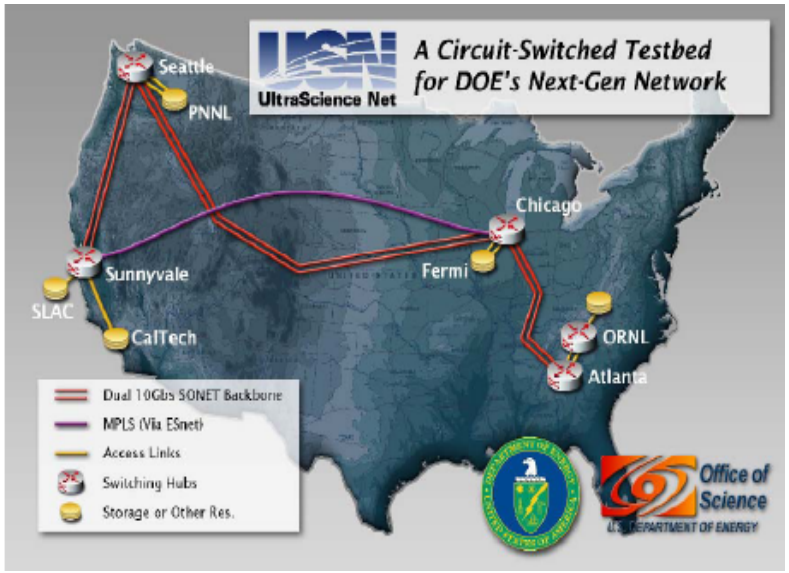
- Goal
  - Explore advanced cost-effective optical network technologies that can be used to distribute petabytes-scale data, interconnect distributed terascale computing resources and instrument, and support distributed high-end applications



- Features:
  - 20 Gpbs with node at: ORNL, StarLight, FNAL, PNNL, Sunnyvale, Caltech, ANL*, BNL*
  - Circuit peering at Starlight with **Internet2 HOPI and EU GEANT**
- Capabilities
  - Guaranteed end-to-end VLAN circuits
  - On-demand and reservation bandwidth services
  - Transport protocols independent (non-IP)
  - Hybrid mode: Seamless co-existence with best-effort IP network
- Tech Transfer
  - LHCnet, Interet2 HOPI, ESNet Science Data Network, LHC & ATLAS tier1 network technologies

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Requirements Grow Rapidly
Networks for LHC

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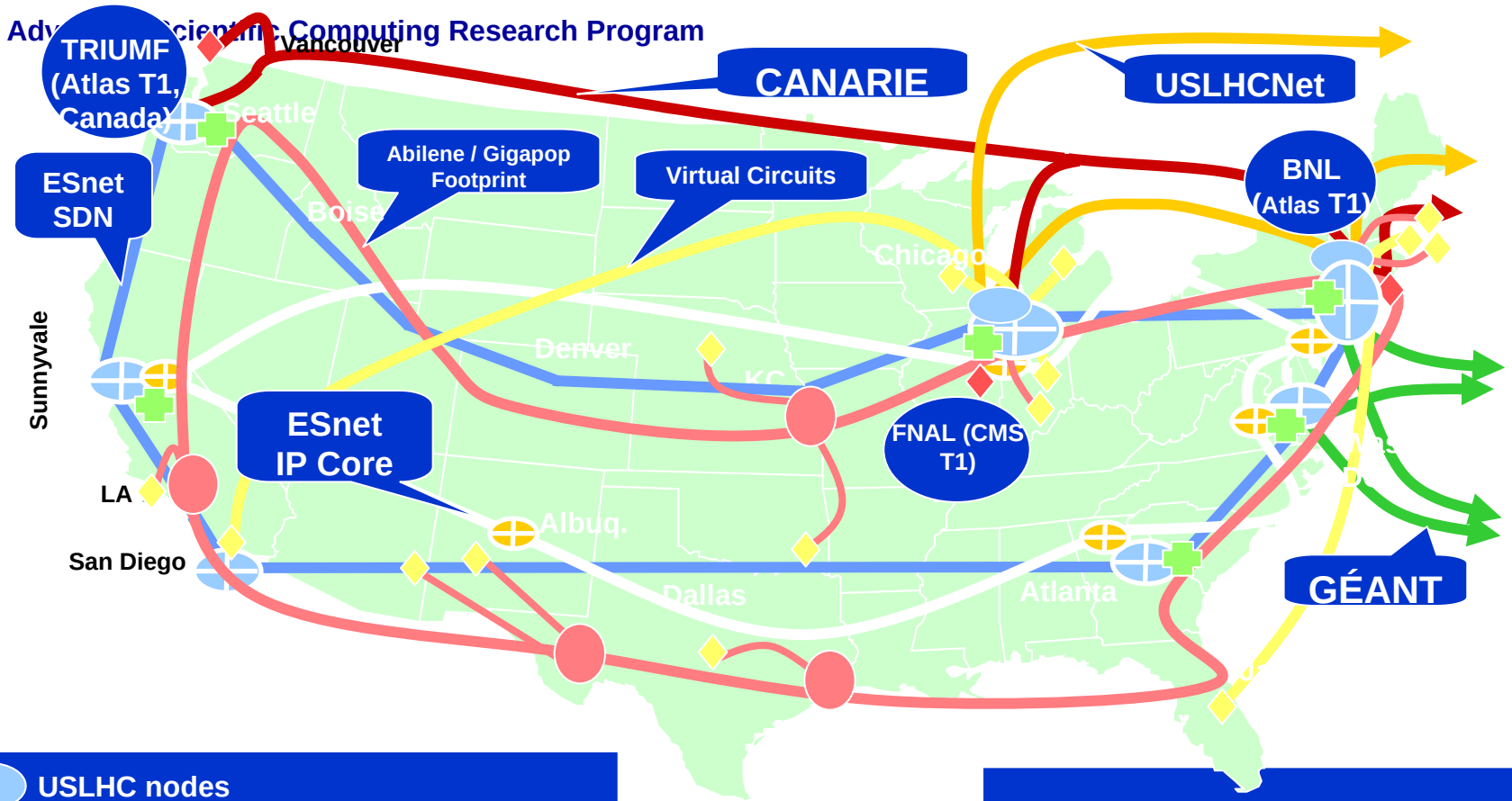

- USLHC nodes
- Abilene/GigaPoP nodes
- ESnet IP core hubs
- ESnet SDN/NLR hubs
- Cross connects with Internet2/Abilene

- Tier 1 Centers
- Tier 2 Sites

- **Direct connectivity T0-T1-T2**
  - USLHCNet to ESnet to Abilene
- **Backup connectivity**
  - SDN, GLIF, Virtual Circuits

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Everything is Integrated in the Future

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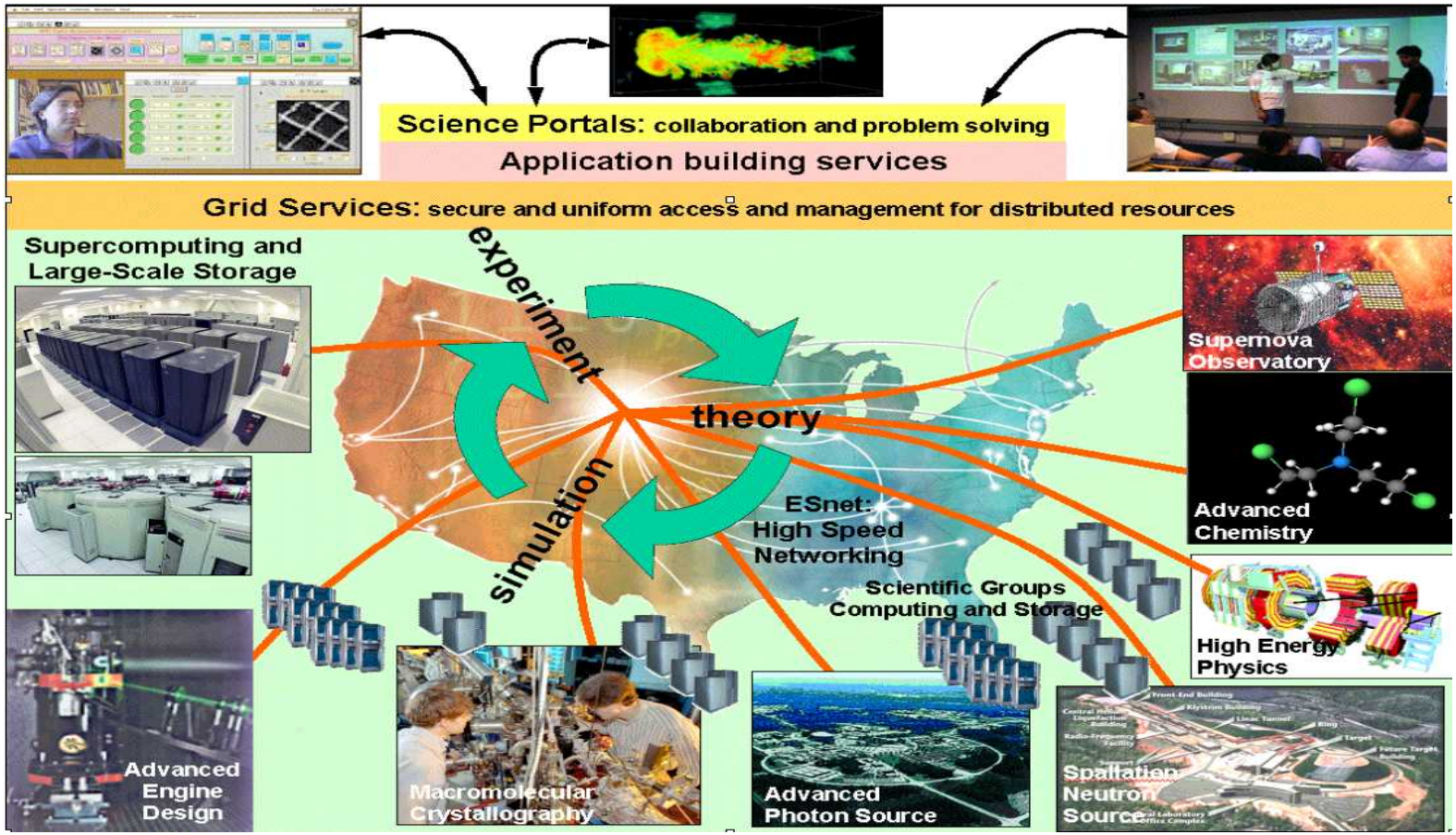

ESnet Traffic Characterization

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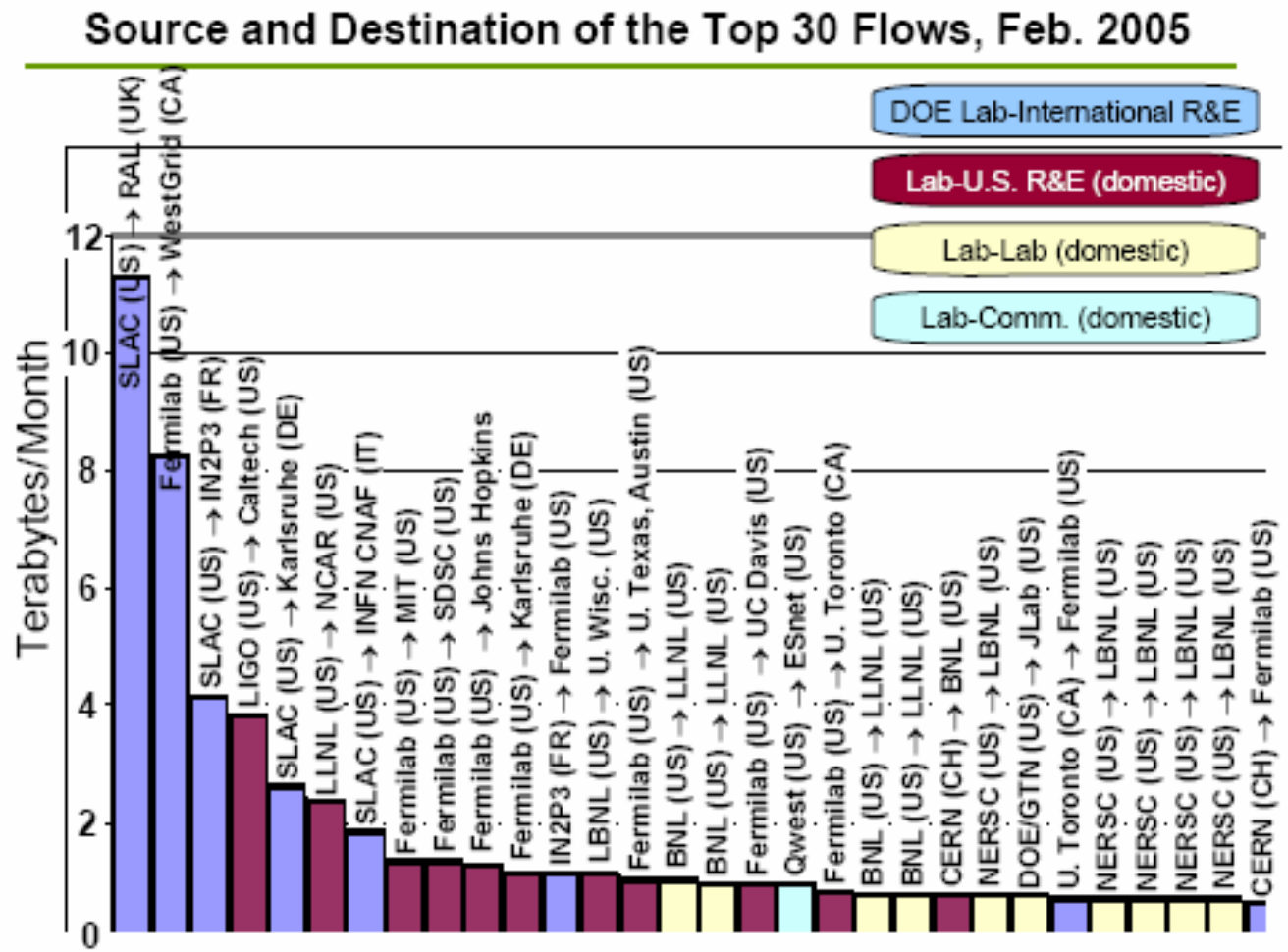
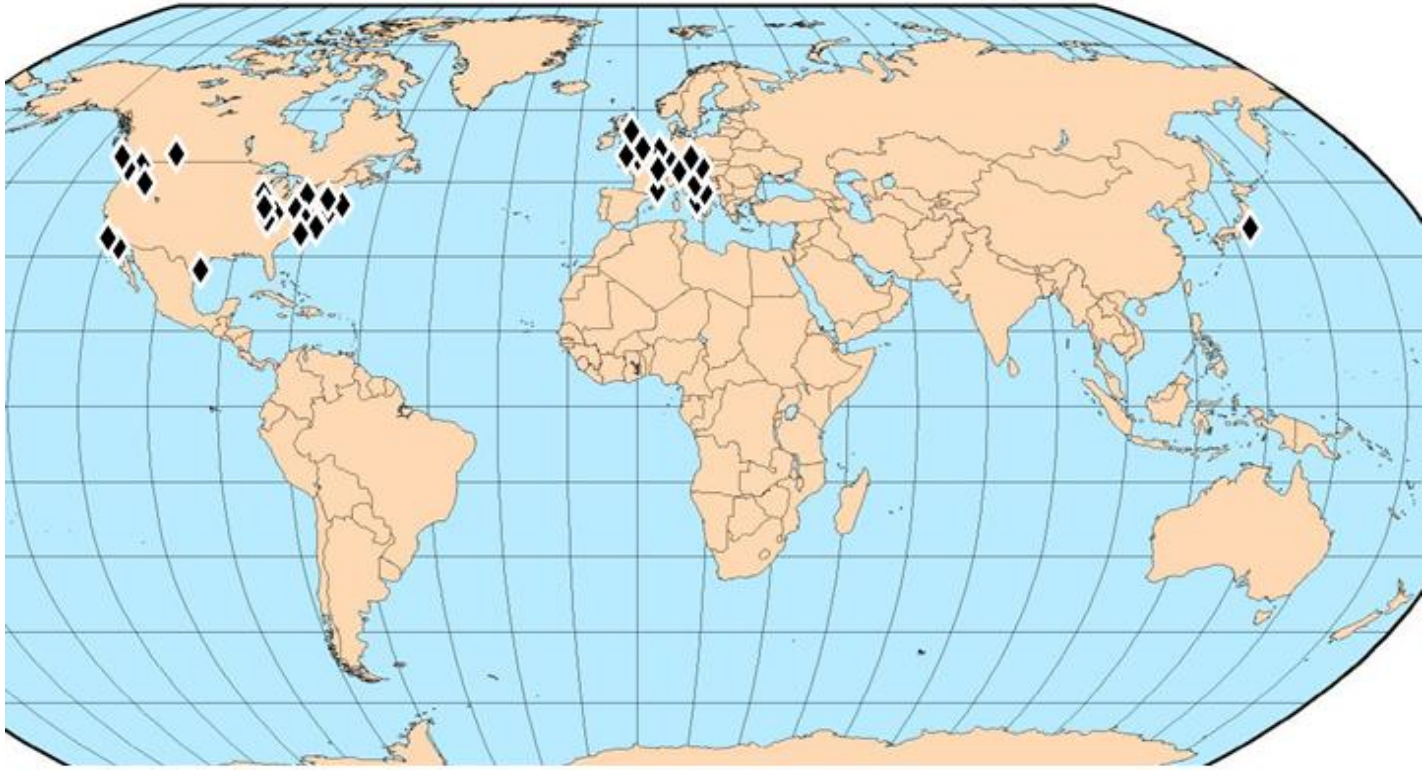


ESnet links US to the World

Footprint of SC Collaborators - Top 100 Traffic Generators



♦ Universities and research institutes that are the top 100 ESnet users

- The top 100 data flows generate 30% of all ESnet traffic (ESnet handles about 3×10^9 flows/mo.)
- 91 of the top 100 flows are from the Labs to other institutions (shown) (CY2005 data)

10

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Disruptive Changes in Networks for Science

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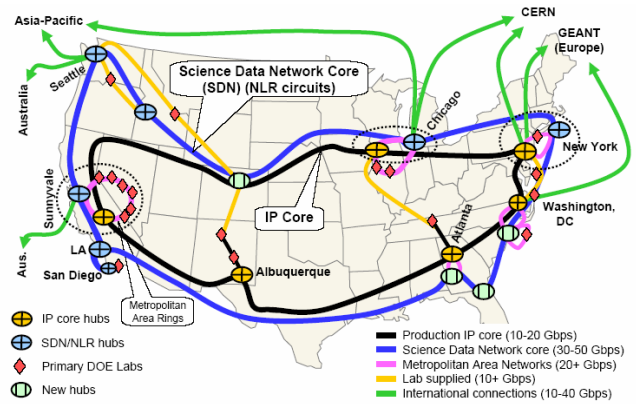

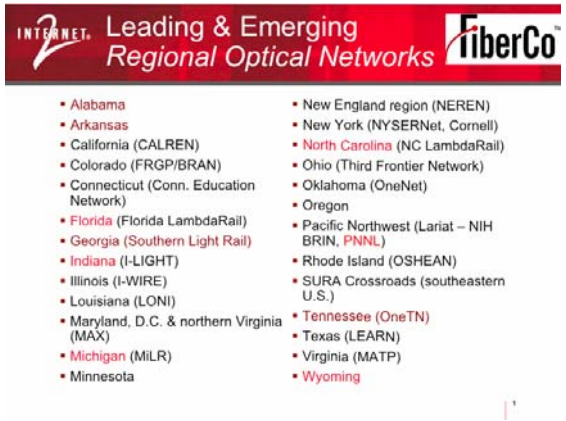

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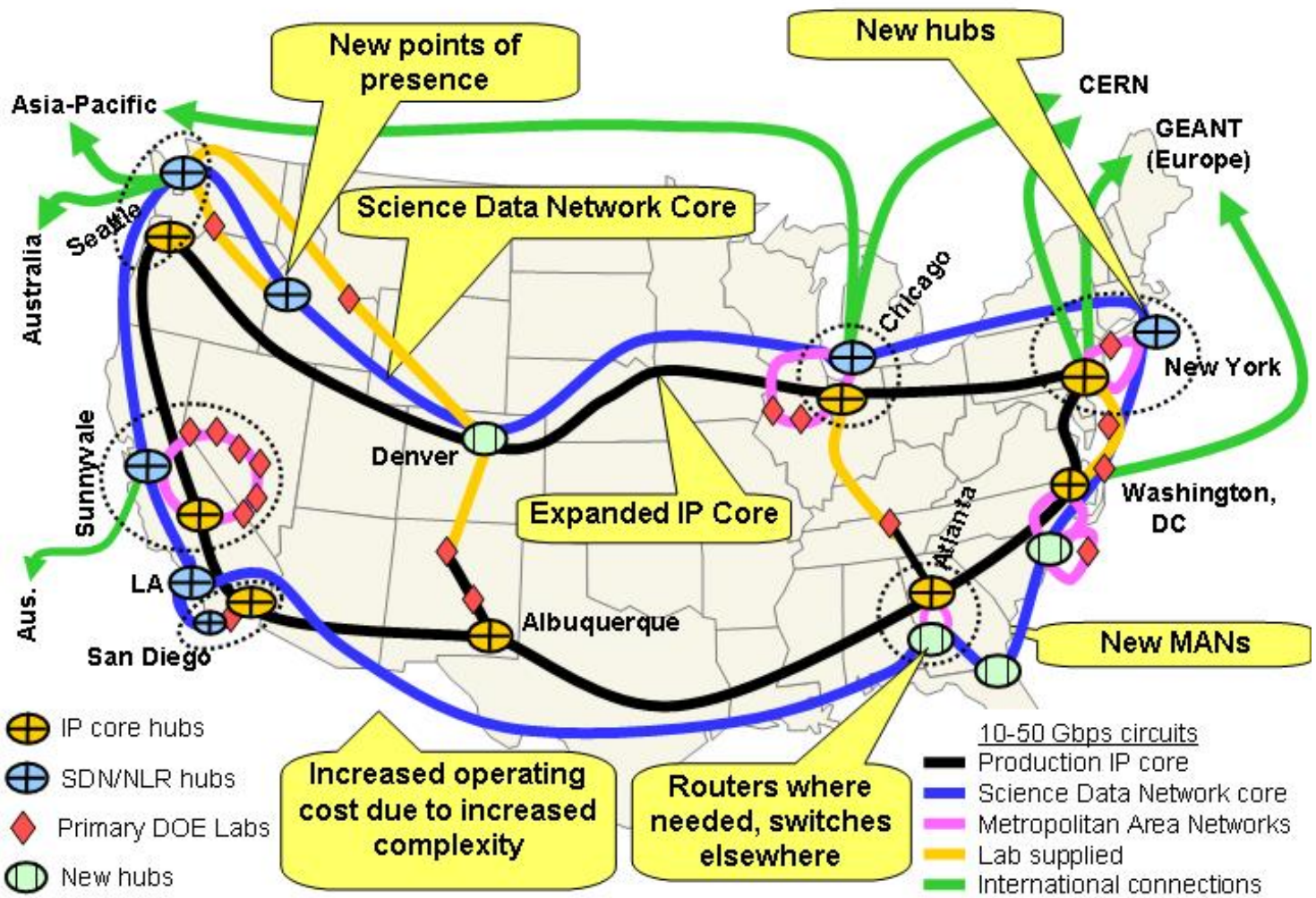
Future ESnet Proposal

Advanced



ESnet External Review Feb 21-23

- **Same, gigapops, network research, SC laboratories Process as used for other major SC projects**

- **Broad Committee representing scientific disciplines, universities**
- **Broad endorsement of ESnet approach**

- **Recognition of increased complexity and need for outreach to partners, especially Regional Optical Networks and end sites**

Implications for Sites

- **Hybrid Networks in site infrastructure**
- **Network "Peering" at Layers 1,2,3**
- **New Cybersecurity Challenges**
- **Defining Next Generation DMZ**

Network Environment Research

- **Inter-Domain Interfaces**
- **End-to-end performance**
- **Cyber security**
- **High-Performance Middleware**
- **Integrated testbeds and networks**