ESnet

U. S. Department of Energy

April 13, 2004

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and the ESnet Team

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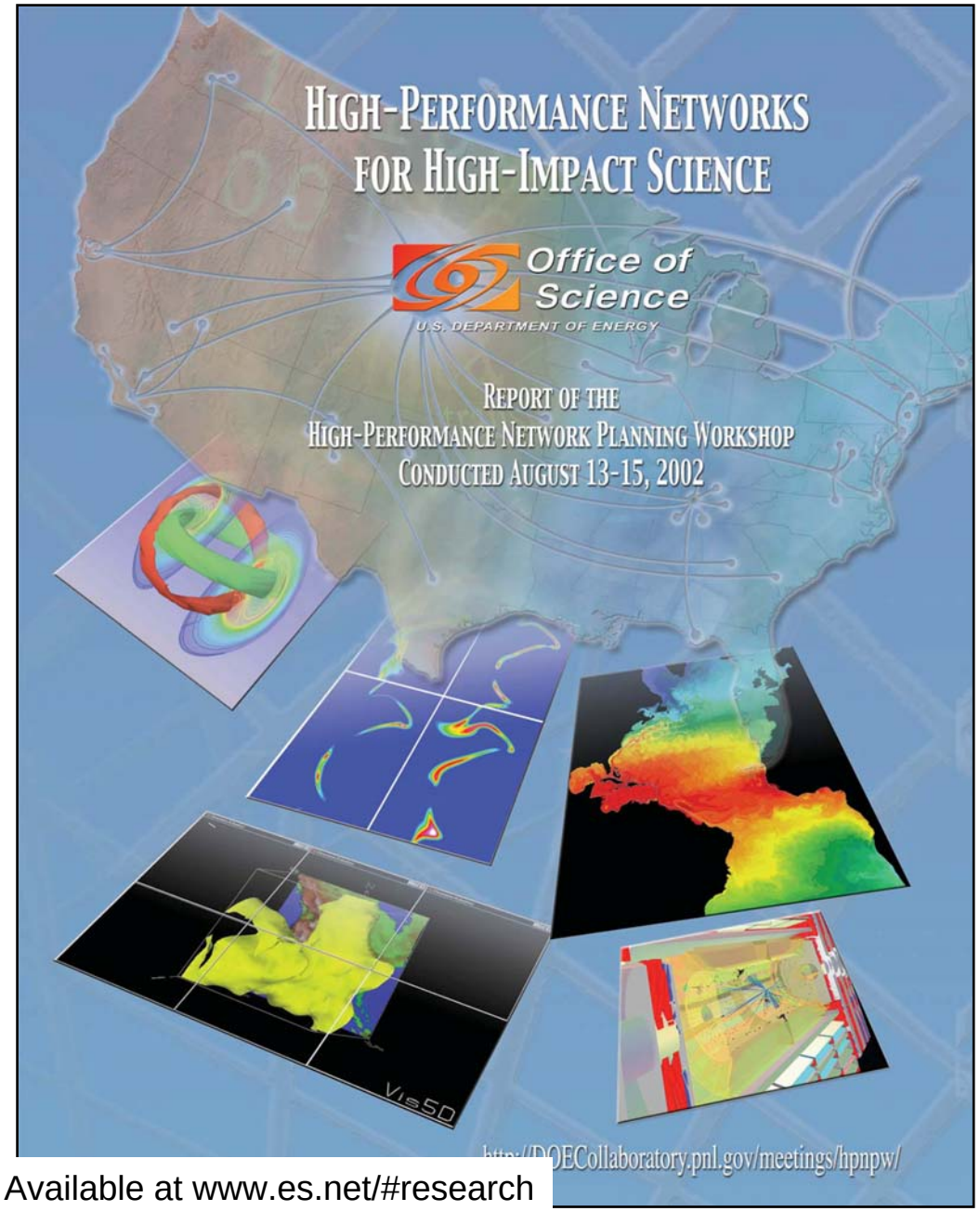
ESnet is Driven by the Needs of DOE Science



Available at www.es.net/#research

August 13-15, 2002

Organized by Office of Science

- Mary Anne Scott, Chair
- Dave Bader
- Steve Eckstrand
- Marvin Frazier
- Dale Koelling
- Vicky White

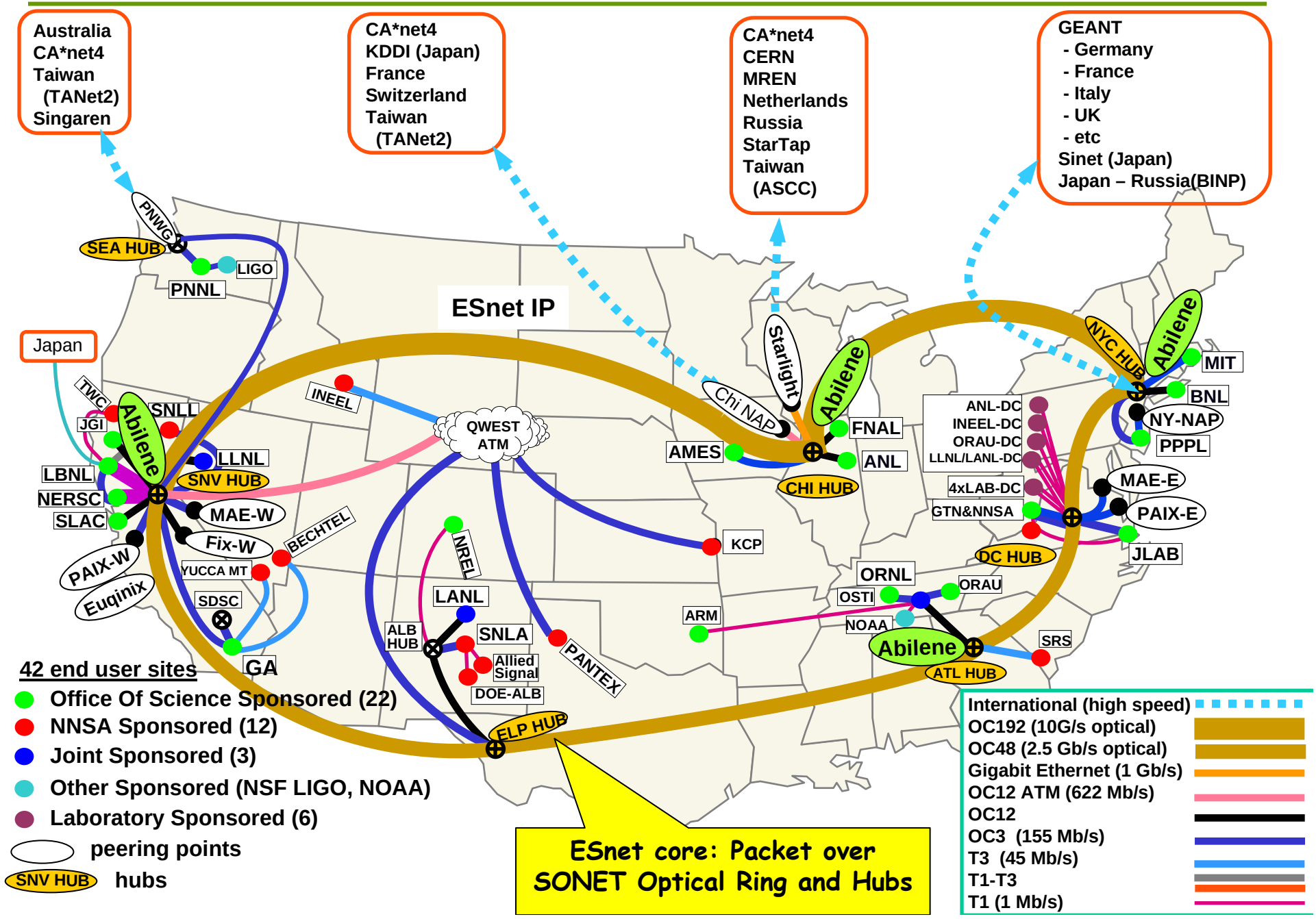
Workshop Panel Chairs

- Ray Bair and Deb Agarwal
- Bill Johnston and Mike Wilde
- Rick Stevens
- Ian Foster and Dennis Gannon
- Linda Winkler and Brian Tierney
- Sandy Merola and Charlie Catlett

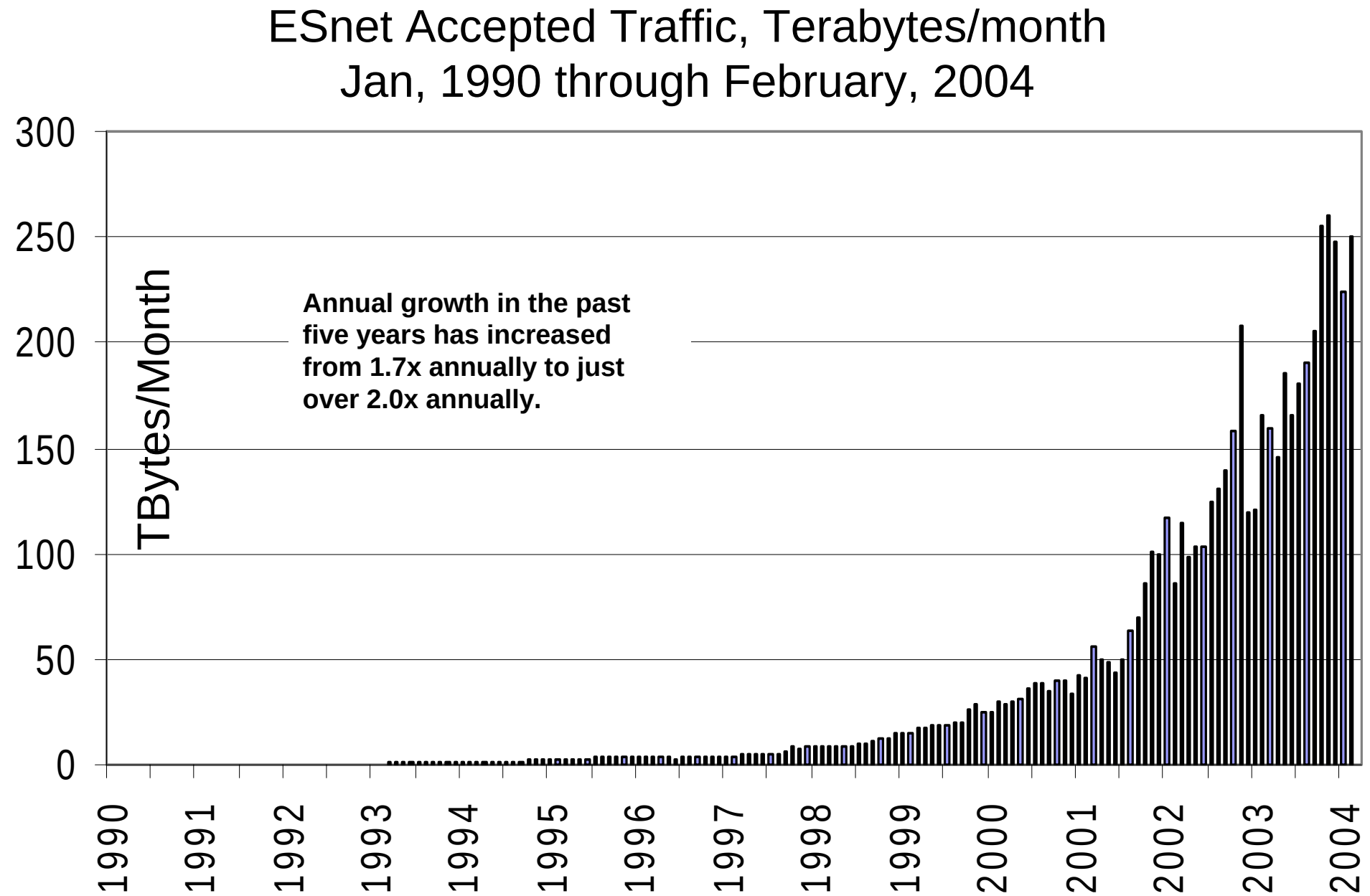
Focused on science requirements that drive

- **Advanced Network Infrastructure**
- **Middleware Research**
- **Network Research**
- **Network Governance Model**

ESnet Connects DOE Facilities and Collaborators



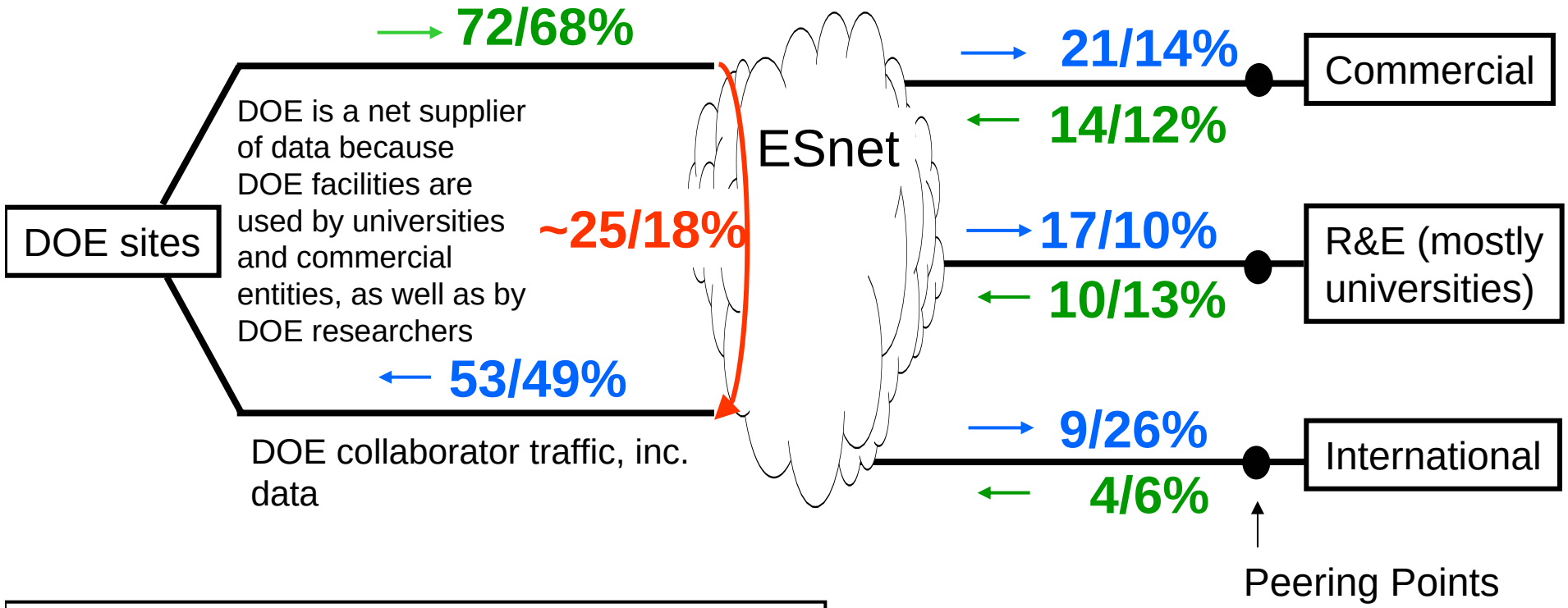
ESnet Accommodates Exponentially Increasing Traffic



Who Generates Traffic, and Where Does it Go?

ESnet Inter-Sector Traffic Summary, Jan 2003 / Feb 2004 (1.7X overall traffic increase, 1.9X OSC increase)

(the international traffic is increasing due to BABAR at SLAC and the LHC tier 1 centers at FNAL and BNL)



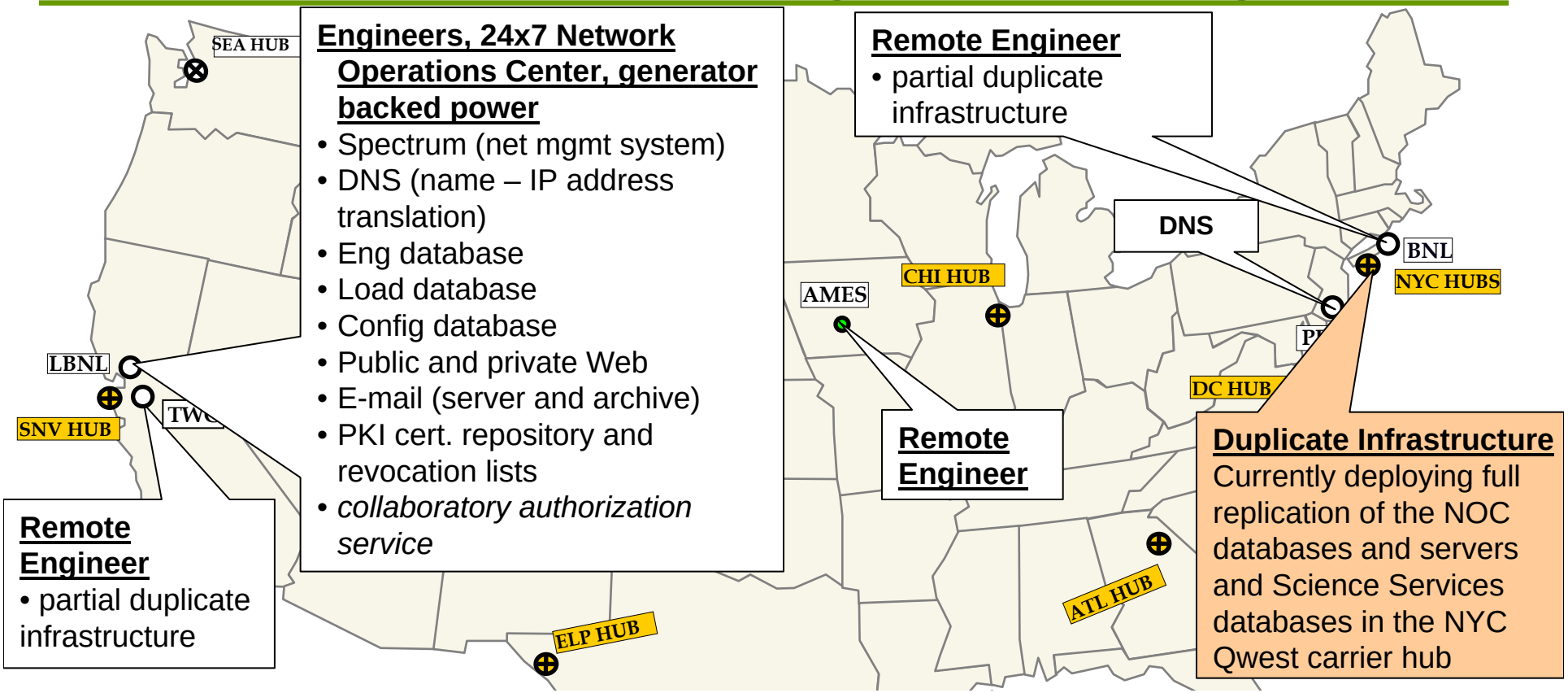
Note that more that 90% of the ESnet traffic is OSC traffic

ESnet Appropriate Use Policy (AUP)

All ESnet traffic must originate and/or terminate on an ESnet an site (no transit traffic is allowed)

Traffic coming into ESnet = Green
Traffic leaving ESnet = Blue
Traffic between sites
% = of total ingress or egress traffic

Disaster Recovery and Stability

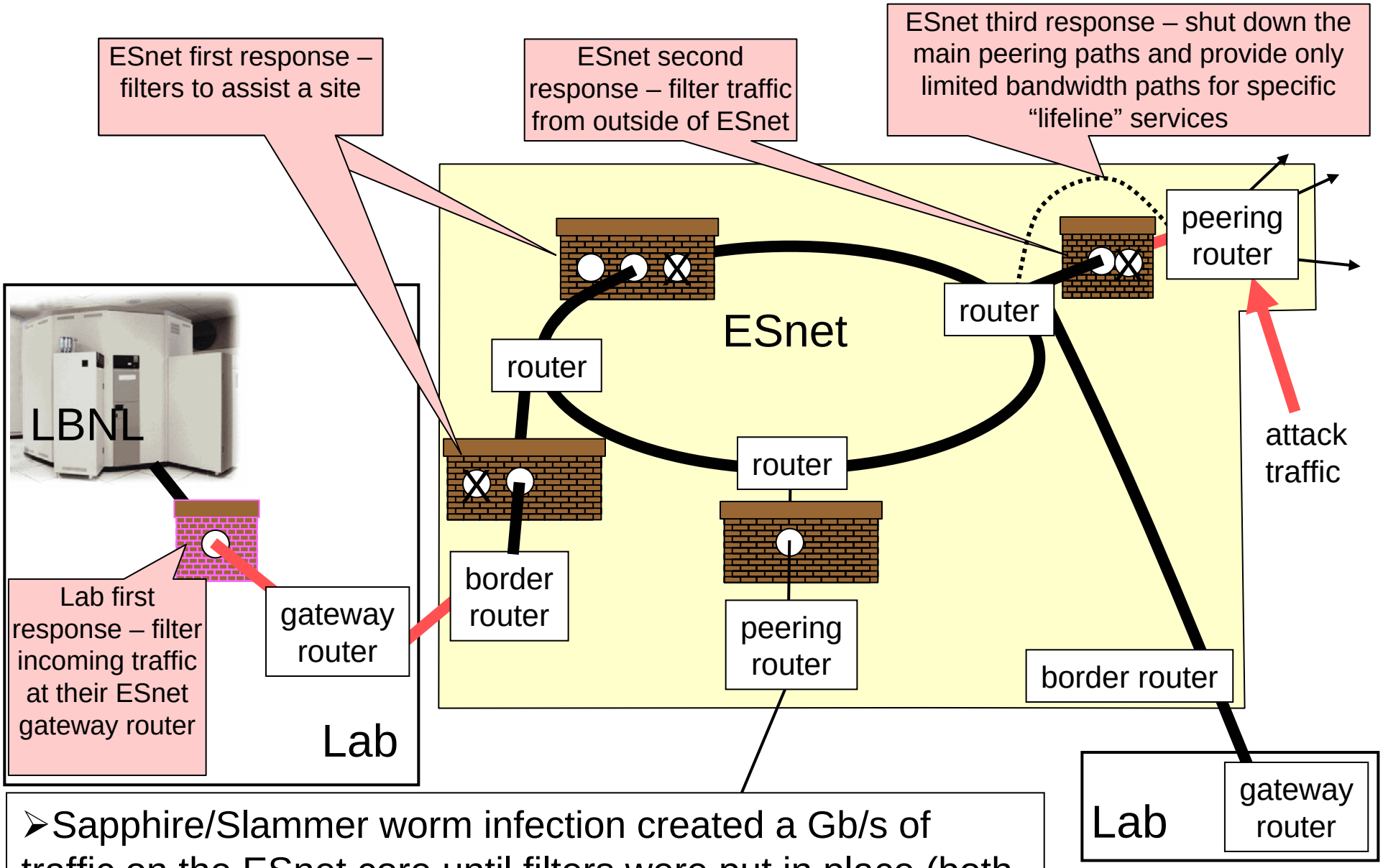


- The network must be kept available even if, e.g., the West Coast is disabled by a massive earthquake, etc.

Reliable operation of the network involves
- remote NOCs
- replicated support infrastructure
- generator backed UPS power at all critical network and infrastructure locations

- non-interruptible core - **ESnet core operated without interruption** through
  - N. Calif. Power blackout of 2000
  - the 9/11/2001 attacks, and
  - the Sept., 2003 NE States power blackout

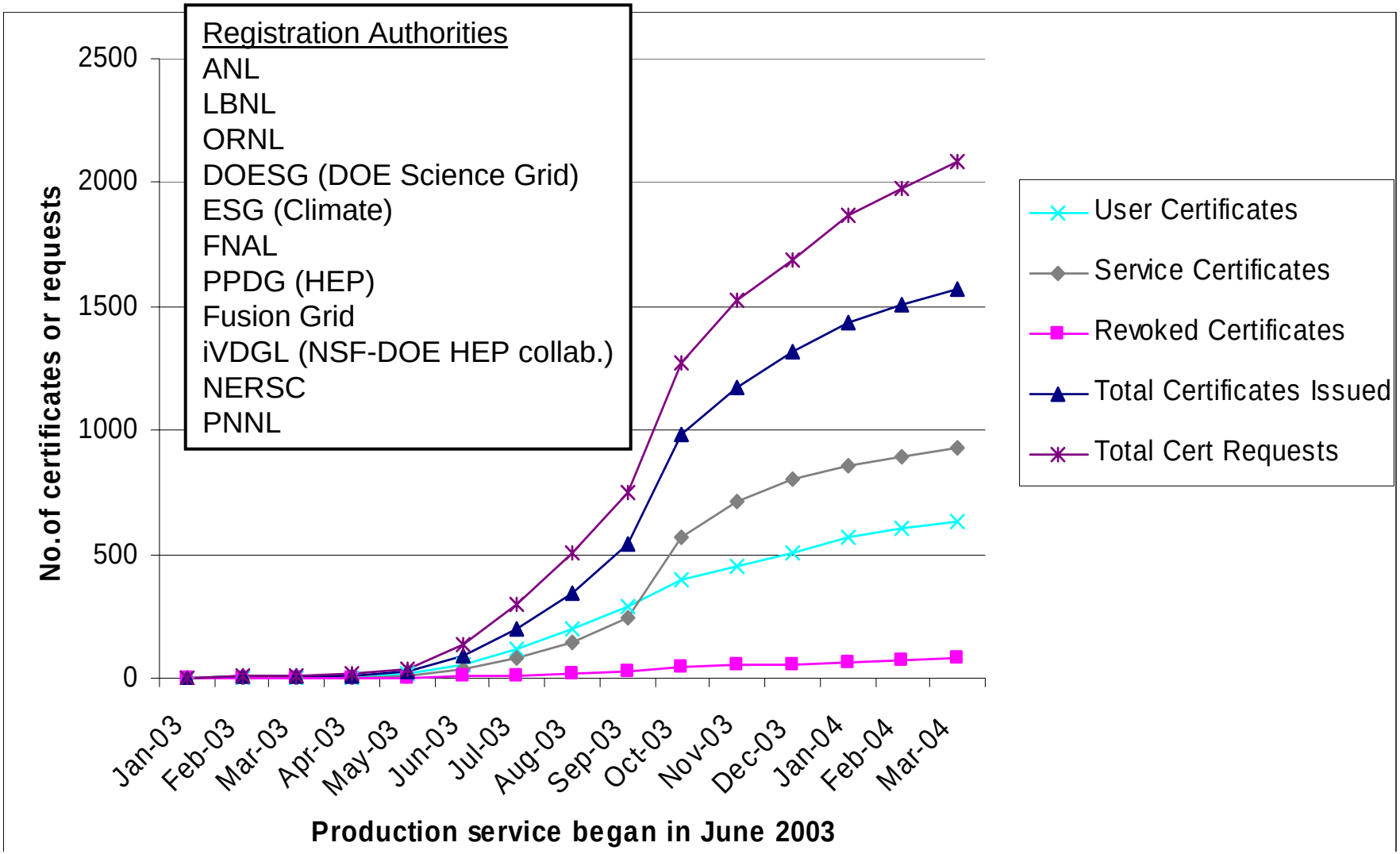
Cyberattack Defense



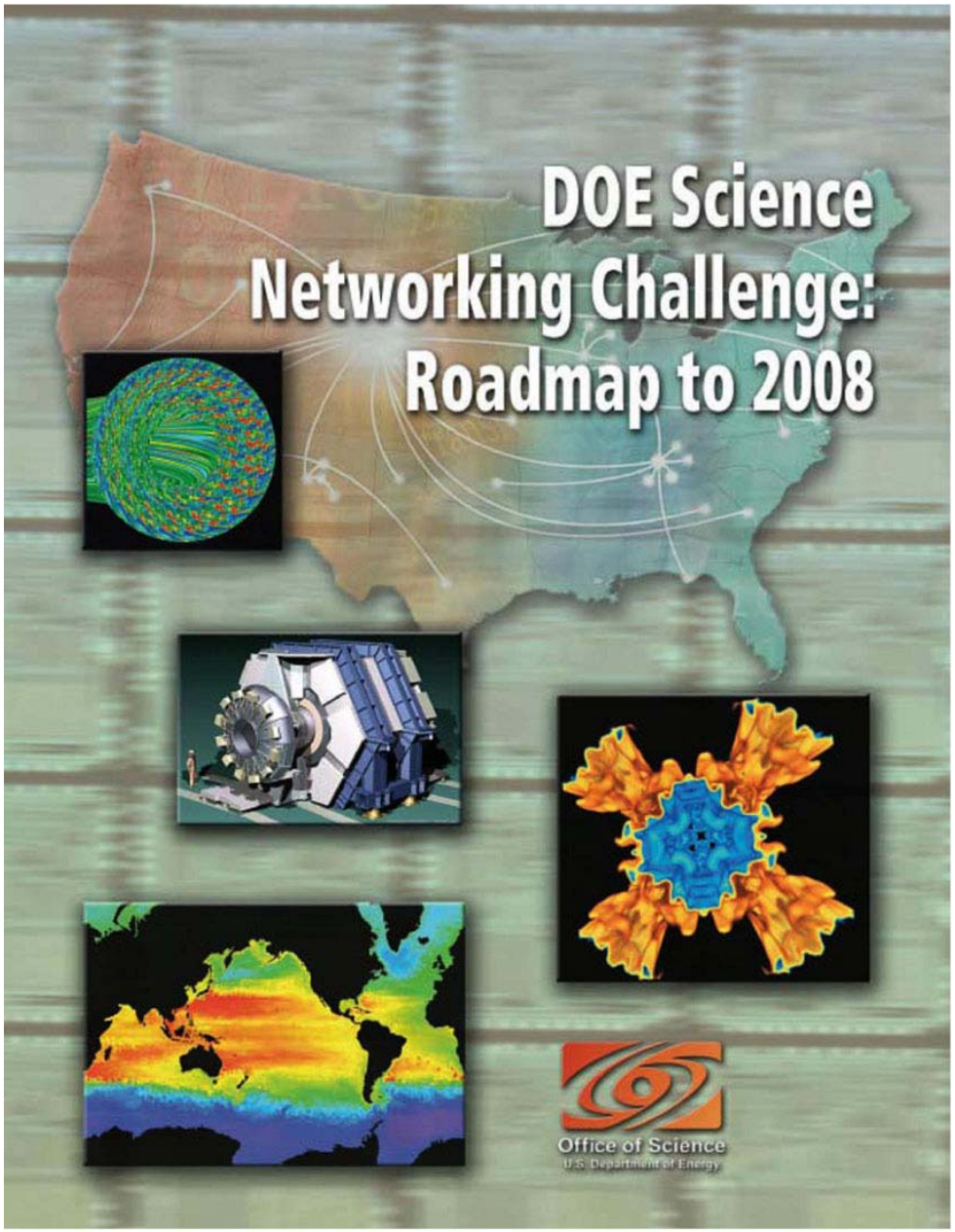
- Sapphire/Slammer worm infection created a Gb/s of traffic on the ESnet core until filters were put in place (both into and out of sites) to damp it out.

Science Services: Public Key Infrastructure

- The rapidly expanding customer base of this service will soon make it ESnet's largest collaboration service by customer count



New Strategic Directions to Address Needs of DOE Science



June 3-5, 2003

Organized by the ESSC

Workshop Chair
Roy Whitney, JLAB

Report Editors
Roy Whitney, JLAB
Larry Price, ANL

Workshop Panel Chairs

Wu-chun Feng, LANL
William Johnston, LBNL
Nagi Rao, ORNL
David Schissel, GA
Vicky White, FNAL
Dean Williams, LLNL

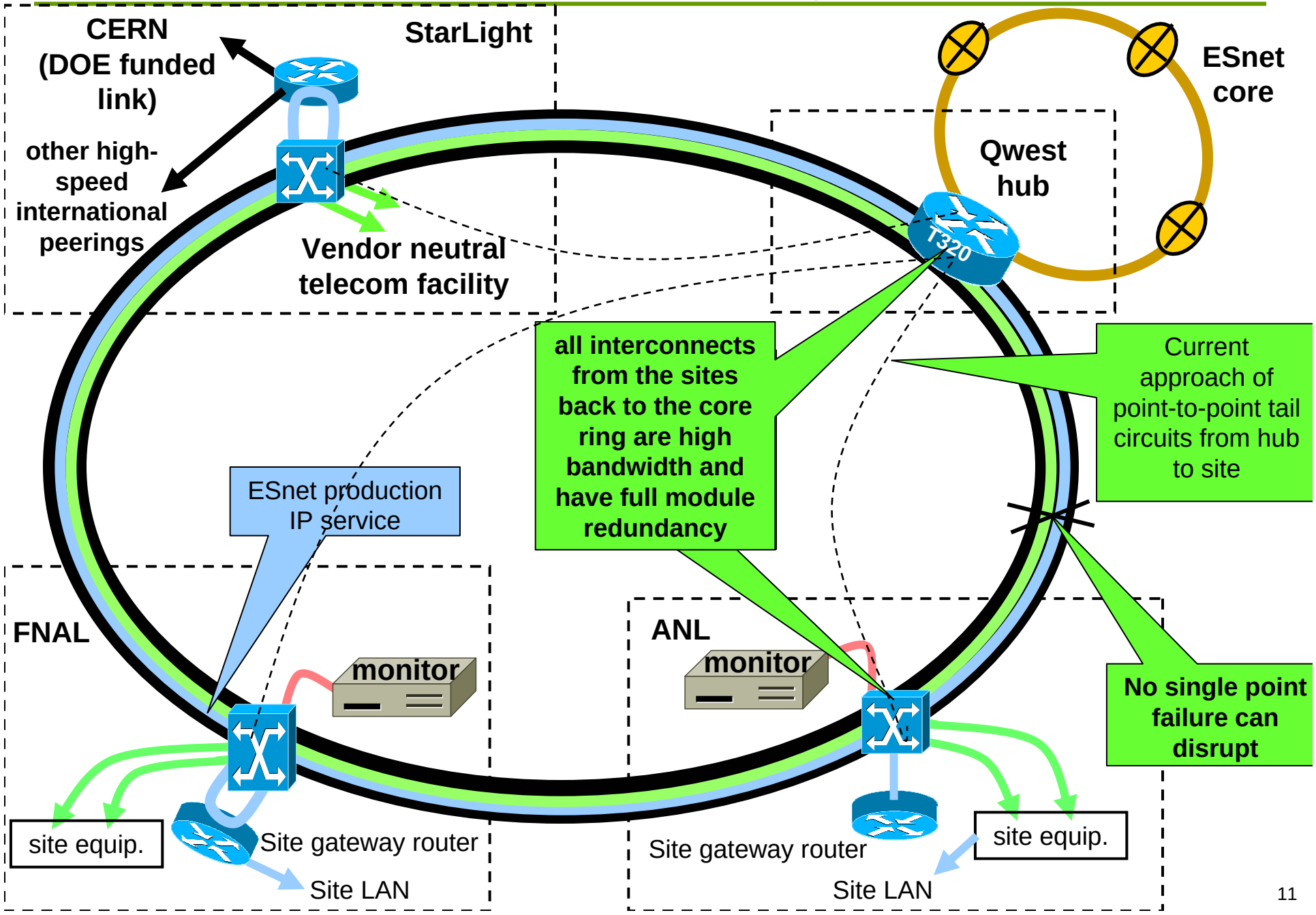
Focused on what is needed to achieve the science driven network requirements of the previous workshop

- **Both Workshop reports are available at www.es.net/#research**

ESnet's Evolution over the Next 10-20 Years

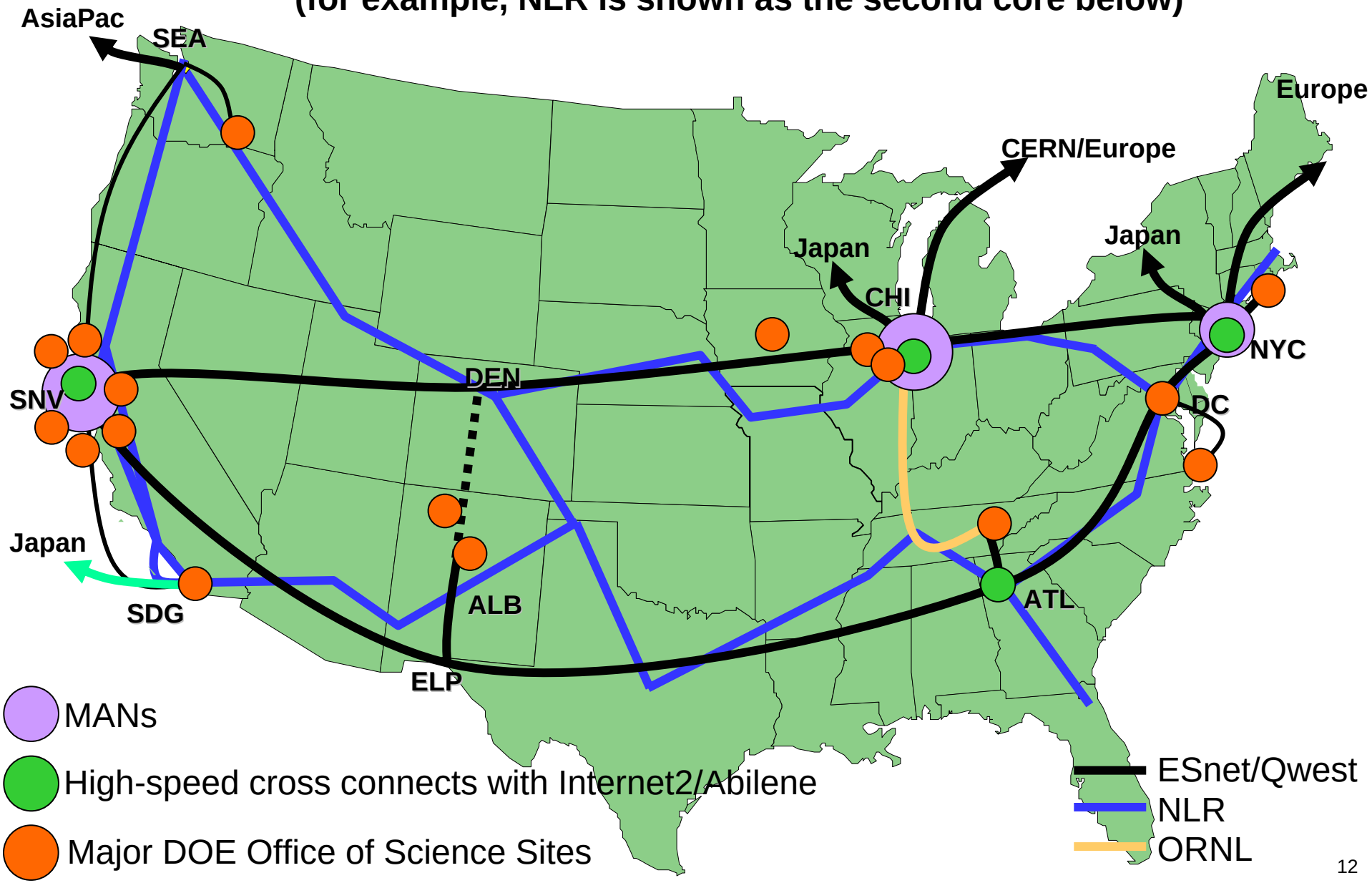
- Upgrading ESnet to accommodate the anticipated increase from the current 100%/yr traffic growth to 300%/yr over the next 5-10 years is priority number 7 out of 20 in DOE's "Facilities for the Future of Science – A Twenty Year Outlook"
- Based on the requirements of the OSC High Impact Science Workshop and Network 2008 Roadmap, ESnet must address
  - I. Capable, scalable, and reliable production IP networking
    - University and international collaborator connectivity
    - Scalable, reliable, and high bandwidth site connectivity
  - II. Network support of high-impact science
    - provisioned circuits with guaranteed quality of service (e.g. dedicated bandwidth)
  - III. Evolution to optical switched networks
    - Partnership with UltraScienceNet
    - Close collaboration with the network R&D community
  - IV. Science Services to support Grids, collaboratories, etc

New ESnet Architecture – Chicago MAN as Example



Production IP: Long-Term ESnet Connectivity Goal

- **Connecting MANs with two cores to ensure against hub failure (for example, NLR is shown as the second core below)**



Hi-Impact Science Bandwidth