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ESnet: tomorrow's network accelerating the pace of today's science

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Author
Leighton, James L.

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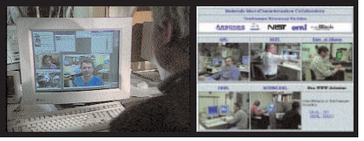
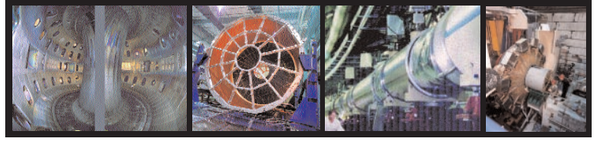
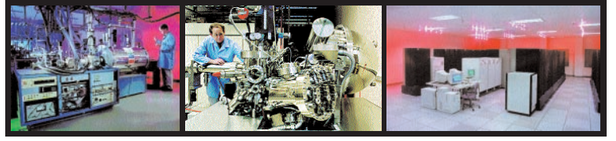
ESnet Tomorrow's Network

Accelerating the Pace of Today's Science







Accelerating the Pace of Today's Science

The Energy Sciences Network, or ESnet, is a high-speed network serving thousands of Department of Energy researchers and collaborators worldwide. Managed and operated by the ESnet staff at Lawrence Berkeley National Laboratory, ESnet provides direct connections to more than 30 DOE sites at speeds up to 622 megabits per second. Connectivity to the global Internet is maintained through "peering" arrangements with more than 100 other Internet service providers. Funded principally by DOE's Office of Science, ESnet allows scientists to use unique DOE research facilities and computing resources independent of time and location with state-of-the-art performance levels.

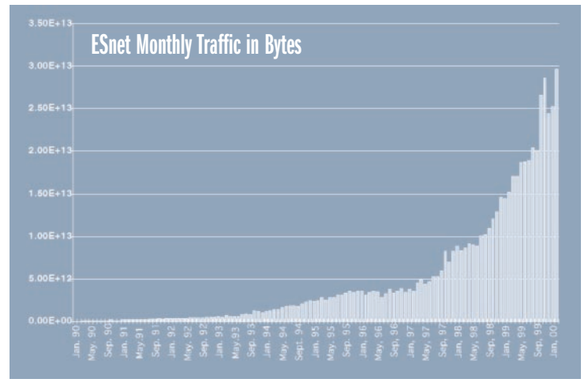
ESnet – The Energy Sciences Network

Community ESnet derives its effectiveness from the extensive cooperation it enjoys with its user community. It is one of the most widely based and successful cooperative efforts within the Department of Energy, perhaps within the federal government. The extensive participation by technical and scientific personnel on a DOE-wide basis results in extremely effective leveraging of both effort and resources. A recent formal review of the ESnet program gave it a rating of "outstanding" while commenting on it's high degree of cost effectiveness.

Performance ESnet performance levels have grown with user demands by a factor of more than 10,000 since its inception in the mid 1980s. Measurements of traffic accepted by the network from researchers shows growth by a factor of 100% every year since 1990 as illustrated in the graph (above right). Current projections call for a possible additional growth of more than 1,000 within the next five years to support DOE's role in proposed new interagency programs, potentially including the ability to network at terabit-per-second (one-million megabit/sec) levels. ESnet is already planning an architecture and approach to accommodate such performance levels.

Collaborations
An essential element of DOE research is the collaboration by teams of researchers located around the world. ESnet enhances the effectiveness of these scientists' work by providing a rich interconnectivity to the "outside" world. This includes interconnections to many other U.S. Internets, as well as a number of direct connections to international sites and networks. Recent emphasis has been placed on enhancing interconnectivity to U.S. universities with new "peering" interconnects to the Internet2 backbone network (Abilene) at speeds up to OC12 (622Mbps).

Services The ESnet project provides additional services beyond the network services mentioned above in support of the research efforts in DOE. The flagship effort is the ESnet Digital Collaboration Services, or DCS. The DCS is a collection of collaboration services and tools brought together in an integrated manner and designed for ease of use. The tools include an MCU (Multipoint Control Unit) for multiple-participant video-conferencing, an audio bridge, and a data-conferencing tool. All components can be reserved via a Web-based reservation tool in combinations that enhance the effectiveness of each one. For example, a user can reserve the audio bridge in association with the MCU so the planned video-conference can be attended with voice participation from a researcher who might be traveling and unable to gain access to video equipment.

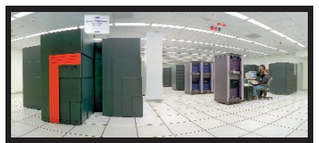


Research The user-driven, collaborative framework of ESnet, with its ongoing combination of reliable services coupled with state-of-the-art capabilities, uniquely positions it to contribute to the development of leading-edge technologies. ESnet is also strategically positioned to participate in interagency, national, and international research and development projects. Specific areas of current research and advanced technology include IPv6, ATM, streaming video, multicast, virtual private network, WDM and IP Differentiated Services.

Security ESnet is chartered to support only unclassified research and associated activities and therefore the security issues are those associated with an unclassified facility.

The Future ESnet will continue researching, developing and implementing new technologies to serve its customer base. Application-driven areas currently being targeted include:

- Remote experimental operations
- Distributed parallel computing
- Remote/shared code development and distributed data access
- Collaborative engineering
- Visualization
- Teleconferencing and videoconferencing.

Opportunities and requirements that are driven by anticipated service-offering advances are in the network crosscutting areas of:

- Quality of service capabilities
- Non-backbone connectivity
- Network status and diagnostic tools for users
- Network and application security.