Networking at the Speed of Science:
>> ESnet at 25

Networking today is ubiquitous, whether waiting for a flight at the airport, sipping a latte at the corner coffee place or reading email during a long meeting at work. And for many, when the network connection is broken, life seems to come to a standstill. While "networking" both refers to and fosters social interactions, the path to today's bandwidth was blazed by the scientific community.

One of those pioneers is the Department of Energy's (DOE) Energy Sciences Network, better known as ESnet. Created in 1986 to meet demands for moving data and accessing remote facilities, ESnet combined two networks serving researchers in fusion research (MFEnet) and high energy physics (HEPnet).

But ESnet's roots actually stretch back to the mid-1970s, when staff at the CTR Computer Center at Lawrence Livermore National Laboratory installed four acoustic modems on a borrowed CDC 6600 computer. Since those days, the network now known as ESnet has marked many milestones and is today one of the world's premier R&E networks.

1980-1981: ESnet's origins begin when American Satellite Corp. is selected by MFEnet to replace unreliable landlines used by researchers to connect with NERSC (then called MFECC). The new satellite links go online in 1981, providing connections to NERSC.

1985: Dr. Alvin Trivelpiece, head of DOE's Office of Energy Research, recommends MFEnet be combined with HEPnet, a network supporting High Energy Physics research to become ESnet.

1986: A formal proposal for creating the Energy Sciences Network is approved and ESnet is born. Responsibility for operating the new network is assigned to NMEFCC. Jim Leighton is named head of ESnet.

1987: Dual satellite links connect General Atomics, and Los Alamos, Argonne and Oak Ridge national labs at 56K speeds, while connectivity to the Princeton Plasma Physics Lab is upgraded to 112K.

1988: ESnet officially begins providing networking services in January.

1989: ESnet deploys commercially supplied multiprotocol routers via T1 lines, which provided speeds of 1.5 Mbps using Cisco AGS routers.

Early 1990: ESnet becomes international, video collaborations introduced. Satellite links to Japan and Germany and fiber links to CERN and U.K. go into service.

1992: ESnet upgraded to Cisco AGS+.

1994: First T3 links go into production, routers upgraded to Cisco 7000.

1995: ESnet is the first major network to convert to the new Asynchronous Transfer Mode technology through an agreement with Sprint.

1995: First OC3 service (155 Mbps).

1996: ESnet and NERSC move to Berkeley Lab. Although the network had been part of the NERSC supercomputing center at LLNL, ESnet becomes a standalone department at Berkeley Lab.

1996: ESnet joins the Internet Protocol Version 6 (IPv6) backbone research effort.

1998: ESnet begins providing OC12 service (622 Mbps).

2000: ESnet is assigned the very first production IPv6 addressing prefix by the American Registry for Internet Numbers and begins providing IPv6 services to users.

2000-2001: Transition from Sprint to Qwest as ESnet's network provider. Equipment includes Juniper M20 and Cisco 8540 & 7500.

2002: ESnet backbone moved from Qwest ATM to SONET at OC48 rate.

2003: Upgrade to 2.5 gigabits per second (billions of bits per second, or Gbps), with 10 Gbps in the highest-speed portion of the network.

2003: Bill Johnston, a distinguished networking and computing researcher, is named manager of ESnet.

2003: Northern route (SNV-CHI-AOA) is OC192 while southern route (AOA, DC, ATL, ELP, SNV) is OC48 Upgraded the core to Juniper T320 and M40e routers.

2005: First MANs (metropolitan area networks) designed and built in the San Francisco Bay and Chicago areas (in partnership with Argonne National Lab and Fermilab), and in Long Island, New York. The MANs provide dual connectivity to connected sites at 20 to 30 Gb/s - 10 to 50 times the sites' current bandwidth.

2005: ESnet becomes a key partner in DICE collaboration – an international collaboration of R&E networks focused on developing globally supported network standards and services. Other collaborators include DANTE in Europe, Internet2 in the U.S. and CANARIE in Canada.

2006: ESnet and Internet2 — two of the nation's leading networking organizations dedicated to research—announce a partnership to deploy ESnet4 to initially operate on two dedicated 10 gigabit per second (Gbps) wavelengths on the new Internet2 nationwide infrastructure.

2006: Network backbone upgraded to a mix of Juniper T320, M320 & MX960/MX480 routers.

2007: ESnet and Internet2 complete five interconnected rings, each consisting of one or more 10-gigabit-per-second (Gbps) paths, that form a coast-to-coast network that is the backbone of ESnet4.

2008: Steve Cotter, who has 10 years of experience in designing and deploying research and commercial networks at the national and international scale, is named as the new head of ESnet. Cotter is the third person to lead ESnet.

2008: ESnet completes hardware installations for the nation's first advance circuit network dedicated solely to scientific research, called the Science Data Network (SDN). This new network consists of multiple 10-gigabit optical circuits.

2005: ESnet is honored with an Excellence.Gov award for its achievements in leveraging technology. The Excellence.Gov awards are sponsored by the Industry Advisory Council's (IAC) Collaboration and Transformation Shared Interest Group and recognize the federal government's best information technology (IT) projects.

2008: ESnet and the Korea Research Environment Open Network2 and the Global Ring Network for Advanced Applications Development achieved a sustained data transfer rate of 1 gigabit per second (Gbps) between the Brookhaven National Laboratory in New York and the Korea Institute of Science and Technology Information in Daejeon, South Korea.

2009: ESnet deploys a production IPv6 management system across its entire network.

2008: ESnet rolls out its On-Demand Secure Circuit and Advance Reservation System (OSCARS) enabling network engineers and users to provision point to point dynamic circuits when and where they need them.

2009: InformationWeek magazine names ESnet as one of the Top 10 Government Agency Innovators in the field of information technology.

2009: Berkeley Lab receives $62 million to create the Advanced Networking Initiative (ANI), a 100 Gbps prototype network initially linking the National Energy Research Scientific Computing Center (NERSC), the Argonne Leadership Computing Facility, the Oak Ridge Leadership Computing Facility , and the MAN LAN international exchange point in New York. ANI also enables ESnet to upgrade its entire backbone to 100 Gbps technology by the end of 2012.

2010: ESnet reaches first milestone in ANI deployment with Infinera DWDM installation.

2010: ESnet acquires its first pair of dark fibers, providing the DOE a long-term investment in raw networking assets.

2011: ESnet announces agreement with Internet2 to share an unprecedented 8.8 terabits of network capacity. ESnet also acquires national dark fiber footprint though the agreement.

2011: ESnet's OSCARS service wins Internet2 IDEA award and receives an honorable mention in the UC Seutter award program.

2011: ESnet announces an agreement with LGS to deploy Alcatel-Lucent 7750 service routers to provide 100 Gbps capabilities on the backbone.

2011: ESnet launches My ESnet portal for real time, customizable information on network utilization and performance.

2011: ESnet and Internet2 complete the world's first transcontinental deployment with 100 Gbps connections between New York, Washington D.C., Cleveland, Chicago, Kansas City, Denver, Salt Lake City and Sunnyvale covering nearly 4000 miles.

2011: ESnet, Orange Silicon Valley and Bay Micro-systems collaborate on the world's first 40 Gbps wide area network deployment of Remote Direct Memory Access over InfiniBand.

2010: ESnet finishes implementing Domain Name System Security Extensions, digitally signing Domain Name System records and managing cryptographic keys, beating a government deadline.

2010: ESnet opens Advanced Networking Initiative testbed, a rapidly reconfigurable high-performance network research environment for disruptive network experimentation.

<< 1980's >>

<< 1990's >>

<< 2000's >>

1969: Tim Berners-Lee invents the WWW.

1988: Berkeley Lab's Van Jacobson pioneers TCP/IP congestion control.

1993: NCSA releases Mosaic 1.0, opening up the Internet to a wider audience, which embraces Doom, the first killer app.

1991: Commercial restriction on Internet use is lifted.

1990: World Wide Web debuts, popularizes Internet, 300,000 users. ARPANET shuts down.

1998: Internet2 builds its first network, Abilene.

1998: Google founded.

2005: Launch of YouTube video-sharing site.

2004: Facebook founded.

2003: Apple opens iTunes.

2001: Apple releases its first iPod, Wikipedia is launched.

2006: Twitter created.

2008: Monthly Internet users top 1 billion (or 1.5 billion depending on which web site you read).

2007: The iPhone debuts, launching the era of the smartphone.

2009: The Internet turns 40, based on the first message sent across ARPANET on Oct. 29, 1969.

2010: iPad introduced.