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In Debt to the NSF

THE DEFENSE ADVANCED Research Projects Agency launched the ARPANET project in 1968 and the Internet project in 1973.

In 1980, the National Science Foundation (NSF) sponsored the development of CSNET^a to connect a number of computer science departments together that had not already been connected to the ARPANET. Using a mix of dial-up phone connections, public X.25 packet network services, and access to the ARPANET, the CSNET was the programmatic forerunner of the National Science Foundation Network (NSFNET).

The NSFNET project had an enormous influence on the evolution of the Internet. The 1985 NSFNET connected five NSF-sponsored super-computer centers together in a 56 kilobit/second network.^b A critical and controversial decision made by NSF was to use the TCP/IP protocols for the NSFNET backbone. Then, the International Organization for Standardization's Open Systems Interconnection (OSI) protocols^c were widely thought to be the direction for international computer networking. By 1987, this network^d had become congested and NSF began a new 1.5 megabit/second development in 1988 through a consortium led by MERIT,^e IBM^f and MCI,^g which would later yield operation to the non-profit organization, Advanced Networks and Services^h (ANS).

Taking advantage of the multi-network architecture of the Internet, NSF underwrote the creation of eight regional networksⁱ that would service some 4,000 universities in the U.S. and connect them to the NSFNET backbone. In addition, NSF initiated an International Connections program to underwrite the cost of international links between NSFNET and other research networks around the world.

Also in 1988, the U.S. Federal Research Internet Coordinating Council approved the interconnection of the commercial MCI Mail system^j with the NSFNET, allowing commercial traffic to flow on the U.S. Government-sponsored backbones, including ARPANET, NSFNET, the Department of Energy's ESNET^k and NASA's NSINET.^l Federal Internet Exchange (FIX) points were created to link these networks to one another.

By 1989, three commercial Internet backbone suppliers emerged: UUNET,^m Performance Systems International (PSINETⁿ) and the California Education and Research Federation Network^o (CERFnet) and they were interconnected to each other by their Commercial Internet Exchange analog of the Federal versions and were also connected to the NSFNET.

Traffic grew dramatically and the NSFNET backbone was upgraded to 45Mb/s in 1992. The next year, the High Performance Computing and High Performance Networking Ap-

plications Act of 1993^p was passed which incorporated provision for commercial traffic transiting the U.S. Government backbones. By 1994, it was becoming apparent that commercial networking was rapidly developing. NSF sponsored the creation of four Network Access Points^q (NAP) setting the stage for the termination of the NSFNET by interconnecting all the intermediate level networks to the NAPs and thus remaining interconnected to each other. The notion of NAPs evolved to become Internet eXchange Points (IXP) where many component networks could interconnect with each other and the larger Internet.

In 1995, the NSFNET backbone was retired. Its network research support functions were taken over by the Very High Speed Broadband Network Service (vBNS) operated by MCI and by Internet2, an academic consortium.^r NSF continues its vigorous support for network research to this day, spinning off new technologies leading to new commercial networking offerings. We collectively owe much to the foresight and nuanced decisions taken by the leadership of NSF's Computer, Information Systems and Engineering Directorate^s (CISE) and its Division of Computer and Network Systems. ■

p <https://www.ibiblio.org/nii/boucher.html>

q one in New York operated by Sprint, one in Washington, D.C. operated by MFS, one in Chicago operated by Ameritech, and one in California operated by Pacific Bell.

r <https://www.internet2.edu/>

s <https://www.nsf.gov/dir/index.jsp?org=CISE>

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a <https://en.wikipedia.org/wiki/CSNET>
 b https://en.wikipedia.org/wiki/Fuzzball_router
 c https://en.wikipedia.org/wiki/OSI_model
 d https://en.wikipedia.org/wiki/National_Science_Foundation_Network
 e www.merit.edu
 f www.ibm.com
 g https://en.wikipedia.org/wiki/MCI_Communications
 h https://en.wikipedia.org/wiki/Advanced_Network_and_Services

i BARRNet, Merit, MIDnet, NCAR, NorthWest-Net, SESQUINET, SURAnet, and Westne
 j https://en.wikipedia.org/wiki/MCI_Mail
 k <http://es.net/>
 l <https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/19910017727.pdf>
 m <https://en.wikipedia.org/wiki/UUNET>
 n <https://en.wikipedia.org/wiki/PSINET>
 o <https://en.wikipedia.org/wiki/CERFnet>