National Research & Education Network

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NASA
GOALS: STRATEGIC PRIORITIES

Extend U.S. technological leadership in high performance computing and computer communications

Provide wide dissemination and applicatin of the technologies both to speed the pace of innovation and to serve the national economy, national security, education, and the global environment.

Spur gains in U.S. productivity and industrial competitiveness by making high performance computing and networking technologies an integral part of the design and production process.
High Performance Computing & Communications

STRATEGY: INTEGRATING PRIORITIES

Support solutions to important scientific and technical challenges through a vigorous R & D effort

Reduce the uncertainties to industry for R&D and use of this technology through increased cooperation between government, industry, and universities and by the continued use of government and government-funded facilities as a prototype user for early commercial HPCC products.

Support the underlying research, network, and computational infrastructures on which U.S. high performance computing technology is based.

Support the U.S. human resource base to meet the needs of industry, universities, and government.
High Performance Computing & Communications

PROGRAM COMPONENTS

High Performance Computing Systems (HPCS)
- 1000-fold increase in computing power

Advanced Software Technology and Algorithms (ASTA)
- Grand Challenges applications

National Research and Education Network (NREN)
- R&D and wide-area gigabit communications

Basic Research and Human Resources (BRHR)
- Infrastructure, training, education
High Performance Computing & Communications

NREN 5-YEAR IMPLEMENTATION
- Interconnect Agency networks with 1.5 mbps backbone
- Upgrade multi-Agency backbone to 45 mbps
- Perform R&D to achieve 3 gbps networking capability

MULTI-AGENCY PROGRAM
- NSF, DARPA, DOE, NASA; also NIST, HHS, NOAA & EPA
The HPCC agencies (NSF, DARPA, DOE & NASA) have demonstrated close collaboration in their networking activities, and they are developing more formal structures for the close coordination needed to ensure success of the NREN.

- DARPA will coordinate gigabit network technology research and development activities in which DARPA, DOE, NASA, NIST, and NSF will participate.

- NSF will coordinate the broad deployment of the NREN by working with all participating HPCC agencies through formal structures, such as the FCCSET subcommittees and the Federal Network Council.

- In conjunction with the other HPCC agencies, NIST will identify and develop network and security standards.
# The HPCC Program

**OSTP-FCCSET 1989**

| 1. High Performance Computers | research on future generations system design tools advanced prototype development evaluation of early systems |
| 2. Software and Algorithms     | grand challenge problems SW components and tools computational techniques HPC research centers |
| 3. National Research and Education Network | interim NREN gigabit networking research & deployment transition to commercial service |
| 4. Basic Research and Human Resources | instrumentation and lab improvement education and training basic CS & CE research |
A Brief History of HPCC

Science & Technology Reports
- Lax
- Bardon - Curtis
- NRC (many)
- OSTP/FCCSET process

'87 FCCSET "Strategy"

OSTP HPCC Program, "Gore Bill" (S1067), etc

Agency Initiatives
- NSF Supercomputer Centers
- DARPA Teraops
- NASA 'Telescience' Initiative
- NSFNET and Internet Cooperation

Academic Nets
- Bitnet, CSNnet

ARPANET / Interagency
- Internet

NSFNET and education
- "National Research Net"

197x 1980 1985 1990 1992 199x
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The Present Internet

Experimental Commercial Services

ARPAnet

ABC net

XYZ net

NSFnet

gateway

gateway

ESnet

gateway

NSInet
NSFNET Traffic Mix*

- Interactive: ~20%
- File Transfer: ~25%
- Name Service: ~12%
- Mail, BB's & Conferencing: ~25%
- Other: ~18%

* All estimates ± ~2%
National Network Hierarchy

NSFNET

Regional Network

Corporate Net

Center Net

Campus Net

Local Area Net

Building Net

Office Net

Value Added Net

USERS

( electronic mail, file transfer, logon, etc.)
Technical Approach to NREN

IF NREN IS FUNDED, THE INTERNET WILL EVOLVE TO NREN
Initial NREN Implementation Plan

Stage 3
Gbits/sec
NREN

Stage 2
45Mbits/sec
NREN

Stage 1
1.5 Mbits/sec
Internet

Stage 3 Operational Network
Stage 3 Testbeds/Experimental Networks
Stage 3 Research and Development

Stage 2 Operational Networks

Transition to Commercial Service

Stage 1 Operational Networks
Stage 1 & 2 Development

Timeline:
89 90 91 92 93 94 95 96
Management Approach to NREN

Federal Network Council

HPCC AGENCIES
NSF, DARPA, DOE, NASA;
NIST, NOAA, EPA, NIH

NSF
Interim NREN
Program Manager

DARPA
Gigabits R&D
Program Manager

NREN
FEDERAL NETWORK COUNCIL
(Charter)

- FORMED by FCCSET Network SubCommittee Chair (Jan, 1990)

- PURPOSE: to establish an effective interagency forum and long-term strategy to oversee the operation and evolution of the Internet and other national computer networks in support of research and education.

- FNC will coordinate with FCCSET to ensure national alignment.

- WORKING GROUPS will be established to support the FNC; members will be limited to Federal employees, Government contractors/grantees, or members of Federal advisory groups.

- FNC will meet at least 4 times per year.
FNC Advisory Committee

FNC, coordinating with OSTP, will establish a charter and formal Advisory Committee representing industry and academia and the national user community; this Advisory Committee will work closely with the FNC to provide guidance in developing the NREN.
Industry-University-Government
High Speed Network
Research Testbeds

UC Berkeley,
LBL, U Wisc,
NCSA,
ATT Bell Labs,
Ameritech,
Bell Atlantic,
ATT, Pac Tel,
US West

MIT, U Penn,
Bellcore, IBM,
Bell Atlantic,
MCI, NYNEX

CMU, PSC,
NRL, Bell Atlantic

SDSC, Cal Tech, Los Alamos,
MCI, Pacific Telesys, US West

UNC, MCNC,
Bell South, GTE

Note: see special report on "GIGABIT NETWORK TESTBEDS", COMPUTER,
V.23 N.9, September, 1990, IEEE Computer Society, Los Alamitos CA 90720