Next Generation Internet Overview

Satellite Networks Workshop
Cleveland, Ohio
June 3, 1998

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NGI Overview

Goals:

- Promote experimentation with the next generation of network technologies
- Develop a next generation network testbed to connect universities and federal research institutions at rates that are sufficient to demonstrate new technologies and support future research
- Demonstrate new applications that meet important national goals and missions

LEGEND

- DREN - Defense Research & Engineering Network
- NREN - NASA Research and Education Network
- vBNS - Very High Speed Backbone Network Service (NSF)
- SuperNet - Terabit Research Network (DARPA)

- - NREN Application Partner
- - vBNS Partner
- - Next Generation Internet Exchange
Advanced Networking: NASA's Relationships with Other Agencies

**Advanced Networking Science & Technology R&D**

- DARPA ($40 M)
  - Basic technology research

- NSF ($23 M)
  - Connectivity & technology delivery to research universities; Internet2

- NASA ($10 M)
  - Applied research for end-to-end systems development and integration

- NIST (5 M)
  - Standards development; interagency

- NIH (5 M)
  - Advanced medical application demos; medical research; health care applications

Advanced networking services delivered to users

NGI/I2 Comparison

**Next Generation Internet**

- Federal funding
- Agency mission driven
- R&D in advanced networking technologies, and demonstrations on a wide-area scalable testbed which connects to academic (including some Internet 2 universities) and industry networks
- Develop general-purpose and agency-specific applications

**Internet2**

- Funded by research universities and communications and computing companies
- Education and research driven
- State-of-the-practice connectivity deployed at universities and GigaPOPs and interconnected using NSF's vBNS as the backbone
- Deploy networking technologies and develop a wide range of applications (many funded by Federal initiatives such as NGI)

Mid Atlantic GigaPOP for Internet2
**Capability**

**Today**
- "Best Effort"
- Unicast (point-to-point networking)
- Lots of human intervention required to manage
- Security handled by host
- Router-to-router performance monitoring

**Tomorrow**
- Differentiated services
- Intelligent network (scalability)
- End-to-end performance management policies and tools
- Security as part of the network
- End-to-end performance measurement
- Qualities of service
- Multicast
- End-to-end service guarantees

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**Capacity**

**Today**
- Internet exchange points are bottlenecks
- Newer applications don't have enough bandwidth
- Available bandwidth is poorly utilized
- Duplicate traffic slows growth of advanced applications

**Tomorrow**
- Robust internetworking exchanges move the traffic
- New technologies provide wide-open bandwidth
- Networks are unclogged by high-speed applications running over high-speed networks
- Multicast reduces traffic exponentially
Revolutionary Applications

Today
- Electronic mail
- File transfer
- World Wide Web
- Remote login
- Travel to meetings
- Isolated design systems

Tomorrow
- Collaboratories
- Metacomputing
- Distance learning
- Telemedicine
- Integrated design systems
- Remote operation

NASA Mission Application Partners

Accelerate network technology development to meet NASA unique mission requirements today.

Astrophysics

Earth Sciences:
Advanced Earth Sciences Investigations

Astrobiology Institute
Collaboratories, Virtual Aerospace Environment

Space Exploration

Telemedicine, Interactive Consultations, Remote Protocols and Procedures

Advanced Aerospace Design Information
Power Grid, Wind Tunnels on-line, Virtual Flight Simulation Laboratories
Today

- Isolated research
- Many autonomous systems with different architectures and policies
- Uncoordinated, duplicate technology development efforts

Tomorrow

- Collaborative research
- True end-to-end systems technology integration across heterogeneous networks
- Partnerships allow collaboration on large-scale testbeds
- Technology scalable across wide area networks

More Information

- National Coordination Office for Computing, Information and Communications
  - http://www.ccic.gov

- Internet 2 (university consortium)
  - http://www.internet2.edu

- NASA Research and Education Network
  - http://www.nren.nasa.gov

- DOE
  - http://www.es.net

- DARPA

- NSF’s Connections
  - http://www.vbns.net

Next Generation Internet
http://www.ngi.gov