NGI , SECURITY, and YOU

Bob Aiken

NGI Project Leader

DOE

aiken@er.doe.gov

Security Workshop

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Points to Remember

- **Dynamic Adaptable Virtual Networks and Computational GRIDS are the Future !!**
- **The NET and NGI are NETS of NETS**
- **More control by the user will mean more security challenges**

Program Goals

- **New technologies and services**: sponsor research and development in new networking technologies and services in support of the high performance applications requirements
- **Testbed(s):** build a high performance network infrastructure in support of both network research and science applications research
- **Applications**: support demonstration of next generation applications requiring advanced networking technologies

GOAL 1: Technologies

- Network Engineering
- QOS
- Security

Goal 1 : Network Engineering

- Planning and Simulation
- Monitoring
- Integration
- Data delivery
- Managing Lead User Infrastructure
- Dynamic and Adaptive Networks

Goal 1 : QOS (end to end)

- Baseline QOS Architecture
- Admission control , accounting / costing, prioritization
- APIs to see and control QOS
- Drill Down Technologies

Goal 1 : Security

- secure and fair means for users to access network resources (e.g. QOS)
- smart network management
- inter-network peering (e.g. surety of routing updates)
- nomadic/remote access
- Public Key Infrastructure (industry interoperable)

Summary: Security Issues for Goal 1

- Multiple security policies
- shared control / management of infrastructure
- adaptive and active networks
- drill down technologies
- QOS - enforcement and admission control
- interoperable industry PKIs
- secure multicast and multipath
- privacy / security for network monitoring and management
- common set of evaluation and testing criteria

GOAL 2 : TESTBEDS

- 10+ sites at 1000x today's Internet of ~ T1 speed

- 100+ sites at 100x today's Internet of ~ T1 speed

Goal 2 : 10 sites at 1000x

- end-to-end gigabits and terabits
- end system 1000x interfaces (e.g. HIPPI 64)
- WDM at WAN, LAN and Local Loop
- optical, electrical, hybrid hardware
- (de) aggregation of high speed tributaries
- Operating System (OS) and end system architectures
- 1000x network management tools / capabilities

Goal 2 : 100 sites at 100x

- end-to-end 100 megabits and up
- 100+ Universities, Labs, and Federal Centers
- IPv4 minimum bearer service , IPv6 in future
- ATM and other services as required (VPNs)
- Gigapops (aggregation points)
- vBNS is I2 and Gigapop interconnect fabric
- interconnection and peering
- Large scale and cross domain network mgmt.
- concurrent production and network research

MORPHNET (Virtual Networks)
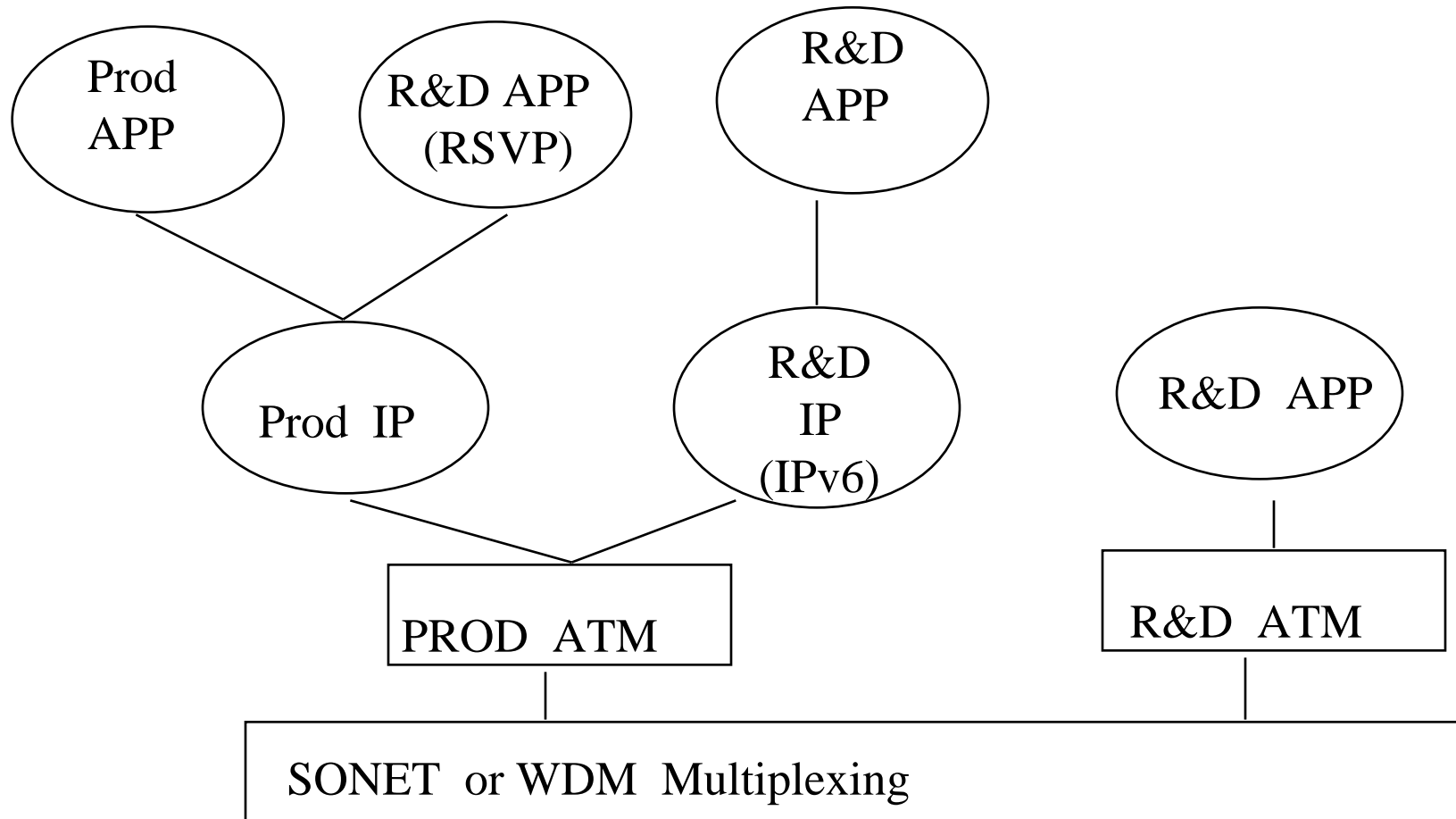
Summary: Security Issues for Goal 2

- Encryption at Ultra High Speeds

- network probes for management, monitoring, and validation of services vs Intrusion detection (traceroutes, pings,…)

- Certificate Authorities and Infrastructure (including large revocation lists)

- Support for dynamic virtual networks

- secure software updates and patches

Summary: Security Issues for Goal 2, ctd

- interconnection/ peering of Nets
  - privacy of customer list and performance data
  - secure exchange of routes / peering
  - propagation and support of multiple QOS and security policies
  - dynamic construction of virtual networks across ISP
  - cross domain/NET Intrusion detection and tracing
  - Help desk and trouble ticket across ISPs

Goal 3 : Applications

- Applications
  - Medicine
  - Crises Management
  - Basic Sciences
  - Education
  - Environment
  - Manufacturing
  - Federal Services

- Characteristics
  - **Distributed Computing**
  - **Remote Operation**
  - **Digital Libraries**
  - **Collaboratories**
  - **Privacy / Security**

Summary: Security Issues for Goal 3

- Application controlled dynamic NETS
- Application invoked multiple security policies
- Application controlled QOS

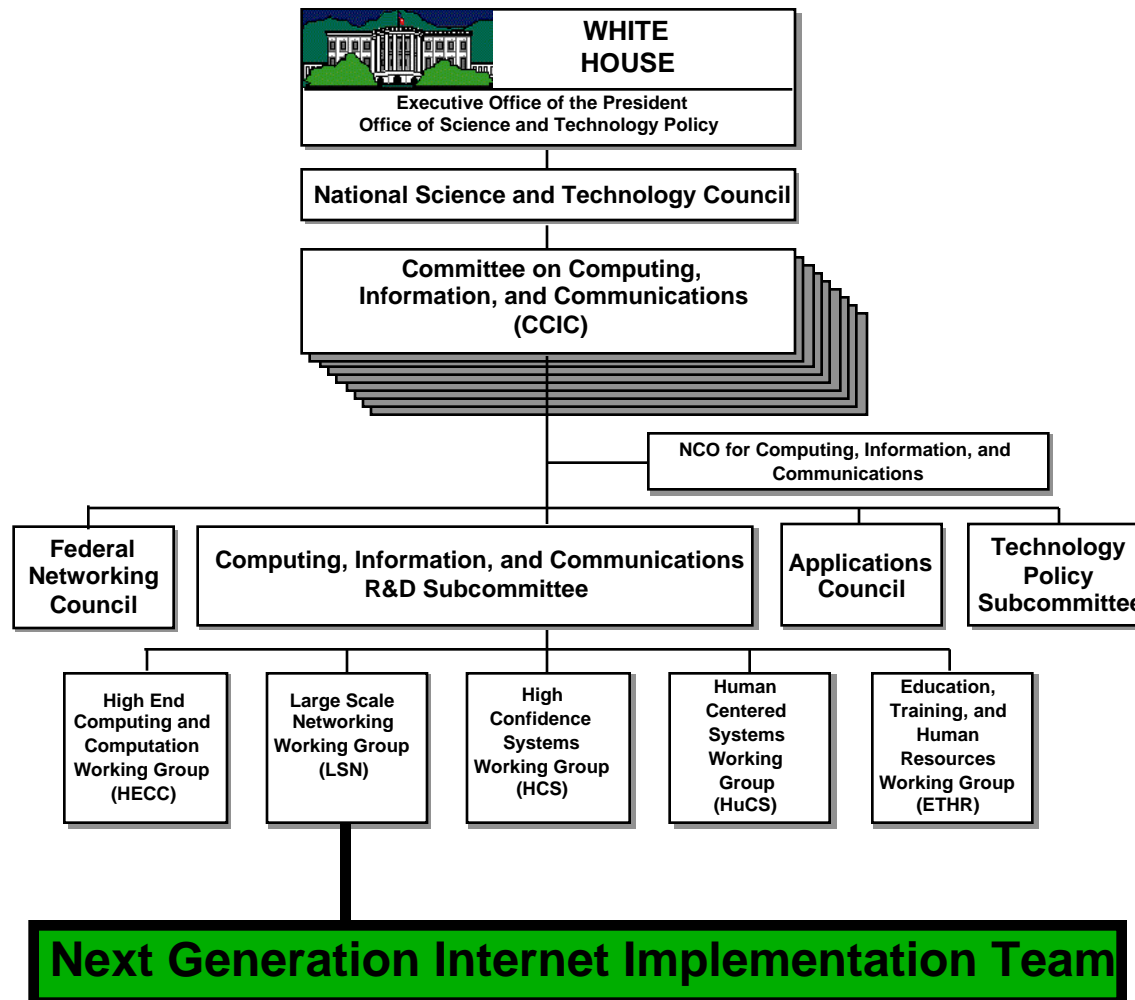# NGI FY 1998 Proposed $105* Million Budget ($ in Millions)

	DoD/DARPA	NSF	DoE	NASA	NIST	NLM/NIH*	TOTAL
Goal 1: Technologies	20	2	6	2	2		32
Goal 2: Advanced Connectivity	20	7	25	3			55
Goal 3: Applications		1	4	5	3	5	18
Total	40	10	35	10	5	5	105

*Note: The initiative was originally proposed at $100 million per year with funding expected from additional agencies who want to be part of the program. NLM/NIH is the first example of an additional NGI initiative partner. Therefore, the total proposed budget is now $105 million allocated as shown above.

NGI Management Structure
see: http://www.ccic.gov

WHITE HOUSE
Executive Office of the President
Office of Science and Technology Policy

National Science and Technology Council

Committee on Computing, Information, and Communications (CCIC)

NCO for Computing, Information, and Communications

Federal Networking Council

Computing, Information, and Communications R&D Subcommittee

Applications Council

Technology Policy Subcommittee

High End Computing and Computation Working Group (HECC)

Large Scale Networking Working Group (LSN)

High Confidence Systems Working Group (HCS)

Human Centered Systems Working Group (HuCS)

Education, Training, and Human Resources Working Group (ETHR)

Next Generation Internet Implementation Team

NGI Participants : DARPA, DOE, NASA, NIH, NIST, NOAA, NSF

- Michael Ackerman, NIH
- Robert Aiken, DoE
- Debra Bailey, NASA
- Richard desJardins, NASA
- Richard DuBois, NIH
- Phil Dykstra, DoD
- Don Endicott, DoD
- Christine Falsetti, NASA
- Jim Fowler, NIST
- Ken Freeman, NASA
- Bert Hui, DARPA

- Gary Koob, DARPA
- Mark Luker, NSF
- Doug Montgomery, NIST
- Hilarie Orman, DARPA
- Alex Poliakoff, Dept. of Education
- Mary Anne Scott, DoE
- George Seweryniak, DoE
- Carl Stanton, NOAA
- Dave Staudt, NSF
- Bill Turnbull, NOAA

More Information ...

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

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

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

- **DOE**
  - **http://www.es.net**
  - http://www.anl.gov/ ECT/Public/research/ morphnet.html

- **DARPA**
  - **http://www.ito.darpa.mil/ ResearchAreas.html**

- **NSF's Connections**
  - **http://www.vbns.net**

Goal 1 : Technologies

- Network Engineering
  - Planning and Simulation
    - network planning language
    - run time tools
  - **Monitoring**
    - **gathering data**
    - network engineering
    - **network management**
    - run time (i.e. dynamic) analysis
    - QOS and drill down analysis tools
  - Integration
    - engineering tools, switching/routing, and transmission to work smoothly

Goal 1 : Technologies ctd.

- Network Engineering ctd.
  - Data Delivery
    - **routing / switching   (secure?)**
    - best effort vs priority traffic
    - dynamic routing vs virtual circuits (VCs)
    - greedy admission vs guaranteed delivery
    - **flat rate vs variable costing**
    - **multicast (reliable vs unreliable)**
    - real time protocols and traffic

Goal 1 : Technologies ctd.

- Network Engineering ctd.
  - Managing Lead User Infrastructure (fast, complex, dynamic)
    - **Concurrent Production and Network Research traffic** (virtual networks)
    - **(de) aggregation of tributaries**
    - operation and management strategies and tools
    - scaling (speed, size, complexity)
    - user requirements that are orders of magnitude larger and more complex that normal applications and traffic

Goal 1 : QOS (end-to-end)

- Baseline QOS Architecture
  - framework of models, languages and protocols to specify QOS
  - negotiate acceptable tradeoffs
  - receive feedback on delivered QOS (enable adaptation)
  - APIs supporting propagation of QOS constraints and feedback
  - **admission control**
  - **accounting / costing**
  - **prioritization**
- Drill Down Technologies
  - **support QOS across ("drill down") layers**
  - **expose interfaces to QOS and network capabilities**
  - emphasis on OS, communication libraries, middleware services and distributed objects

Goal 1 : Security

- secure and fair means for users to access network resources (e.g. QOS)

- smart network management

- inter-network peering (e.g. surety of routing updates)

- nomadic/remote access

- Public Key Infrastructure (industry interoperable)

Goal 2 : 10 sites at 1000x

- end-to-end gigabits and terabits to Applications
- **end system 1000x interfaces** (e.g. HIPPI 64)
- Operating System (OS) and end system architectures
- 1000x network management tools / capabilities
- **(de) aggregation of high speed tributaries**
- **WDM** at WAN, LAN and Local Loop
- optical, electrical, hybrid hardware
- interconnect to 100x networks

Goal 2 : 100 sites at 100x

- end-to-end 100 megabits and up
- 100+ Universities, Labs, and Federal Centers
- supports applications (goal 3) using advanced network technologies (goal 1)
- **IPv4 minimum bearer service**
- **IPv6 in future**
- ATM and other services as required (VPNs)
- **Gigapops** (aggregation points)
- vBNS is I2 and Gigapop interconnect fabric
- **concurrent production and network research**

Goal 2:100 sites at 100x ctd

- Interconnection
  - at L2 and L3 among Federal Networks / Carriers
  - QOS (IP and ATM)
  - Management tools and capabilities (NOCs, Helpdesks, ...)
  - **Monitoring, Analysis and Accounting (settlements) tools**
  - routing / peering exchanges between Federal networks and Federal networks at Gigapops (when appropriate)
  - **Flexible and dynamic methods for setting up interagency virtual networks**

Goal 2 : 100 sites at 100x ctd

- Network Management
  - **distributed help desk**
  - **security and authentication methods**
  - gigapop and agency network NOCs (NOC to NOC)
  - **applications can schedule bandwidth and services**
  - network management tools (existing and new)