
# The Co-mingled Universe of R&E Networking

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# Topics

- A brief history from a good seat…
- Going forward “opportunities”
- Characteristics of R&E networking
- Relating to corporate requirements
- What does comingled mean?
  - To the current commodity
  - To the future clean slate…

# A Brief History …

- Getting onto Arpanet…
- The mid ’80’s
  - JVNC, NSFnet, ESNet, BITnet, CSNet
  - On-campus, the shift from TN3270 to campus nets
- The mid ’90’s
  - vBNS, Abilene, etc
  - The emergence of the border router
  - On-campus, from multiprotocols to TCP/IP

# And now…

- A major R&E institution has several external connections, with distinct characteristics (performance, AUP's, etc.)
- Complex campus networks, with high-performance meshes, lower-speed extensions, clusters of advanced nets, etc.
- Distributed management of networks and desktops
- Lots of special cases, like Medical Schools, Engineering Colleges, Dormitories

# And now…

- Security challenges
  - The demise of the fictitious perimeter
  - Roaming devices
  - Wireless
  - Slow to deploy DNSSec and problematic IPSec
- The prospect of new types of external non-IP connections
- Complex, undiagnosable deployments
- Policy drivers for technology

# Going Forward “Opportunities”…

- The prospect of on-demand personal “lambdas”
- Infocard
- Federated identity and trust
- Uneven economics

# Characteristics of R&E Networking

- Enterprise centric
  - Networking is part of an infrastructure provided to members. Operated often as a common good
  - Often run to a building or POP in a sub-unit; often some wall-plate services as well
- Desktop autonomy
  - Heterogeneity of platforms
  - Loose desktop management
- Leading edge
  - Early developers/adopters of new technologies
- Regulatory complexity
  - HIPAA, FERPA, AUP, DMCA

# More characteristics

- Demanding applications
  - Bandwidth, latency, jitter, transparency
- Strong inter-institutional requirements
- Multiple external links
  - AUP's
  - Performance distinctions
- Funding that favors one-time versus continuing costs

# Relating to corporate needs

- From the Jericho forum:
  - Can no longer assume that an organization owns, controls and is accountable for the ICT infrastructure it employs
  - Should not assume that all individuals sit within organizations and are managed by a single IdM
- Vision statement:
  - Cross-organizational security processes and services
  - Open standards
  - Assurance processes that when used in one organization can be trusted by others

# Network Applications Consortium

- NAC - a group of 25-30 major companies (Boeing, Bechtel, GlaxoSmithKline, PG&E, etc.) with intermingled research and operational environments
- ***Welcome to the Network Applications Consortium "where membership radically improves the delivery of agile IT infrastructure in support of business objectives"***
- Original focus was on middleware, where Internet2 and NAC members have had meaningful if sporadic interactions
- Added focus over the last year on network security
- http://www.netapps.org/

# NAC Enterprise Security Architecture

Key Concepts:

- Security by design
- Usability and manageability
- Defense in depth
- Simplicity
- Enforced policy

Key leveraging technologies:

- Identity Management
- Directory Services
- Border Protection
- Reusable tools
- Desktop management
- Role based security

# Comingled with the commodity

- The commodity Internet is a part of the R&E network environment
  - With its security issues
  - With its packet disruption appliances
  - With its legacy requirements
- True to being the original crucible, new deployments in commodity often begin in R&E
  - Multicast, IPv6, DNSSec

# Co-mingled with the future

- It is likely that any advanced network initiatives will have presence on campuses and require integration.
- Forces may drive management of long distance networking to the end points
- Layers of invention that new networking approaches could leverage are being developed in the R&E community
  - Trust fabrics
  - Manageability discussions

# Distinctions?

- This workshop is more on architectures than protocols
- We have steep requirements around policy
- We are driven by researcher needs as much as by economics, capabilities, security, policy, etc.

# Questions -1

- Role of enterprise vs role of VO vs role of individual
  - In authn/z
  - In provisioning networking
  - In resource discovery, etc…
- What role will the enterprise have in personal lambdas?
- What parts of the infrastructure will the enterprise own? Manage?

# Questions -2

- What parts of manageability matter? Costs, downtime, security, privacy…
- Does the control plane/data plane distinction continue to matter? Do we need more planes or less? (remember dynamic networking…)
- How will diagnostics happen in the face of complexity, higher levels of performance, scale, etc?
- How will resource discovery be addressed at so many layers?

# Questions - 3

- How important is e2e transparency? How important is innovation in the face of security?
- What will drive change?
- How will devices and appliances on the net change the problem?
- Will outsourcing, offshoring etc affect R&E nets?