Outrageous Opinion:
Vision for the Internet

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ICNP Panel, October 2004

What Did the Internet Look Like in 1984?

- Very small number of hosts.
- Very simple applications.
- Small user community of experts.
- Relatively clean architecture.

What Factors Caused the Internet to Change?

- Moore’s law: cheaper, faster, ...
  - Reduction in cost of bandwidth (e.g. optical)
  - Improved endpoints
- Richer applications: web, e-commerce, ...
  - Easier to use
  - Useful to a much broader population
- Commercialization: ISPs, content providers, ...
  - Very wide-spread deployment
  - More complex architecture

Trends

- Copper technology: coax, twisted pair, ...
- Optical technology: fiber, optical amp, ...
- Incremental evolution: ubiquitous wires, harder VCs, ...
- Limited end-points: Mainframes, workstations
- Richer End-points: PCs, servers, PDA, ...
- Specialized endpoints: video, audio, games, ...
- Simple applications: telnet, ftp, ...
- Richer applications: web, e-commerce, ...
- RT/interactive applications: Virtual/ized reality, ...
- Simple architecture: IP class driven, packet-based, ...
- Complex architecture: policy, middleboxes, soft VCs, ...
- More complexity: more middleboxes, ...

Quality of Service

- People’s expectations about service quality increase.
- Applications become more sophisticated and interactive.
- Providers are looking for value-added services.
- The Integrated Services QoS model no longer looks that far fetched!
  - Existing standards
  - Mathematical basis
Let Us Try Again

- Did we miss something?

Factors that will Drive Changes

- Incremental changes in the infrastructure.
  - Improve efficiency, throughput
  - Similar to other mature industries
- Providers have to make money.
  - Must be able to add value to commodity throughput
  - Must be able to differentiate from competitors
- Security will drive architecture.
  - Captures authentication, DOS defenses, privacy, ..
  - But your grandparents/parent/kids must be able to use it
- People are willing to pay for quality.
  - See “providers have to make money”

Trends Revisited

- Copper technology: 
  - coax, twisted pair, ..
- Optical technology:
  - fiber, optical amp, ..
- Incremental evolution: 
  - ubiquitous wireless, harder VCs, ..
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  - web, e-commerce, ..
- RT/interactive applications: 
  - Virtual(ized) reality, ..
- Simple architecture: 
  - IP class driven, packet-based, ..
- Complex architecture:
  - policy, middleboxes, soft VCs, ..
- More complexity:
  - more middleboxes, ..
- Security: 
  - clear passwords
- Ad hoc security: 
  - ssl, firewalls, SP2, ..
- Hard security: 
  - strong auth, encr.

What Might Happen

- Islands with limited connectivity to Internet.
  - Keep the bad guys out
  - Lots of internal connectivity
  - High degree of self-configuration and self-management
  - Home/office islands: integrated with sensor networks
    - Island structure reflects physical infrastructure
  - Application-level gateways.
    - Help in security at island boundaries
    - Provide application-level support
      - Help with loss of connectivity caused by NAT/firewall
      - Value-added features!
Home Environment Example

My Home

Your Home

Oma's Home

My Bank

What Might Happen

- Automated secure sessions.
  - Connect known/trusted islands
    - Different methods for un/less trusted islands
    - Hierarchical: connect individual or groups of applications
    - Automated – invisible to most users
- Some quality of service.
  - Wireless, e.g. home networks
  - Value added service in the wide-area network
    - Value-added for providers
    - Driven by application gateways
  - Likely to be just be per-island (not end-to-end)