

U.S. Broadband Policy and the Challenges of Dependability

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Opinions expressed are those of the author alone

American Recovery and Reinvestment Act (ARRA)

- ARRA passed in Feb. 2009
 - \$787 billion economic stimulus
- Three broadband components
 - \$7 billion in funding for broadband
 - Creation of National Broadband Plan (NBP) for U.S.
 - Broadband mapping

Broadband Funding Programs

- Two primary funding programs
 - \$4.7 billion dispersed through NTIA
 - \$2.5 billion dispersed through RUS
 - FCC actively consults on program development
- Many uses, including
 - Deploying broadband infrastructure for public use
 - Last mile, backhaul, etc.
 - Facilitating broadband access for disadvantaged groups
 - Deploying broadband for public safety agencies
 - Connecting anchor institutions
 - Expanding public computer center capacity

National Broadband Plan (NBP)

- The FCC is responsible for cohesive set of recommendations on broadband policy
 - A national plan is not a funding program
 - A national plan is not a report
 - A national plan is not an FCC plan
- Chairman calls this most important thing the FCC has done since 1996 Telecom Act

Broad Scope of NBP

- Develop strategies to extend broadband access to all
 - Analyze most effective means of expanding infrastructure
 - Set benchmarks
- Develop strategies to
 - improve affordability of broadband
 - maximize utilization of broadband
- Develop strategies for use of broadband in important national purposes, including
 - consumer welfare, civic participation, public safety and homeland security, community development, health care delivery, energy independence and efficiency, education, worker training, private sector investment, entrepreneurial activity, job creation, economic activity

Dependability and Security in the NBP

- Do dependability and security matter?
 - Do they influence cost of deploying/upgrading infrastructure? pros and cons of various strategies?
 - or motivation for broadband adoption?
 - or usefulness for important national purposes?
 - energy, health care, economic activity, ...
 - or benchmarks to indicate infrastructure progress?
- Workshops
 - One on security.
 - One on public safety / homeland security
- Input in public comments?

Research and Innovation in NBP

- NBP should improve broadband in both short and long term.
 - Innovation matters.
- We can consider
 - what research topics should be pursued, and funded
 - what methods of funding research are most effective
 - how best to move important advances from the research lab into the infrastructure and applications
- Soliciting input from research community on these topics as well.
 - (But the FCC is not a research funding agency.)

Status of NBP

- Plan will be delivered to Congress Feb. 2010.
- So far, we have
 - Held over two dozen “workshops” with diverse experts
 - All videos available online
 - Done extensive analysis on broadband deployment and use today, strategies for advancing tomorrow, and costs
 - See Sept 29 FCC open meeting
 - Solicited written comments (Can submit through website)
 - Has the research community heard this call?
- Still working on recommendations

Network Neutrality

- Related to NBP, but placed in separate proceeding
 - Notice of Proposed Rule Making issued in late Oct.
 - Now soliciting comments. Later reply comments.
 - Process will continue into 2010.
- FCC Chairman and President have discussed its importance

Net Neutrality Principles

- A provider of broadband Internet access service may not prevent users from
 - sending or receiving lawful content
 - using lawful applications or services
 - connecting and using lawful devices
 - benefiting from competition
- Proposing two new principles
 - prohibiting providers from discriminating among content, application, and service providers
 - requiring providers to disclose important information concerning network management and other practices
- Principles would apply to wired and wireless networks
 - Could manifest somewhat differently. To be determined.

Many Technical Issues

- Public policy will not specify technical design, but it will influence technical design.
- Applications and content
 - Want to prevent provider from blocking content it does not like, but allow provider to block denial of service attack
 - Want to prevent telco from degrading competing VOIP service, but allow provider to intelligently manage congestion, promote fairness, and provide adequate quality of service
- Devices
 - Want to prevent monopoly broadband provider from controlling the CPE market, but allow provider to keep potentially harmful devices off their network.

Public Policy and Dependability

- Note: this discussion of policy issues is *not* the announcement of any new activities at the FCC.
- Dependability *metrics* are important for policy.
 - Quantitative measure of dependability of a network.
 - Can the research community offer help?

How Policy-Makers Have Used Metrics

- To regulate a monopoly.
 - Are they investing enough? Are they investing too much?
- To inform the public
 - How can consumers choose the best option?
 - How will better (e.g. more dependable) networks get ROI?
- To establish build out requirements
 - e.g. what must provider do for exclusive access to spectrum?
- To better respond to disasters, such as hurricanes
 - Where is need greatest? Where should limited resources go?
- To identify problems across networks.
 - Are failures occurring from the same cause? Commercial providers may be unable or unwilling to share info directly.

Metric Characteristics

- For these purposes, we need metrics
 - Indicative of network characteristics that matter.
 - With technical details obscured so as to be useful to non experts.
 - Derivable with available data, which is limited
 - Verifiable when necessary
 - Applicable consistently across networks, over time
 - even when networks have little incentive for consistency
- Variations
 - Info required or provided voluntarily?
 - Confidential or disclosed to public?

Example 1: Public Safety Networks

- Communications infrastructure used for public safety in U.S. is highly fragmented.
 - 50 thousand distinct public safety agencies
 - Interoperability failures
 - Lack of fault tolerance
 - Lack of security
 - Lack of advanced features, e.g. broadband, geolocation
 - Inefficient use of spectrum

A New Public Safety Policy?

- FCC attempted to create new nationwide system
 - Auction spectrum at 700 MHz. (DTV)
 - Winner would
 - operate in both commercial and public safety bands
 - offer commercial services to the public
 - offer services to public safety that meet public safety requirements
 - Public safety requirements are more strict
 - Infrastructure dependability, handset dependability, signal reliability, coverage, etc.
 - In initial auction, requirements would be determined after the auction was complete, through negotiation.
 - Winner would pay penalty if agreement not reached.
 - No one was willing to make a viable bid
 - The challenge: *specifying requirements*

Specifying Public Safety Dependability Requirements

- Requirement that given percentage of towers must be “hardened”
 - What does it mean to harden a site? Is it different in New Orleans vs. San Francisco?
 - Can you trade reliability for fault tolerance?
- Is there a better way to specify requirements of a network before it is built?
 - Design for rare events. Cannot depend on actual performance in hurricane
 - Must be technology-neutral and forward-looking
 - Must be unambiguous, at least partially quantitative

Also Interoperability Requirements

- Interoperability has been problematic for public safety
 - Extent to which individuals and machines from different agencies can communicate and share information
- What technical requirements are needed for interoperability?
- What institutional arrangements are needed to ensure interoperability in the short and long term?
 - Do we need some form of “national interoperability center”?
 - If so, what would its functions be?
- Is there a way to benchmark success in interoperability?

Example 2: Commercial Broadband Providers

- Reporting requirements for telephone networks
 - Reportable if Outage > 30 minutes. and Customers * minutes > 900K
- Some efforts to extend to ISPs on voluntary basis
 - Voluntary -> Cannot be used for marketing, etc.
 - Same criteria

Reliability Reports on ISPs?

- Challenges of a packet-switched network of networks
 - Many failures are not binary.
 - Protocols react to/avoid problems.
 - Some problems cross networks
 - Information may be difficult to obtain
 - Incentives to share information with government, other ISPs?
- What is a reportable event or problem?
- How can the magnitude of an event be quantified?
- Are there meaningful dependability measures that reflect failures prevented? mitigated?

Reliability Reports on ISPs?

- How do you define type or area of failure?
 - By geography or topology? e.g. near a given central office.
 - By layer? by protocol or algorithm? e.g. errors in routing tables
 - By software type? e.g. common misconfiguration in firewalls
 - By equipment type? e.g. specific type of router
 - By type of equipment failure? e.g. insufficient backup power
- Can/should you distinguish
 - dependability issues from security issues?
 - “public Internet” from private networks?
 - routine problems from threats to critical components or infrastructure?

Summary

- Much broadband-related activity today
 - ARRA funding programs
 - National Broadband Plan
 - Network Neutrality
 - Public safety communications
- Immediate areas where comments are sought
 - Research funding and innovation in NBP
 - Dependability and security in NBP
 - Net neutrality implications on technical design
 - Requirements for public safety communications
- Possible longer term issues
 - Measuring and reporting dependability of commercial packet-switched networks

The FCC Welcomes Input

- National Broadband Plan
 - www.broadband.gov
- Open Internet Initiative (net neutrality)
 - www.openinternet.gov
- Electronic Comment Filing System
 - <http://fjallfoss.fcc.gov/ecfs2>