

Scenarios for the Network Neutrality Arms Race

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Net Neutrality and the Policy Challenge

- ❑ Vision of the future
- ❑ Why reasonable to believe there might be a problem
- ❑ Net neutrality arms race: end-user response options
- ❑ Policy agenda and conclusions

Vision of the Broadband Future

- Future of ICT is Broadband Wireless Internet
 - Internet (1990s) + Mobiles (1990s) + Broadband (2000s)
 - Pervasive computing: always on, everywhere connected, unaware
 - RFID/Sensors, Smart network edges, post-PC devices
- Lots of Networks → No one size-fits-all solution desirable/possible
 - Wired (coax, copper, fiber) & wireless (WiFi, 3G/4G, WiMAX, UWB, FSO, ...)
 - Heterogeneous technology → convergence, interoperability, connectivity
 - More complex competitive landscape
 - Broadband is local
 - Different environments, different technologies
 - Markets differ in ability to attract/sustain infrastructure
 - Overlapping generations of technology
- More Investment in Last Mile access networks needed

Is it plausible to believe there is a problem?

- ❑ Broadband traffic grows exponentially
 - Dial-up “throttle” no longer bounds individual peak
 - P2P, rich media, mixed delay tolerance traffic....
 - Few heavy users (or everyone heavy sometimes?)
- ❑ Penetration saturates and so revenue growth slows: why invest in delivering order-of-magnitude bandwidth increases if revenues don't reflect?
- ❑ SOLUTIONS???

 - Quotas and application blocking
 - Moore's Law: can't you just over-provision???
 - Charge for usage: but is it fair???

 - Cost-based or value pricing???
 - Optimal Recovery of shared/common/fixed costs??

 - Tiered service: new digital divide???

The Broadband Incentive Problem

(see <http://cfp.mit.edu>)

Scenarios for the Network Neutrality Arms Race

- Assume:
 - No net neutrality regulation (ignore policy)
 - Last-mile providers “discriminate” (aka Jon Peha paper)
- How can end-users respond?
 - Revenge of the edge....
 - Carrier response..
 - And so on...*Net Neutrality Arms Race*

Why “net neutrality” a concern?

Fear: last-mile providers (with market power) will engage in harmful discrimination

- Block access to content
- Differential QoS
- Price discrimination

But what about DDoS, viruses
or, Traffic management
or, Ramsey pricing...

And, is it really “discrimination”

- Higher costs for more resources (preferential caching)
- 2-sided markets (positive network externalities)

So, goal needs to be to protect against HARMFUL discrimination

- Lots not harmful (or even discrimination)

And, end-users may respond even when not HARMFUL discrimination

- Resist paying higher prices or tolerating reduced QoS

Revenge of the Edge: end user responses

- Carrier does something end-users do not like
 - e.g. Higher prices, lower QoS (incl. blocked access)
 - So, what can end-users do??

Strategy #1: Bypass differentiation

Strategy #2: End-user countermeasures

Strategy #3: Learning to live with differentiation

Strategy #1: Bypassing Differentiation

- Taking advantage of multiple bit paths
 - Facilities-based competition lessens market power concerns... market disciplines harmful discrimination
 - Terminating problem may still exist... multihoming can help here but not option for mass user probably
- End-user provided alternative bit paths
 - Cooperative access sharing (e.g., scalable meshes)
 - Broadband resale (e.g., WiFi)
 - Municipal networking (e.g., open access)

Strategy #2: End-user countermeasures

- Non-technical:
 - shine a light on the rats...
 - lie on applications (small biz gets residential DSL)
- Technical
 - How implemented? Link layer, application port blocking, source/destination address filtering, traffic-analysis-based filtering.... Etc., etc....
 - QoS enhancing v. degrading
 - “Hiding basis of discrimination”

Strategy #3: Learning to live with differentiation

- Suppose they discriminate and no one cares??
 - Many apps not very vulnerable (delay tolerant, lots of substitutes, e.g., postal system v. broadband delivery)
- Buffering: stream slow and store on DVR
 - Not for real “real-time”
 - Not if Comcast controls the DVR
 - Pre-loading contingent content
- Distributed caches: keep traffic local
 - Limited applicability but makes sense where it works
- End-user processing substitutes for conduit (compression)
 - But it costs...

What do we learn...

End-users have strategies to respond to carrier differentiation

-- “but for” world of “no rules” needs to consider these

-- Responses can occur even when differentiation is good

-- Responses imperfect and carriers have responses so...

* effectiveness varies dependent on mode of differentiation

* bypass is only sure way to defeat

(1) Net neutrality problem complex and remains a concern

(2) Welfare (efficiency & equity) implications ambiguous

(3) Arms Race has costs also, so some rules may help discipline

Broadband Policy Agenda

- Broadband future: complex & heterogeneous
 - Need nuanced response → strong FCC
 - Minimize regulatory uncertainty → clear framework
- Eliminate barriers to infrastructure investment
 - (1) Cable Franchise Reform – yes
 - (2) Municipal Entry – yes
 - (3) Spectrum Reform – yes
 - Wireless is best hope for facilities-based competition
 - Need flexible licensed & unlicensed

Thank You!

For more, see:

<http://csail.mit.edu/~wlehr>

- Interconnection & Net Neutrality
 - Broadband Access
 - Spectrum Policy

MIT Communications Futures Program
<http://cfp.mit.edu>