

# Socioeconomic issues in the Internet of the future

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# Some questions

- What are the challenges in building the future Internet?
- Just build “good” technology?
- **Basic question: is good engineering enough?**
  - What is “good” engineering?
  - Why bother with socio-economics?
- **Related FP7 projects: SmoothIT, Trilogy**

Good engineering (D. Clark):

- Development of models, techniques, tools that deliver *predictable desired behaviour*
- **Criteria: robustness, scalability, stability...**

But Internet is more a mirror of the societies in which it operates!

- **Criteria: dynamic management of evolving and conflicting interests, *no prediction***
- ***Technical architecture must accommodate tussles in society AND traditional eng. goals***

# The Internet landscape

- Many different stakeholders: users, ISPs, private sector networks, governments, content providers, ...
- Unsurprisingly different stakeholders exhibit different conflicting interests, continuously contending in the Internet ecosystem (tussle)
- The Internet architecture and its protocols only rarely allow the involved parties to resolve **in-band** conflicts of interest.
- **Instead they violate many times the architecture to achieve their ends, compromising the intended benefits**
- Can we correct that in the future development of the Internet?

CNET News

February 22, 2008 12:00 PM PST

# Comcast vs. BitTorrent to be focus of FCC hearing

By [Anne Broache](#)

Staff Writer, CNET News

**The high-profile squabble over Comcast's slowdown of BitTorrent file-sharing traffic--and broader questions of network handling by Internet service providers--is set for public scrutiny Monday at a federal hearing.**

This time, the Federal Communications Commission will depart its headquarters just off the National Mall in Washington and head north to a courtroom on Harvard Law School's campus in Cambridge, Mass. (The FCC wouldn't comment on why the site was selected, but Boston is the home turf of Democratic Rep. Ed Markey, who chairs a House Internet subcommittee.)

The hearing, which will be open to the public on a first-come, first-served basis and be otherwise accessible via an "audio-only" Webcast on the FCC site. It's an outgrowth of the agency's recently launched [inquiry into what constitutes "reasonable" network management practices](#) by Internet service providers.



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## Bittorrent declares war on VoIP, gamers

### The next internet meltdown

By [Richard Bennett](#) • [Get more from this author](#)

Posted in [Networks](#), 1st December 2008 12:29 GMT

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Gamers, VoIP and video conference users beware. The leading BitTorrent software authors have declared war on you - and any users wanting to wring high performance out of their networks. A key design change in the P2P application promises to make the headaches faced by ISPs so far look like a party game. So what's happened, and why does it matter?

Upset about Bell Canada's system for allocating bandwidth fairly among internet users, the developers of the uTorrent P2P application have decided to make the UDP protocol the default transport protocol for file transfers. BitTorrent implementations have long used UDP to exchange tracker information – the addresses of the computers where files could be found – but the new release uses it in preference to TCP for the actual transfer of files. The implications of this change are enormous.

## More in this article:

- Is bypassing TCP congestion control a good thing for the users of the network?
- Why should one persons [sic] non-interactive file sharing generating a dozen to a hundred streams be more important than my interactive VoIP call or gaming experience?
- Using it as a feature, maybe, but enabling this behavior by default is just wrong and will lead to continuing counter, counter measures and more justification for caps.

- Economics is needed to understand the wider system interactions and conflicts
  - Eng.+ Economics: Internet + stakeholders
- Engineering solutions can not be applied by force but through incentives
  - Must allow stakeholders to express their economic preferences and interact
  - Should not preclude the outcome of the tussle
- Game theory instead of optimization theory



# Game model of tussle

- Technology defines the **rules of the game**
- Stakeholders uses these rules in the most appropriate way for them
- **Operating point** = equilibrium of the game
- Examples: Congestion control (TCP), Google, ...

# An example: the Congestion Control tussle

- Internet bandwidth sharing: TCP, UDP
- Tussle development: p2p vs ISPs
  - ISPs: flat rate
  - p2p:  $N \times$  TCP, rarely inactive
  - ISPs: DPI, bandwidth throttling + TCP resets
  - p2p: encryption, UDP instead of TCP
  - ISPs: DPI' + volume caps, ad-hoc congestion control
  - p2p:....
- What do we learn from this?

## Some questions:

- Is the concept of TCP fairness sensible?
- Is flat rate pricing or volume pricing sensible?
- Are DPI boxes sensible?
- Is e2e sensible?
- Is BitTorrent a bad algorithm?
- Is there something fundamentally wrong with the current Internet architecture?
  - provides the appropriate economic info to agents?
  - incentives are correctly set?
- **All these are economic questions!**

## Need for new criteria besides technical correctness

- Incentives of players to comply to the solutions
- Promote competition, low barriers of entry
- Do not force specific outcome in the market
- Incentives for investment, innovation
- Allow for conflicts to be resolved “in” the architecture, not “outside”
- Isolate tussles, avoid spillover
- More socio-economic criteria...

# Some examples of technologies that induce tussles

- SIP
- IMS
- IPv6
- NAT
- BitTorrent
- TCP best effort resource control
- DPI
- Active networks
- ENUM
- WLAN-3G interworking
- Http
- .....

# Conclusions

- New technical solutions must be analyzed for their socio-economic implications
- Good engineering must be redefined
- Solutions must be incentive-compatible
- Interest-neutral, do not force competitive outcomes
- Alignment of costs and benefits
- Provide accountability
- Be open to new concepts, not everything well understood

# Thank you!!!