

**George Ou**

Former Network Engineer

ZDNet Editor at Large

<http://blogs.zdnet.com/Ou>

The engineering and economics of BitTorrent and P2P

# Network Management

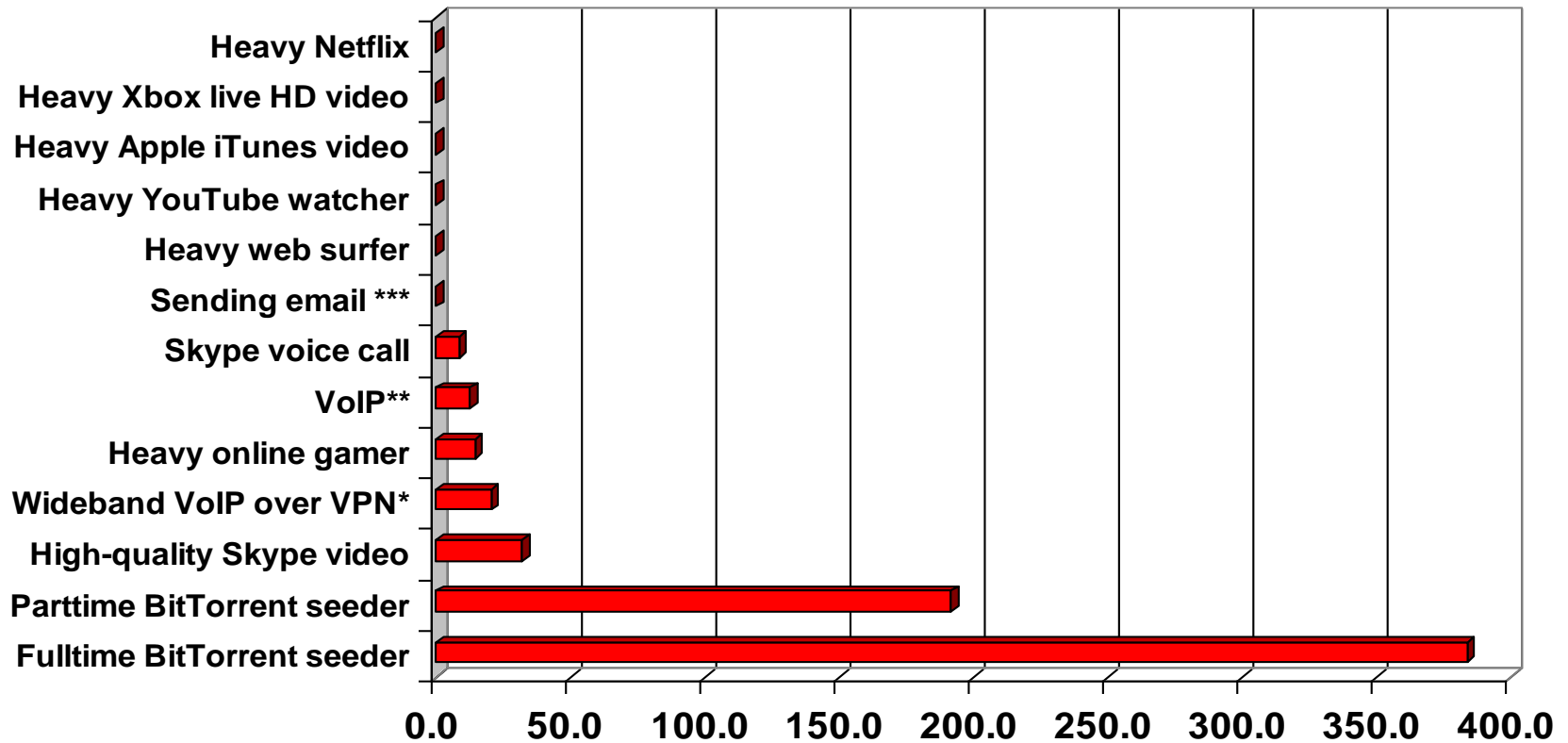
# Who's the bandwidth hog?

|                               | Hours used per day | In-use upstream kbps | Average upstream kbps | Kilobytes sent per day | Active Sessions in use |
|-------------------------------|--------------------|----------------------|-----------------------|------------------------|------------------------|
| Fulltime BitTorrent seeder    | 24                 | 384                  | 384.0                 | 4,147,200              | ~20                    |
| Part time BitTorrent seeder   | 12                 | 384                  | 192.0                 | 2,073,600              | ~20                    |
| High-quality Skype video call | 2                  | 384                  | 32.0                  | 345,600                | 1                      |
| Wideband VoIP over VPN*       | 5                  | 98.8                 | 20.6                  | 222,300                | 1                      |
| Heavy online gamer            | 10                 | 35                   | 14.6                  | 157,500                | 1                      |
| Heavy VoIP** user             | 6                  | 50.8                 | 12.7                  | 137,160                | 1                      |
| Heavy Skype voice user        | 6                  | 34.8                 | 8.7                   | 93,960                 | 1                      |
| Sending email ***             | 0.0031             | 384                  | 0.05                  | 535                    | <1                     |
| Heavy web surfer              | 12                 | 0.1                  | 0.05                  | <500                   | <1                     |
| Heavy YouTube watcher         | 12                 | 0.1                  | 0.05                  | <500                   | <1                     |
| Heavy Apple iTunes video user | 12                 | 0.1                  | 0.05                  | <500                   | <1                     |
| Heavy Xbox live HD video user | 12                 | 0.1                  | 0.05                  | <500                   | <1                     |
| Heavy Netflix                 | 12                 | 0.1                  | 0.05                  | <500                   | <1                     |

# Who's the bandwidth hog?

## Internet application usage

Average upstream kilobits/second



# Shifting the costs of video distribution

- YouTube pays several Millions of \$\$\$ for bandwidth a year
- YouTube operates their own servers and storage
- Vuze uses the P2P business model
  - Offloads servers and storage to customer's personal computers
  - Offloads bandwidth costs to the broadband providers

# Who should bear the costs?

- YouTube was funded by venture capital, then Google, and eventually advertisement
- Ad supported content is good for consumers
- YouTube has empowered the common man to broadcast VHS quality video to the world
- YouTube plays a key roll in this year's political campaign
- YouTube does not shift bandwidth costs to ISPs
- Vuze expects ISPs to bear the bandwidth costs
  - Hurts the smaller ISPs the most
  - Bigger ISPs may be forced in to doing metered Internet
  - End result is that consumers are harmed

# Scarcity in shared medium networks

|                             | <b>Total Upstream Bandwidth</b>                                   | <b>Total Downstream Bandwidth</b> | <b># of 24 7 # of BitTorrent seeders to kill network</b> |
|-----------------------------|---|-----------------------------------|--|
| <b>Cable DOCSIS 1.1</b>     | <b>10 Mbps</b>  | <b>40 Mbps</b>                    | <b>Less than 26 <sup>(1)</sup></b>                       |
| <b>Cable DOCSIS 3.0</b>     | <b>120 Mbps</b>   | <b>160 Mbps</b>                   | <b>Less than 60 <sup>(2)</sup></b>                       |
| <b>Wireless 802.11g ISP</b> | <b>16 to 20 Mbps shared between Up/down under good conditions</b> |                                   | <b>Less than 10 <sup>(3)</sup></b>                       |

1. Fewer than 26 fulltime BitTorrent seeders saturating their upstream at 384 kbps 24 7 kills a DOCSIS 1.1 network

2. Fewer than 60 fulltime BitTorrent seeders saturating their upstream at 2 Mbps 24 7 kills a DOCSIS 3.0 network

3. Fewer than 10 fulltime BitTorrent seeders OR users can kill a Wireless 802.11g ISP. This is because a Wireless LAN is not only shared, but it's shared between upload and download.

# FreePress proposal #1

“More importantly, if Comcast is concerned that the collective set of users running P2P applications are affecting quality of service for other users on a cable loop, they could readily set dynamic quotas for each user on the loop, so as to ensure that there is always bandwidth available for users who are not running P2P applications – and they could do so without interfering in protocol choice.”

**Really nice solution!**

**If only such a thing existed**

# FreePress proposal #2

“Or they could also charge by usage”

Translation: Metered Internet access

“Metered prices may chill innovation in cutting-edge applications because consumers will have a disincentive to use them. Viewed in the context of our long-term national goals for a world-class broadband infrastructure, telling consumers they must choose between blocking and metered pricing is a worrying development.”

# EFF's call for metered Internet

Exetel

[Report errors](#)

Wireless

ADSL2

ADSL

ADSL2 + Phone

'NAKED' ADSL2

| Plan speed<br>Up to 24576 / 1024 kbps | Pre-paid<br>data | Off-peak<br>bonus | Excess<br>data | Upload<br>data | IP     | Monthly cost    | Calc<br>TCO   |
|---------------------------------------|------------------|-------------------|----------------|----------------|--------|-----------------|---|
| AnyPhone A*                           | 8 GB             | 48 GB             | \$3 /GB        | Free           | Static | <b>\$40 /mo</b> |    |
| AnyPhone B*                           | 12 GB            | 48 GB             | \$3 /GB        | Free           | Static | <b>\$50 /mo</b> |    |
| AnyPhone C*                           | 24 GB            | 48 GB             | \$3 /GB        | Free           | Static | <b>\$60 /mo</b> |   |
| AnyPhone D*                           | 36 GB            | 48 GB             | \$3 /GB        | Free           | Static | <b>\$75 /mo</b> |  |
| AnyPhone E*                           | 48 GB            | 48 GB             | \$3 /GB        | Free           | Static | <b>\$95 /mo</b> |  |

# Other FreePress & EFF proposals

## Random packet drops

**Translation:** Punish everyone across the board

- Random packet drops devastates single session applications
- Multi-session applications will continue to saturate the pipe
- As some P2P sessions slow, other sessions will pick up the slack
- Even killing 9 out of 10 upstream sessions means the sole remaining session will fill the pipe

# What are reasonable terms of service?

- Bans on VoIP are unreasonable and anticompetitive
- FCC has slapped down VoIP service bans
- Bans or throttling of bandwidth hogs is reasonable
  - More equitable distribution of bandwidth among customers
  - Minimizes network congestion
  - BitTorrent still gets the biggest chunk of the pie

# Ramifications on Wireless industry

- Wireless networks all have finite spectrum & bandwidth
- Lots of new \$99 unlimited wireless plans springing up
- All have restrictions on terms of services
- Those plans can't do all-you-can-eat P2P
- Mandatory P2P means an end to unlimited plans

# Ramifications on small ISPs

- Brett Glass operates LARIAT, a wireless ISP
- He and thousands of other independent wireless ISPs cover the areas the big guys won't
- Pays \$100 or several hundred for ever Mbps wholesale for Internet backbone connectivity
- Offers flat rate Internet with full ban on P2P
- LARIAT prioritizes VoIP to make it stable and sound good
- LARIAT operates on razor thin margins (\$5 per customer)
- Mandatory P2P policies put LARIAT and ISPs like it out of business

# What are America's priorities?

- What is the impact of slowing down BitTorrent?
- What is the impact of no BitTorrent access?
  - Is access to Video on Demand critical?
  - Businesses don't use P2P
  - American innovation is strong despite lack of Video on Demand
  - America's overall presence and influence on the Internet is #1
  - American economy is still #1
- What does losing an ISP mean to rural America?
  - Cut off from Internet
  - Little or no access to phone