# Internet Service Provision: Terminology and Principles

Presentation to the Net Neutrality Working Group of BEREC

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# Outline

## Terminology

- Internet, Internet Service, ISPs, IP-based services, Internet-based services

## Simple rules for happy users

- As simple as possible, but no simpler

## Monitoring service provision

- For the benefit of the end-users
- For the benefit of the Internet

# Terminology, not in isolation

**Frequent reference to ITU-T standards in relation to QoS, QoE**

**We recommend that when discussing the Internet, adopting the terminology of the Internet community is most desirable**

- Internet Engineering Task Force

**ISOC believes there is a need to develop common terminology for Internet access, given the commercial pressures on network operators to undermine the best-efforts Internet service and give preference to their managed services.**

# The Internet

***The Internet* is: the system of interconnected networks that use IETF-specified best current practices and protocols, including the Internet Protocol, for communication with resources or endpoints reachable via a globally unique Internet address.**

- IETF defines this technology
- Not just protocols, operational practice is important as well
- Globally unique addressing is integral

# Internet Service

***Internet service* is: connection of an Internet endpoint or network to the rest of the Internet with non-discriminatory, best-effort routing of data packets as part of the Internet.**

- Non-discriminatory by definition
- End systems best placed to figure out relative priorities of competing flows
- Networks should simply move the bits along the wire
- Necessary to establish this baseline, to allow for transparency through itemisation of exceptions to the baseline
  - Alternative route of itemising features isn't practical given dynamic and diverse nature of the medium
- Can include application-agnostic congestion management, for example, or traffic management to maintain network resilience

# Great minds…

**"Internet access should be clearly defined and the use of the term in marketing restricted to those who provide open access to the internet. This measure could be implemented nationally under consumer protection powers."**

**'*The open internet – a platform for growth*', a report for the BBC, Blinkbox, Channel 4, Skype and Yahoo!, October 2011**

**"In this scope, using a common frame of reference – for example, regarding what "Internet access" is supposed to encompass - may lead to a simpler range of information for customers, such as only listing the differences between the offer and the reference."**

**DRAFT BEREC Guidelines on Net Neutrality and Transparency: Best practices and recommended approaches, October 2011**

# Internet Service Providers

***Internet service providers* are: companies that offer Internet service to customers.**

- For example, broadband ISPs that offer Internet service over some broadband infrastructure
- May or may not own or maintain that infrastructure — they may lease it
- Responsible for the experience of their customers over both the broadband infrastructure *and* the infrastructure that links the ISPs network to the rest of the Internet
  - Not just the access link: peering and transit links also an integral part of the overall service provision
- Wireless ISPs are not a special case

# IP-based services (Specialized services)

***IP-based services* are: services that are built using the Internet Protocol, but that operate within a restricted set of networks, or only one network.**

- Often optimized for a single service or service type, and rely on a single administrative domain controlling the network in order to ensure (or enforce) specific service characteristics.
- May not conform to the full set of Internet best practices, including network management techniques.
- Examples of IP-based services include video delivery and some communications service offerings (such as voice over broadband).

# Internet-based services and applications

***Internet-based services and applications* are: services and applications that are delivered over or made possible by the Internet service direct to end-users.**

- *Do not* rely on administrative control from the network.
- *Do* rely on the underlying Internet service conforming to standardized best practices and non-invasive network management techniques.
- Skype is an example of an Internet-based online communications application. Blinkbox is an example of an Internet-based video-on-demand service.

# Internet is end-user centric

**In general, users expect Internet traffic to be conveyed in a manner that is independent of its source, content or destination and in a manner that respects their privacy.**

## Choice and transparency

- at the heart of a user's Internet experience,
- enabling them to remain in control of their Internet experience, and thereby
- allowing them to benefit from, and participate in, the open Internet.

# Internet is sharing

**Internet access service enables the user:**

- to communicate
- to access content
- to use applications

**+ to *provide* content**

**+ to *develop* applications**

# Simple rules for happy users

## Minimum speed in peak-hour

- A true measure of the quality of service provision

## No application-specific blocking*

## No destination-specific blocking*

## No destination-specific throttling

## Application-neutral throttling must be transparently communicated to the end-user

- Only applicable during busy hour (in response to congestion)
- Only applicable to non-specific ‘background’ traffic
- In-network throttling is a stop-gap measure while better mechanisms for end-users and networks to agree about LBE traffic are devised

*excepting blocks required by law

| | 12am-4pm | 4-6pm | 6-8pm | 8-10pm | 10-11pm | 11pm-12am |
|---|---|---|---|---|---|---|
| Browsing | Line speed | Line speed | Line speed | Line speed | Line speed | Line speed |
| Email | Line speed | Line speed | Line speed | Line speed | Line speed | Line speed |
| VoIP | Line speed | Line speed | Line speed | Line speed | Line speed | Line speed |
| Peer to peer/Usenet | Line speed | 100kb/s | 100kb/s | 100kb/s | 100kb/s | 128kb/s |
| Plusnet FTP | Line speed | Line speed | Line speed | Line speed | Line speed | Line speed |
| External FTP | Line speed | 256kb/s | 128kb/s | 128kb/s | 256kb/s | 256kb/s |
| VPN | 512kb/s | 512kb/s | 512kb/s | 512kb/s | 512kb/s | 512kb/s |
| Gaming | 2Mb/s | 2Mb/s | 2Mb/s | 2Mb/s | 2Mb/s | 2Mb/s |
| YouTube | Line speed | Line speed | Line speed | 2.5Mb/s | Line speed | Line speed |
| Download sites | Line speed | 512kb/s | 256kb/s | 256kb/s | 256kb/s | 512kb/s |
| Download servers | Line speed | Line speed | 2Mb/s | 2Mb/s | 2Mb/s | 2Mb/s |
| Streaming | Line speed | Line speed | Line speed | Line speed | Line speed | Line speed |
| Other | Line speed | Line speed | 192kb/s | 192kb/s | Line speed | Line speed |

The Internet

# Antidisintermediation

**Imagine your electricity provider could charge you more for the electricity you use to light, heat and power ICT devices in your home office.**

- they can't do that
- if new technology made that possible, would we welcome it?

**This has nothing to do with 'reasonable network management' and everything to do with trying to segment the market for commercial advantage.**

**It is an abuse of the network operator's role.**

**Section 2: Traffic management to optimise network utilisation** (what happens during busy times and places in addition to traffic management described in section 1)

| | | | |
|---|---|---|---|
| Is traffic management used during peak hours? | Yes | | |
| When are typical peak hours? | Weekdays: 4pm - 12pm<br>Weekends: 9am - 12pm | | |
| What type of traffic is managed during these periods?*** | Blocked | Slowed down | Prioritised |
| Peer-to-Peer (P2P) | | ✓ | |
| Newsgroups | | | |
| Browsing/email | | | |
| VoIP (Voice over IP) | | | |
| Gaming | | | |
| Audio streaming | | | |
| Video streaming | | | |
| Music downloads | | | |
| Video downloads | | | |
| Instant messaging | | | |
| Software updates | | | |
| Is traffic management used to manage congestion in particular locations? | No | | |
| If so, how? | n/a | | |

=42% of week

***If no entry is shown against a particular traffic type, no traffic management is typically applied to it.

# Internet service monitoring

## Competition in the marketplace for ISPs

- helpful to minimise the likelihood of rampant abuse, and to offer consumers a choice,
- insufficient to prevent widespread traffic management practices that are harmful to the public-interest goal of maintaining the Internet as an open, transparent, and freely accessible platform for global communication and innovation.

## Service monitoring is essential

- (Transparency + Competition + low switching costs) is insufficient as users are not technically adept
- Combination of detailed technical metrics for market and per-ISP (health of the Internet) and broader ‘health of the market’ analysis

## Evolutionary trends of the whole market for Internet service must be watched closely

- Expanding definitions of ‘peak hour’
- Expanding definitions of ‘background traffic’
- Rising numbers of end user complaints about their experience of the service offered

# Implications for metrics

## IP-based services vs. Internet services

- Measurements of Internet service performance must be made in the presence of bundled IP-based services where present

## Peering and transit links

- Measurements must be to a wide range of destinations

## Ability to evolve

- Connectivity and throughput tests must use a broad range of protocols, applications and destinations
- Testing support for the ‘long tail’

# Internet vs. IP-based services

**Apportioning bandwidth between IP-based services and Internet traffic:**

- It is important that Internet service providers are fully transparent to their subscribers about the bandwidth being offered for Internet service
- This can best be verified independently by testing throughput to a wide variety of Internet destinations at various times of day, and in the presence of bundled IP-based services if applicable.

**Individual network operators are unlikely to be able to create a closed service with limited reach and limited content that is more compelling than an Internet-based alternative, with all the positive properties that unfettered global communication can bring.**

# Inter-ISP links

**Historically, considerable effort has been put into ensuring that peering relationships and network gateways are optimized to allow good quality access to Internet destinations beyond a given network.**

**Interface speed says nothing about available bandwidth end-to-end, so what, if any, obligations do network operators have to provision additional bandwidth for best-efforts Internet services in the face of rising demand from their subscribers? Absent a competitive marketplace for ISP services consumers could expect their Internet access performance to diminish over time.**

**Essential that measurements of Internet service performance are made to as wide a range of destinations as possible to ensure that the quality of Internet service links doesn't atrophy over time relative to other IP-based services.**

- replicated at regular intervals
- compared with the stated performance characteristics of the subscribed Internet service
- publicized to the relevant stakeholder community.

# Ability to evolve

**Measurement methodologies need to verify that popular Internet-based services and applications perform adequately over any given Internet service.**

**Should also verify that a much broader range of less commonly used protocols, applications and destinations are similarly functional.**

- Selecting destinations at random from a long list.

**This is necessary to ensure the continued availability of the Internet as a general purpose data networking and communications medium.**

**To the extent the platform becomes constrained by technical restrictions applied to shape user experience or behavior (e.g., blocking standard ports, blocking DNS responses, inappropriate traffic management), it loses scope, both for today's experiences and as the basis for future development.**

# A popular current testing regime

## ICMP latency and packet loss

ping a few well-known hosts, record latency and loss

## Recursive DNS resolver responsiveness and failures

dig hostnames of a few popular hosts, record resolution time in ms and failures

## Web page loading times

fetch main HTML body from a few popular websites, record time in ms to receive complete response and failures

## Voip capability

10 second burst of 160-byte UDP packets at 64kbps to one of several target servers

only upstream due to NAT issues for downstream testing, record delay, loss, jitter

## SMTP email relaying

periodically send mail to test address using ISP SMTP relay, record latency and failures

## Speed tests

HTTP download on port 80, single thread

HTTP upload ”

HTTP download on port 80, multi-thread

HTTP upload ”

# Analysis paralysis

## Detailed consideration of per-application quality requirements tacitly accepts the widespread existence of per-application network performance

- this is highly undesirable
- will date quickly

## Avoid normalizing negative behaviour

- For example, Internet ‘nutrition labels’ that allow for blocking or widespread throttling
- Greater transparency vis-à-vis unwanted practices is necessary, but not sufficient

# International measurement standards

**Co-operation between Regulators to develop widely applicable and acceptable measurement methodologies and standards is highly desirable**

**Given that the Internet is a global network of networks that does not adhere to national boundaries, policy makers should strive to minimize obstacles to network operators building their networks across national boundaries**

**Having to submit to and satisfy multiple different measurement approaches and quality of service requirements could be a serious impediment to Internet growth and investment.**

# Future challenges

**More bandwidth will always help, but viewed globally it will always be a very diverse environment**

**Need to find scalable, global solutions to better apportion bandwidth without resorting to network 'smarts'**

- Innovation will become more expensive otherwise

**Monitoring regimes should also be forward looking**

- IPv6
- Enhanced security features, e.g. DNSSEC

# Right problem, wrong solution

## Interests of content providers, ISPs and users not always well-aligned

- Fair management of congestion is a whole network issue
- Per service charging is antithetical to Internet

- Innovators lose for want of being able to execute
- Content providers lose due to having to manage and service a fee structure that's almost as complex as the routing table
- Customers lose as a result of inconsistent and unpredictable usability
- ISPs lose as function of customers losing confidence in their ability to provide service (to them, it 'just doesn't work for everything').

# Innovation – what's at stake?

## Skype

- Created in Tallinn, Estonia, launched in 2003
- Sold to Microsoft for $8.5B in 2011
- Largest international voice carrier (by call mins)
- Regular users in the hundreds of millions
- Widely blocked/throttled, esp. by mobile operators


## Moshi Monsters

- Created in London, England, launched in 2008
- As of June 2011, over 50M users
- Mind Candy worth > $200M

# Relevant IETF Work

## IPPM Working Group

- Defines metrics and procedures for accurately measuring these metrics
  - connectivity
  - one-way delay and loss
  - round-trip delay.
  - delay variation
  - loss patterns
  - packet reordering
  - bulk transport capacity
  - link bandwidth capacity
  - packet duplication

## ALTO, CDNI, CONEX, DECADE, LEDBAT Working Groups

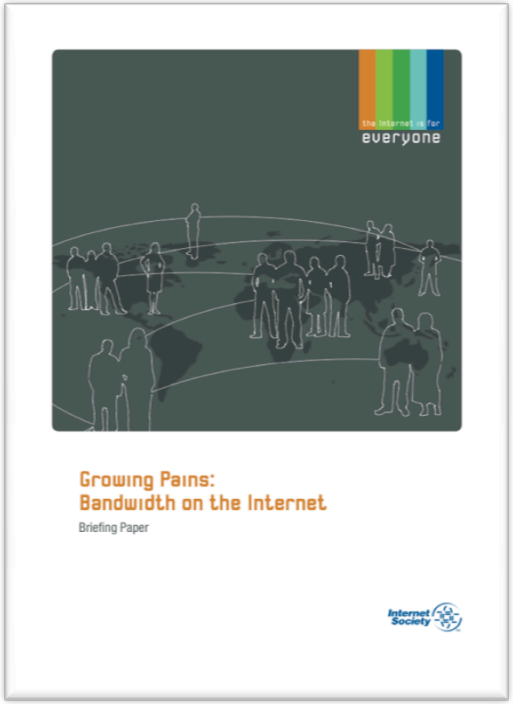
- Better than random peer selection in P2P nets
- Interconnecting separately administered CDN nets
- Exposing the marginal cost of networking – congestion volume
- In-net storage for P2P and other apps
- Congestion control for LBE traffic

## RFC6057 Comcast's Protocol-Agnostic Congestion Management System

# Relevant ISOC outputs

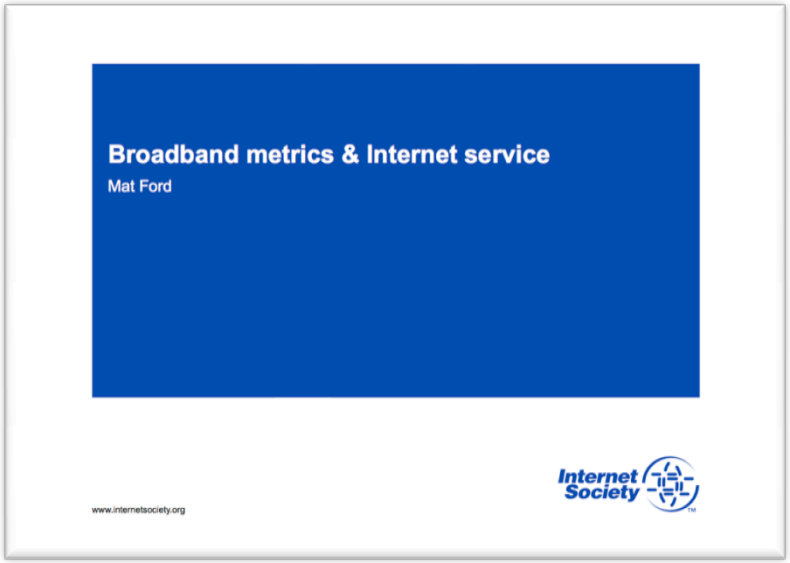
## Bandwidth Panel

- http://www.internetsociety.org/news/isoc-briefing-panel-internet-bandwidth-growth-dealing-reality




## Submission to OECD/FCC Broadband Metrics Workshop

- http://www.fcc.gov/events/oecd-broadband-metrics-workshop
- In collaboration with, and on behalf of OECD Internet Technical Advisory Committee



# Conclusions

**We must share common terminology of Internet service**

**Build measurement methodologies designed to reveal the quality of that service**

**Develop a 'test harness' for Internet service**

- agree a diverse set of Internet applications
- in an automated fashion, test the performance of these applications to establish the extent to which functioning Internet service can be said to be being delivered.

**Testing diversity and global reach are key to ensuring the long-term viability of the Internet as a platform for innovation and growth**