Broadband – Regulatory challenges in addressing QoS issues

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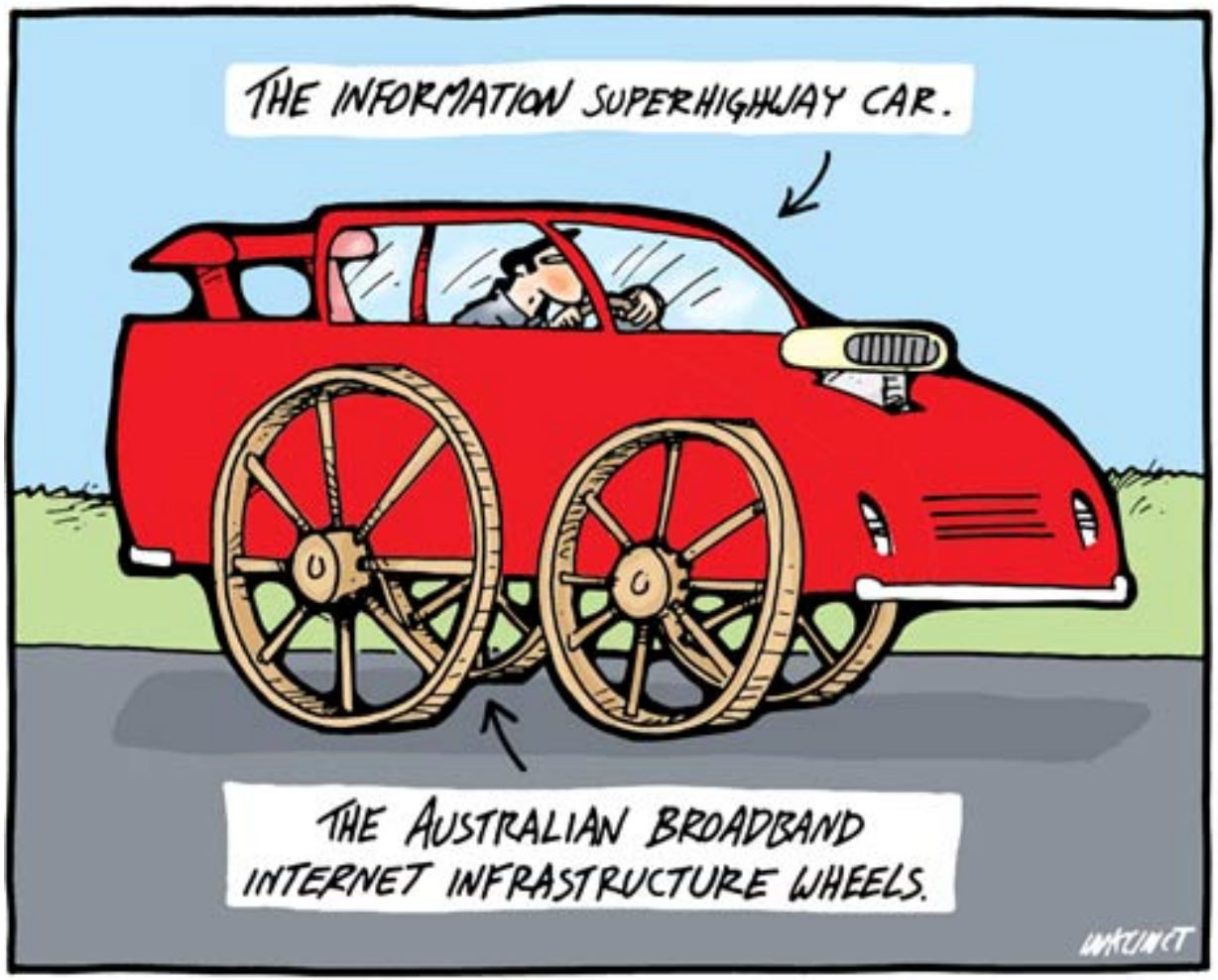
Is this your definition of ‘broadband’ ?



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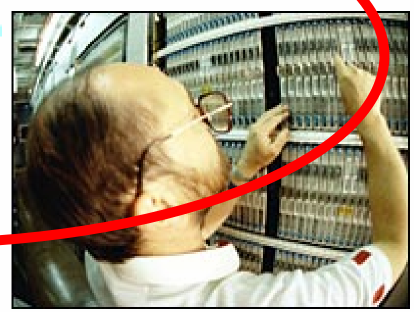
Britain 'failing' net speed tests

There is a huge gap between advertised broadband speeds and the actual speeds users can achieve, research has shown.



Broadband speed depends on how far you live from local exchange

A survey by consumer group Which? found that broadband packages promising speeds of up to 8Mbps (megabits per second) actually achieved far less.

Tests of 300 customers' net connections revealed that the average download speed they were getting was 2.7Mbps.

Which? has called on regulator Ofcom and Trading Standards to launch a fresh investigation into UK broadband.

Misleading ads

The speed tests were prompted by complaints from members of the public, unhappy with the speeds of their broadband connections.

Not just in developing world!

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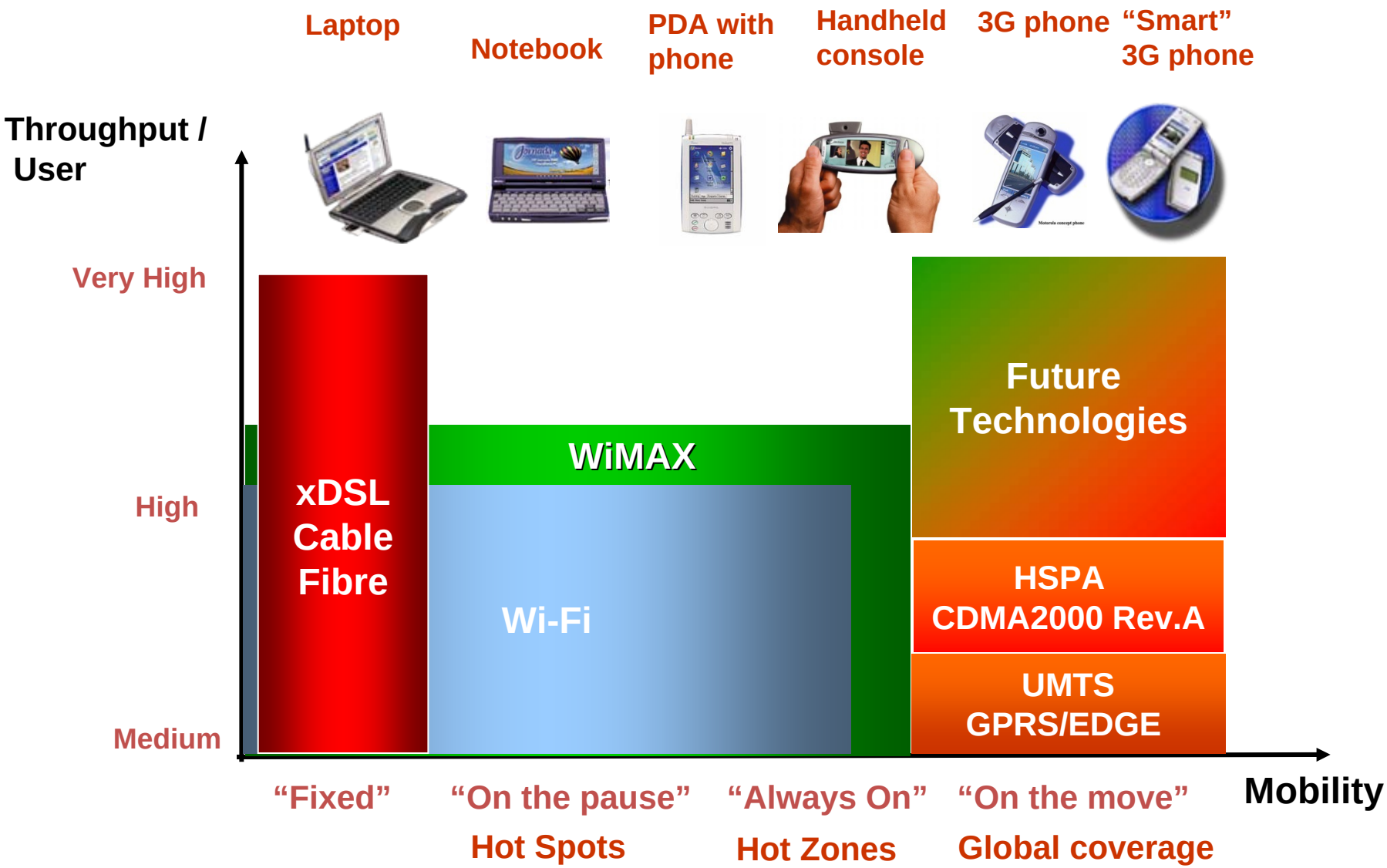
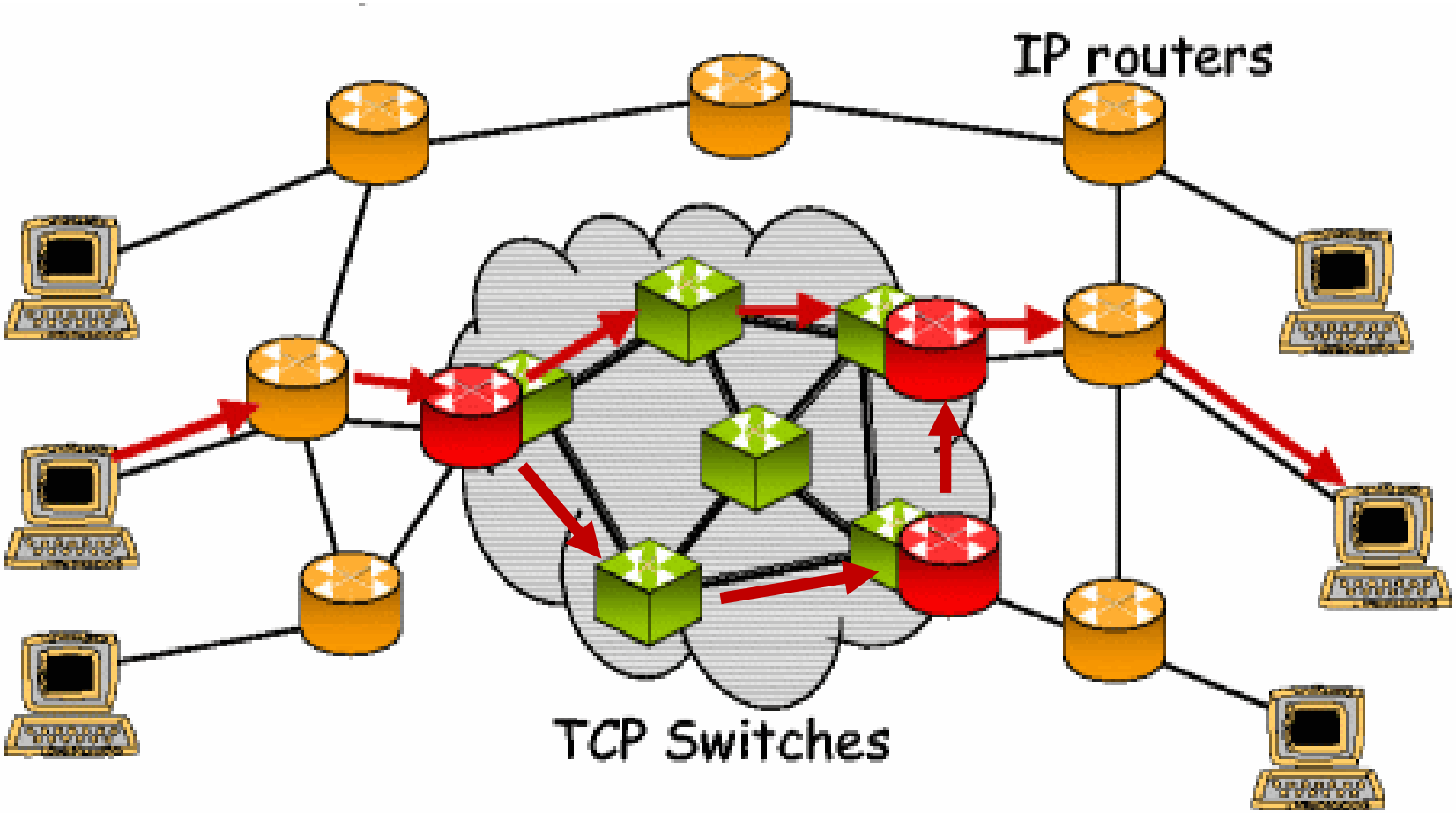
Too many technologies; too heterogeneous!

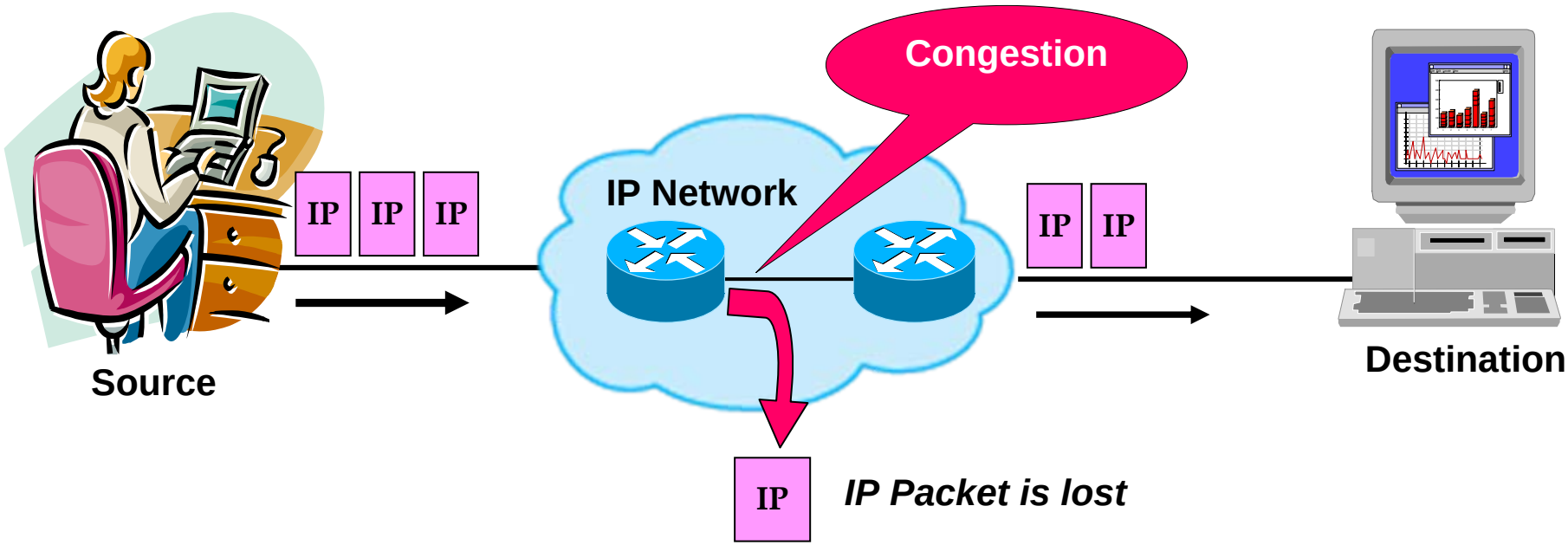


Too complex. Why?

- Circuit switching vs. Packet switcing

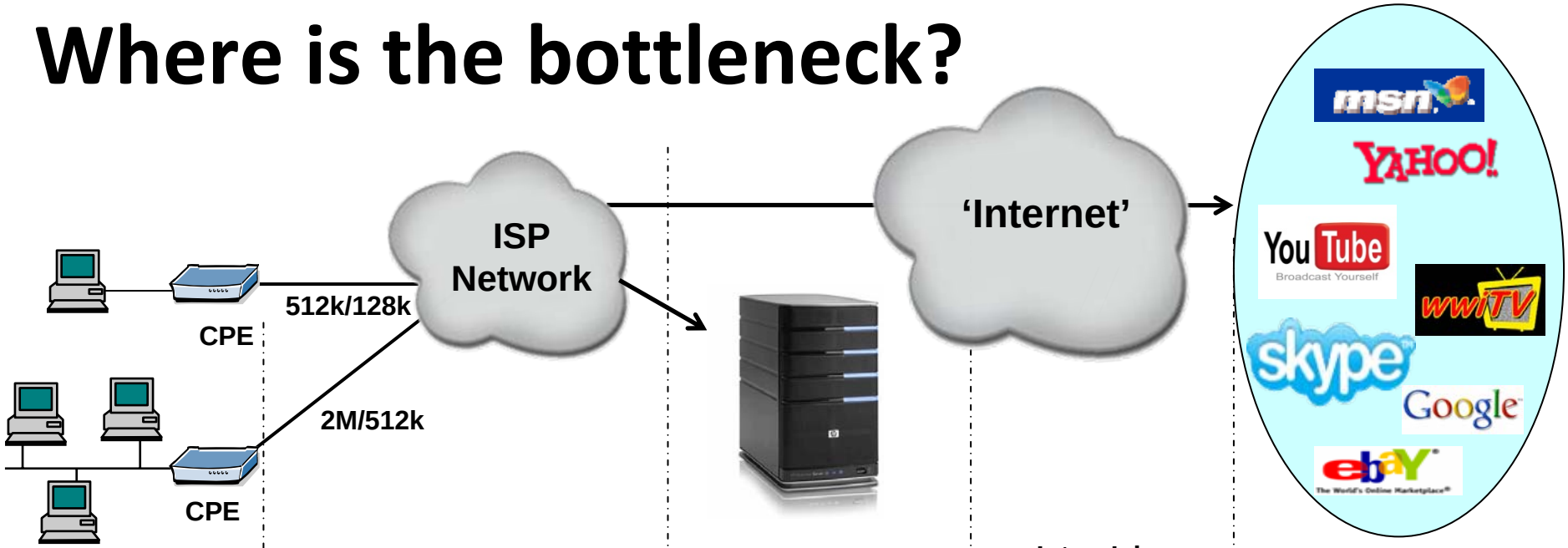


The congested nodes drop packets when they cannot transmit; have to resend them…



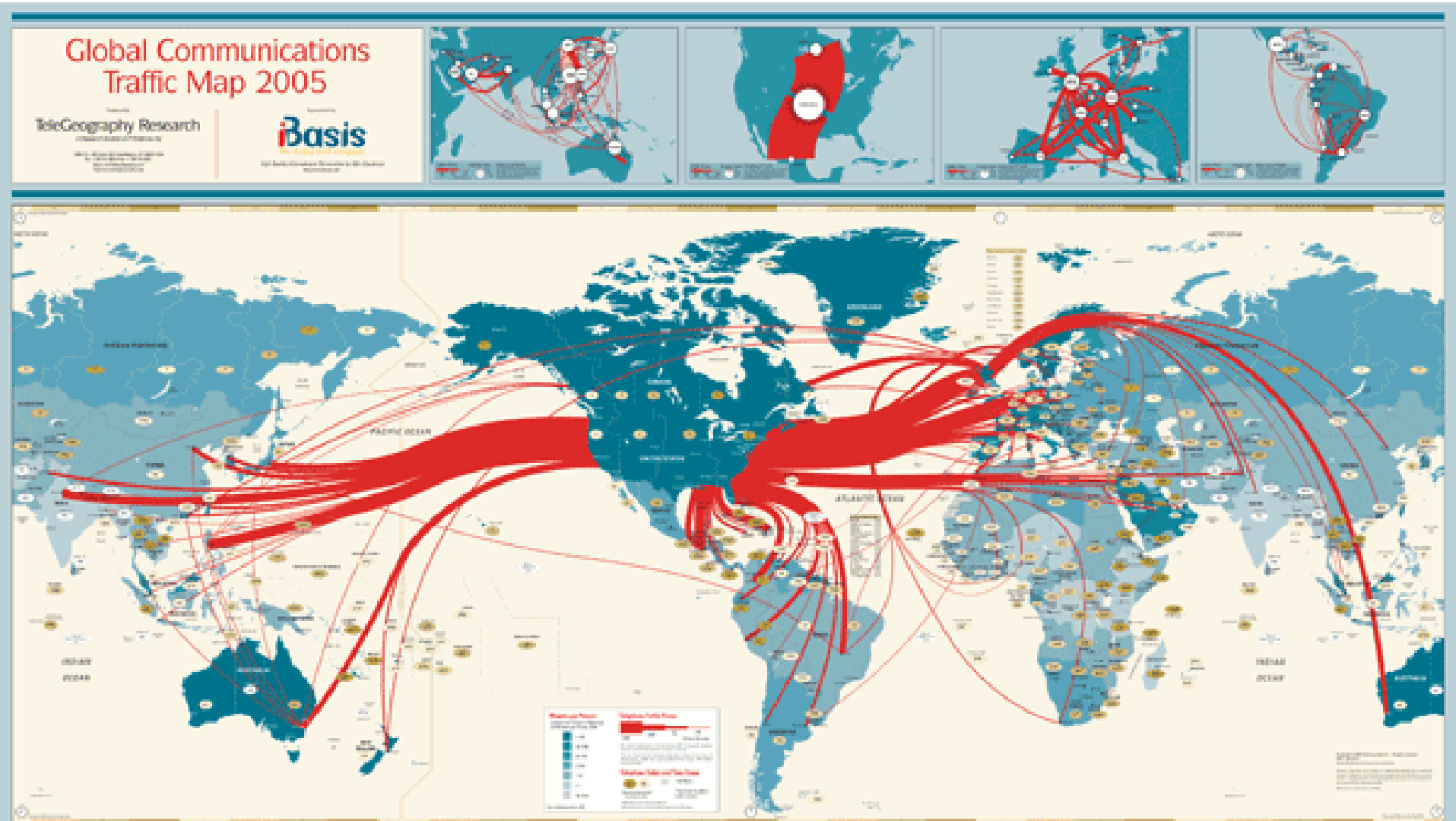
- Let every body send.
- Try to deliver, what the network can … and
- if not possible, drop!

Where is the bottleneck?



User Network	Broadband Network	Local Contents	Intern'al Backbone	Global Internet
PC: CPU Occupancy, Memory Capacity and Virus etc.	**Network Devices**: CPU Occupancy, Memory Capacity Stability, Processing capacity & Delay.	**Network Congestion:** Number of concurrent users	**Peer Network Congestion.**	**Network Congestion:** Number of concurrent users
CPE: DSP Speed and Stability	**Transport Media**: Bandwidth, Propagation Delay.	**Hosting/Streaming Server:** CPU, Memory and Stability.	**Backbone bandwidth.**	**Hosting/Streaming Server:** CPU, Memory and Stability.
User Network Cabling	**Network Design.**	**Bandwidth of Server-Network Connection.**	**Number of Hops**	**Bandwidth of Server-Network Connection.**
Number of Users	**Subscriber & Traffic management.**		**Propagation Delay.**	

Issue of International bandwidth…



QoS Monitoring - Approaches

- Regulator centric – involves operators, monitor from operator end, checks parameters like Network availability, contention ratio, Bandwidth utilisation
- User centric – does not involve operator (or regulator), monitors from user end, more straightforward, checks parameters like throughput, delay, jitter, adv: easier; disadv: may not be complete

Broadband QoS regulation in Singapore

$$\text{Network Availability} = \frac{(\text{Up time} - \text{Down time}) \times 100\%}{\text{Up time}}$$

Should be more than 99%

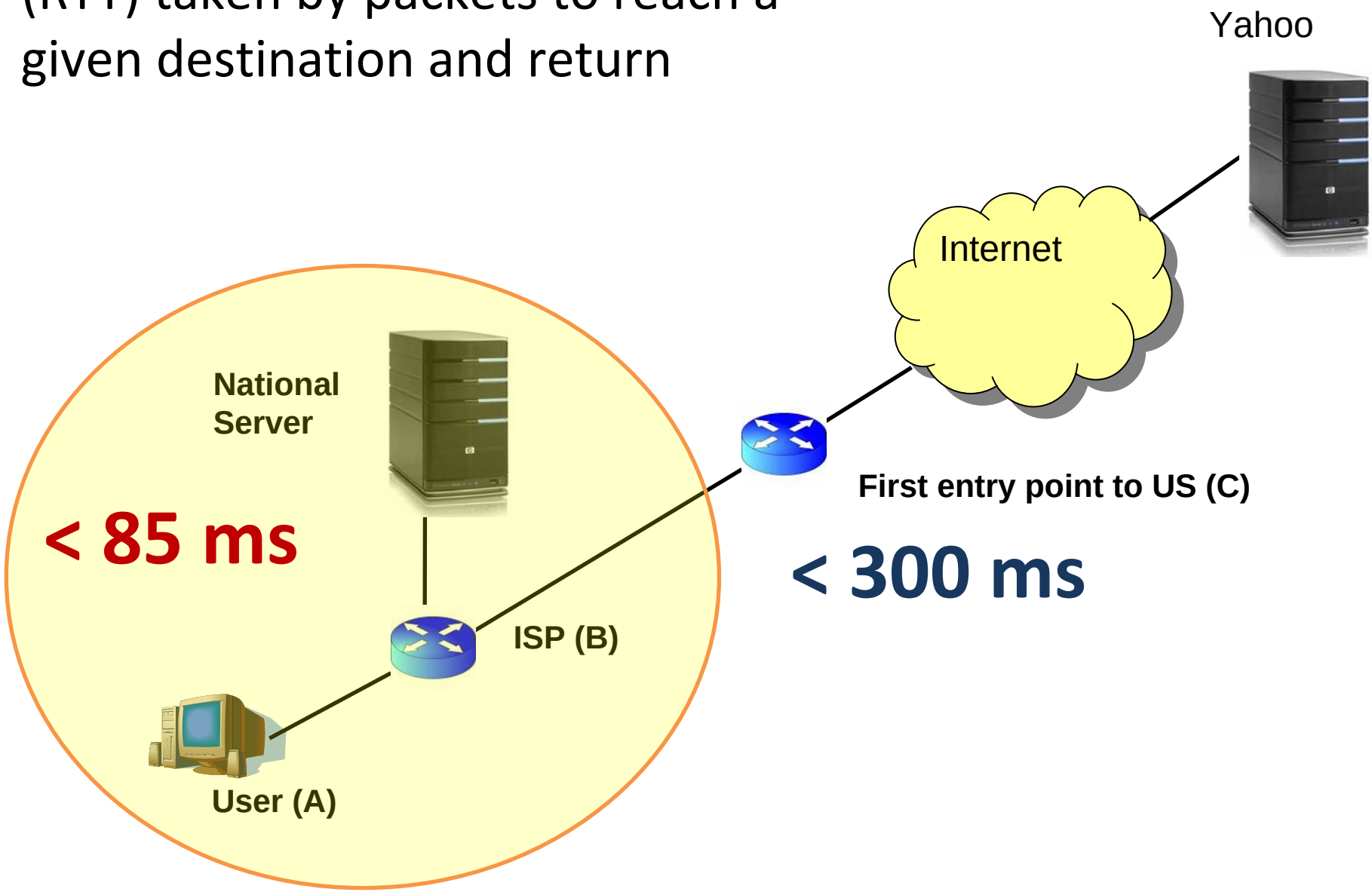
(Excluding pre-announced maintenance periods)

$$\text{Bandwidth Utilisation} = \frac{\text{Peak utilisation} \times 100\%}{\text{Available bandwidth}}$$

Should be less than 90%

If it exceeds 90% for 3 consecutive months, the provider needs to expand.

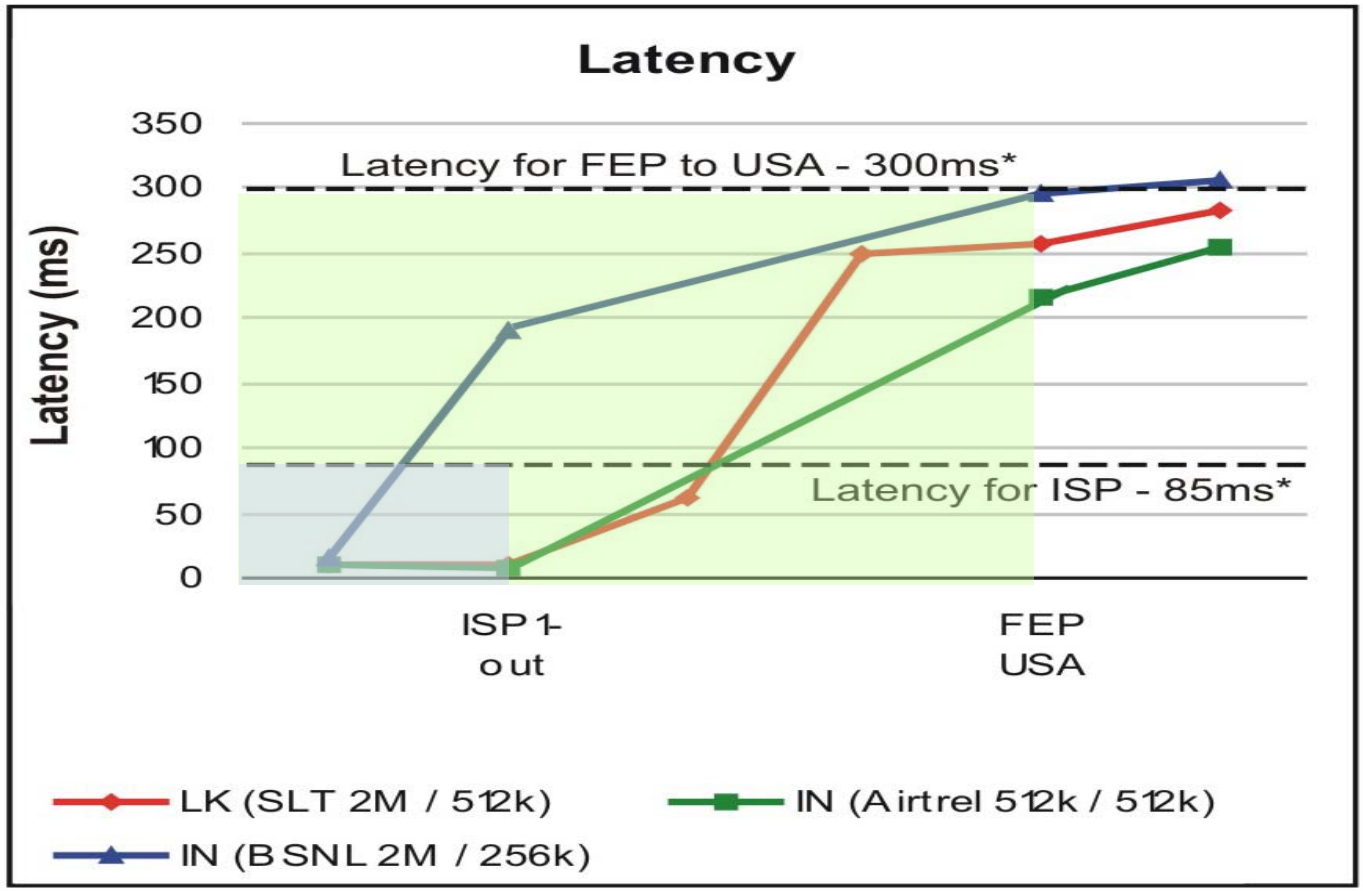
Network Latency: Round Trip Time (RTT) taken by packets to reach a given destination and return



Where do we stand?

ISP1 – Out: Exit from local ISP

FEP: First Entry point to USA



Package	Local Network Latency			International Network Latency		
	Requirement	Achivement	Passed?	Requirement	Value	Passed?
Airtel (512k/512k)	85 ms	8 ms	☺	300 ms	217	☺
BSNL (2M/256k)	85 ms	191 ms	☹	300 ms	295	☺
SLT (2M/512k)	85 ms	11 ms	☺	300 ms	258	☺

Regulation in India and Singapore

Parameter	Singapore	India
Network Availability	> 99%	> 98%
Latency (Local)	< 85ms	< 120 ms
Latency (Intl)	< 300ms	< 350 ms (ter) < 800 ms (sat)
Bandwidth Utilisation	90% during peak time	< 80% during peak time
Broadband Connection Speed (download)	Not Specified	> 80% of specified from user to ISP
Service Activation	Not Specified	100% in 15 working days
Customer Support	Not Specified	60% calls in 60 sec 80% calls in 90 sec

Broadband QoS regulation elsewhere

- Malaysia – Regulates QoS; but little info available
- Australia – No regulation but manual available for consumers
- South Korea – Speeds are an issue but consumers more concerned about billing
- Bahrain – A consultation has been done, but no regulation
- UK – Customers were queried on quality ; 90% were satisfied. Speed test by non-gov players

Test Methodology

- Uses multiple tools (BW monitor, ping, tracert)
- Tests 6 parameters
- Tests three servers (ISP, National, International)
- Repeated at different times of the day
- Repeated at weekdays and weekends
- Tests for long intervals to minimize effects of short term variations (eg. 100 pings, 100 sec download)
- Variations studied and outliers removed

Broadband QoS Metrics

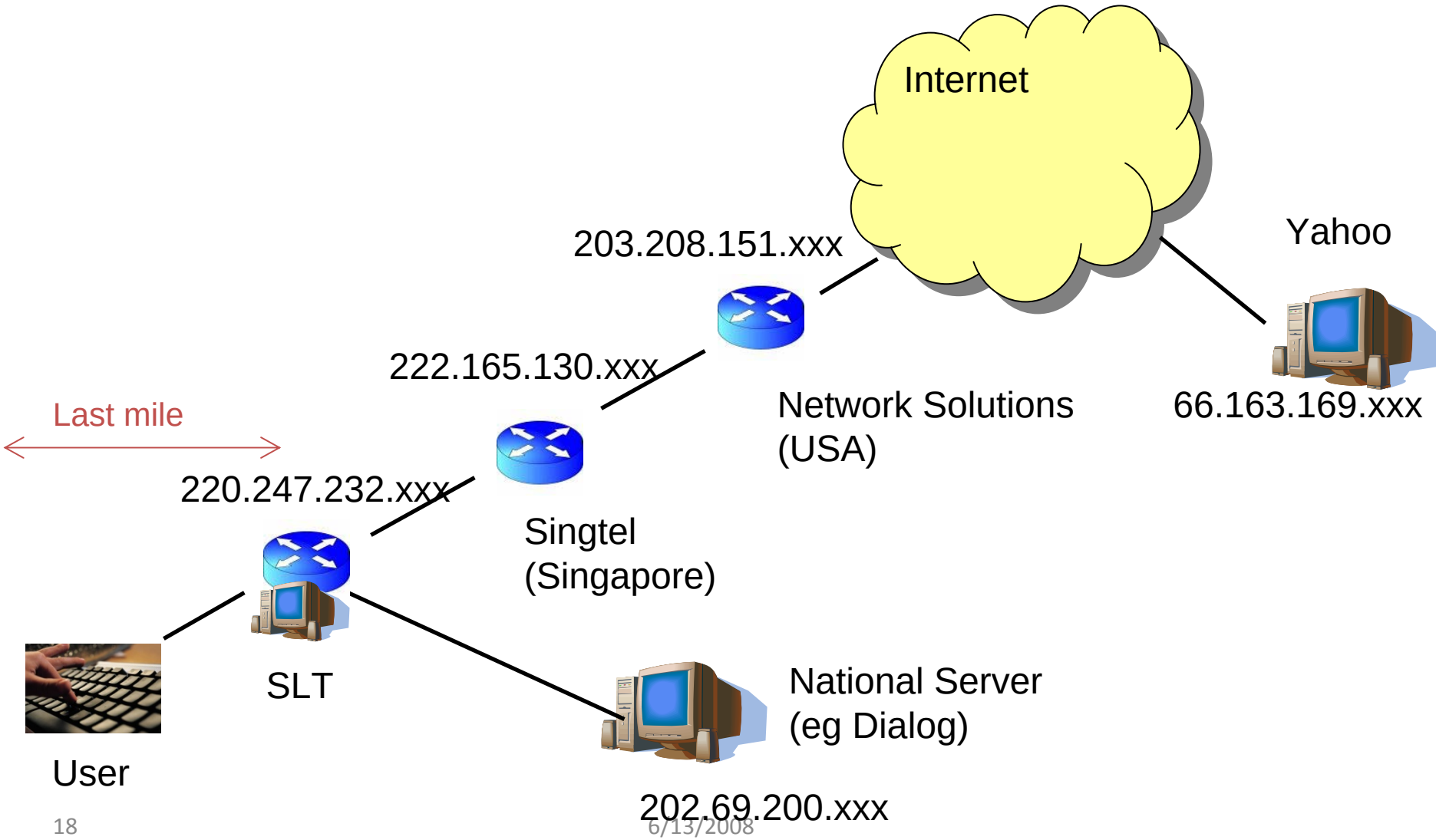
- Download throughput
- Upload throughput
- Round-trip delay (RTT)
- Delay jitter -- average variation in delay
- Packet loss
- Availability of service

Relevance of Metrics

	Throughput		Delay		
Service	Down	Up	RTT	Jitter	Loss
Browse (text)	++	-	++	-	-
Browse (media)	+++	-	+	+	+
Download file	+++	-	-	-	-
Transactions	-	-	++	+	-
Streaming media	+	-	+	++	++
VOIP	+	+	+++	+++	+++
Games	+	+	+++	++	++

+++ highly relevant, ++ very relevant, + relevant, - not relevant

Network Diagram of a Test



What's next?

- A decentralised approach based on 'Volunteer Computing'*
- Automating the manual test process (otherwise too resource consuming and cumbersome)
- Need to conduct tests from different point (take Last Mile issues into account)
- A software application that tests with the minimal involvement from the user
- Volunteers report test results to a web site that stored and presents on-line QoS data

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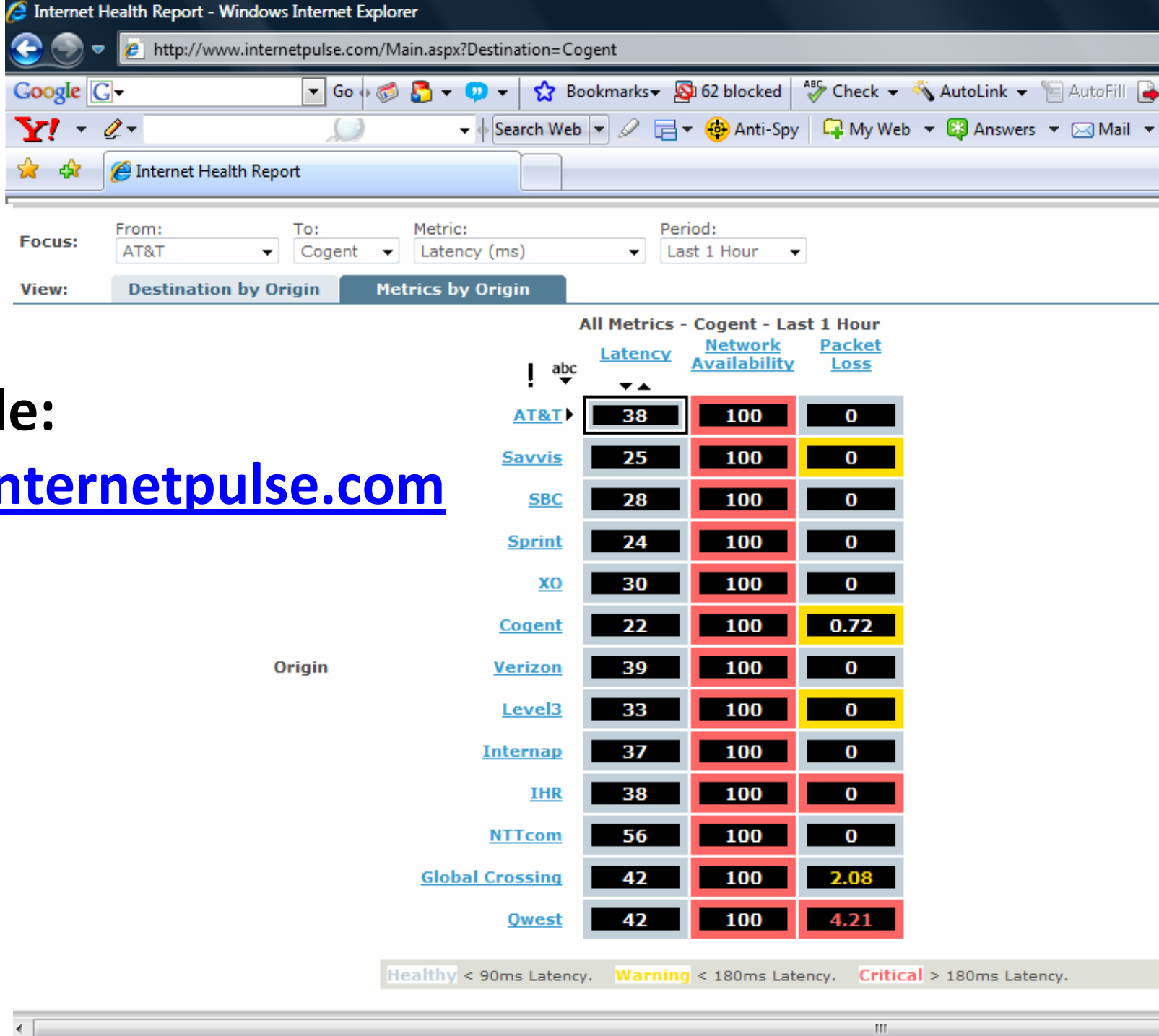
*** Volunteer computing** is a type of distributed computing in which computer owners donate their computing resources (such as processing power and storage) to one or more "projects". It is distinct from Grid computing, which involves sharing of managed computing resources within and between organizations.

Example:

www.internetpulse.com



Thank You!

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