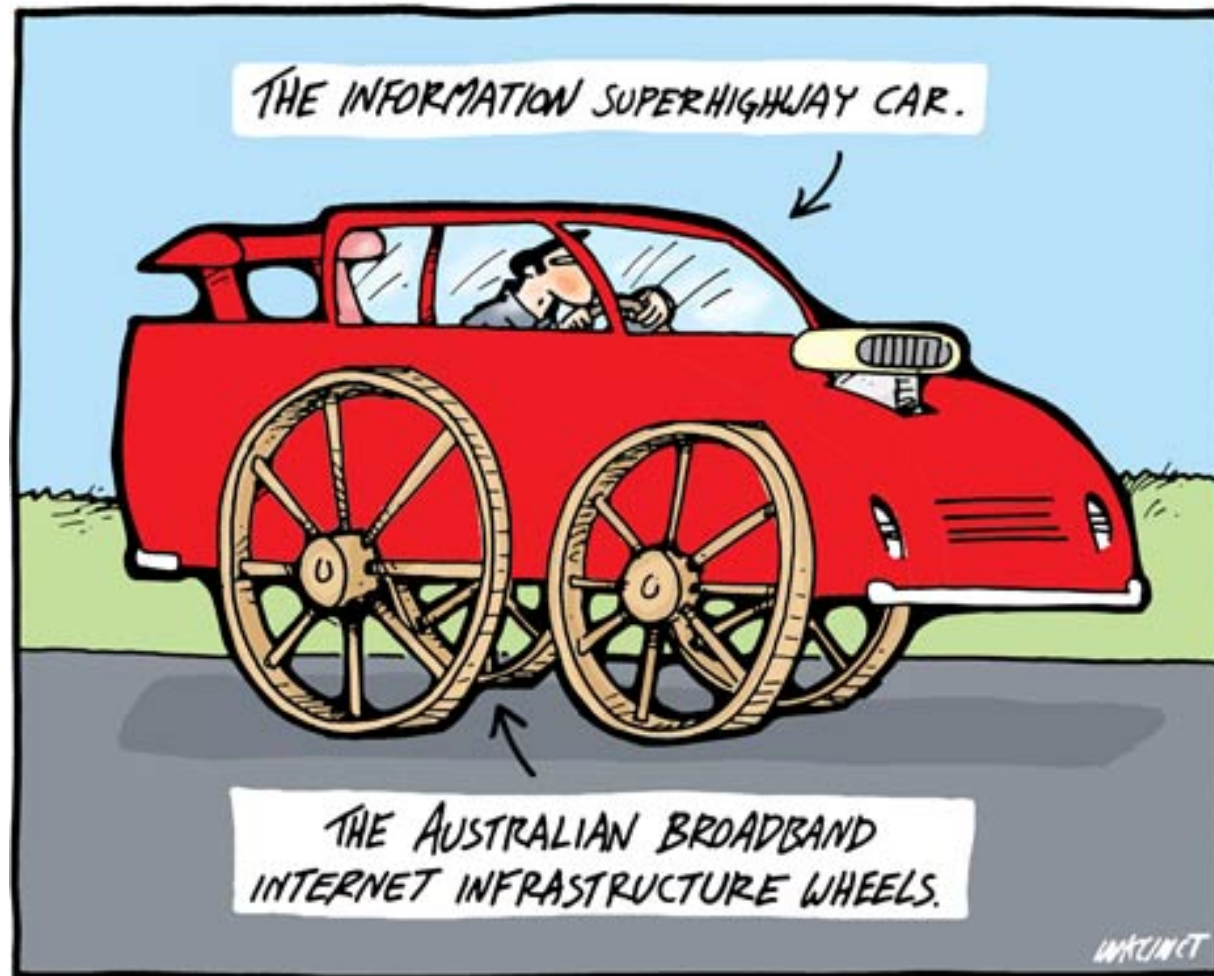


# Broadband – Regulatory challenges in addressing QoS issues

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**LIRNEasia**

**Executive Course on Telecom Reform,  
Changi Village, Singapore  
June 10-14, 2008**

# Is this your definition of 'broadband' ?



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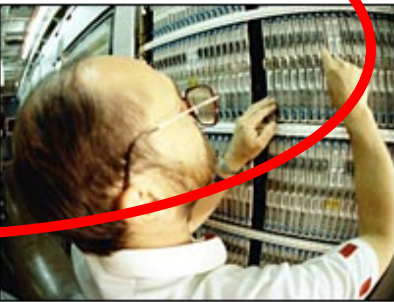
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Last Updated: Thursday, 2 August 2007, 02:04 GMT 03:04 UK  
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## Britain 'failing' net speed tests

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.

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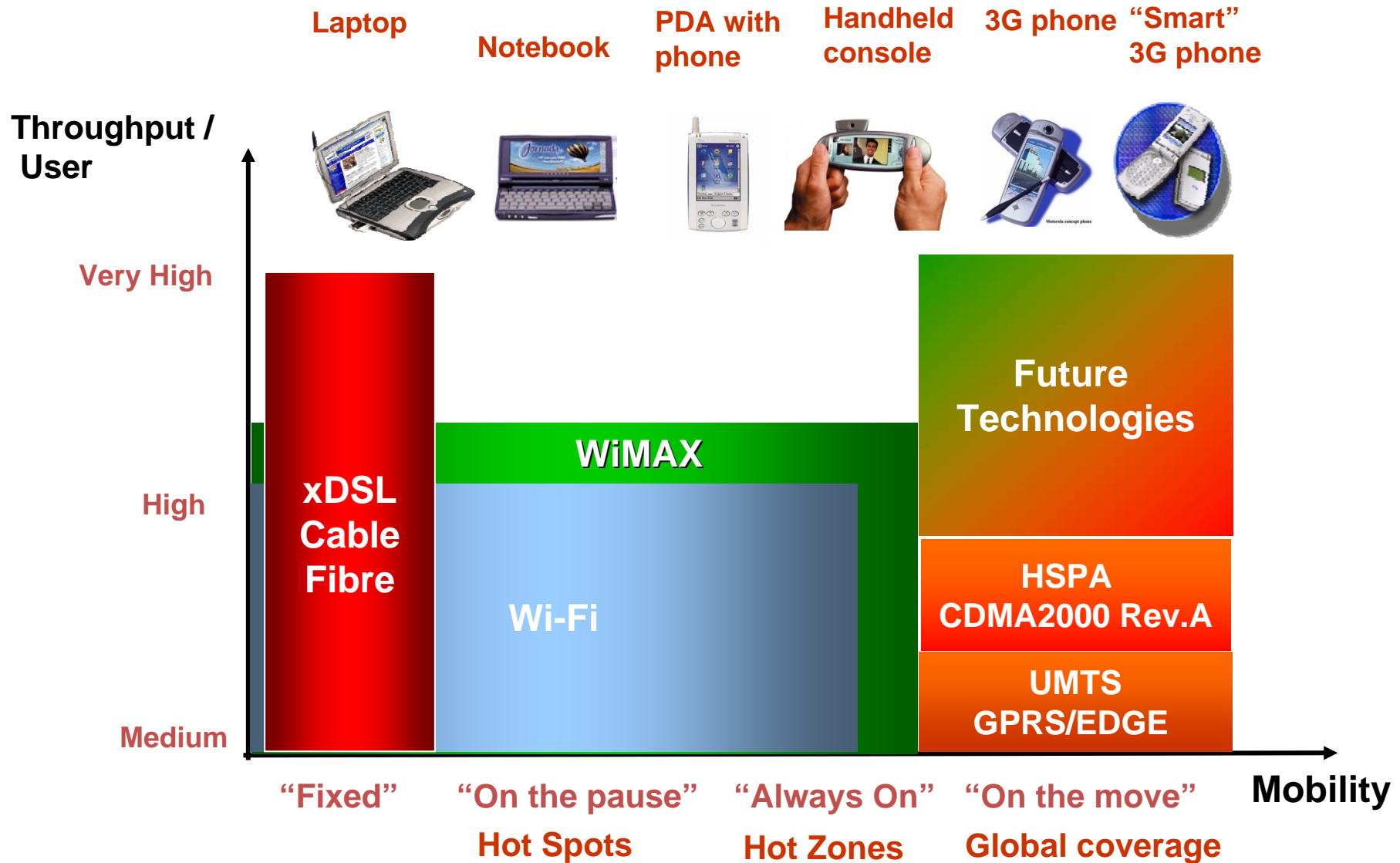
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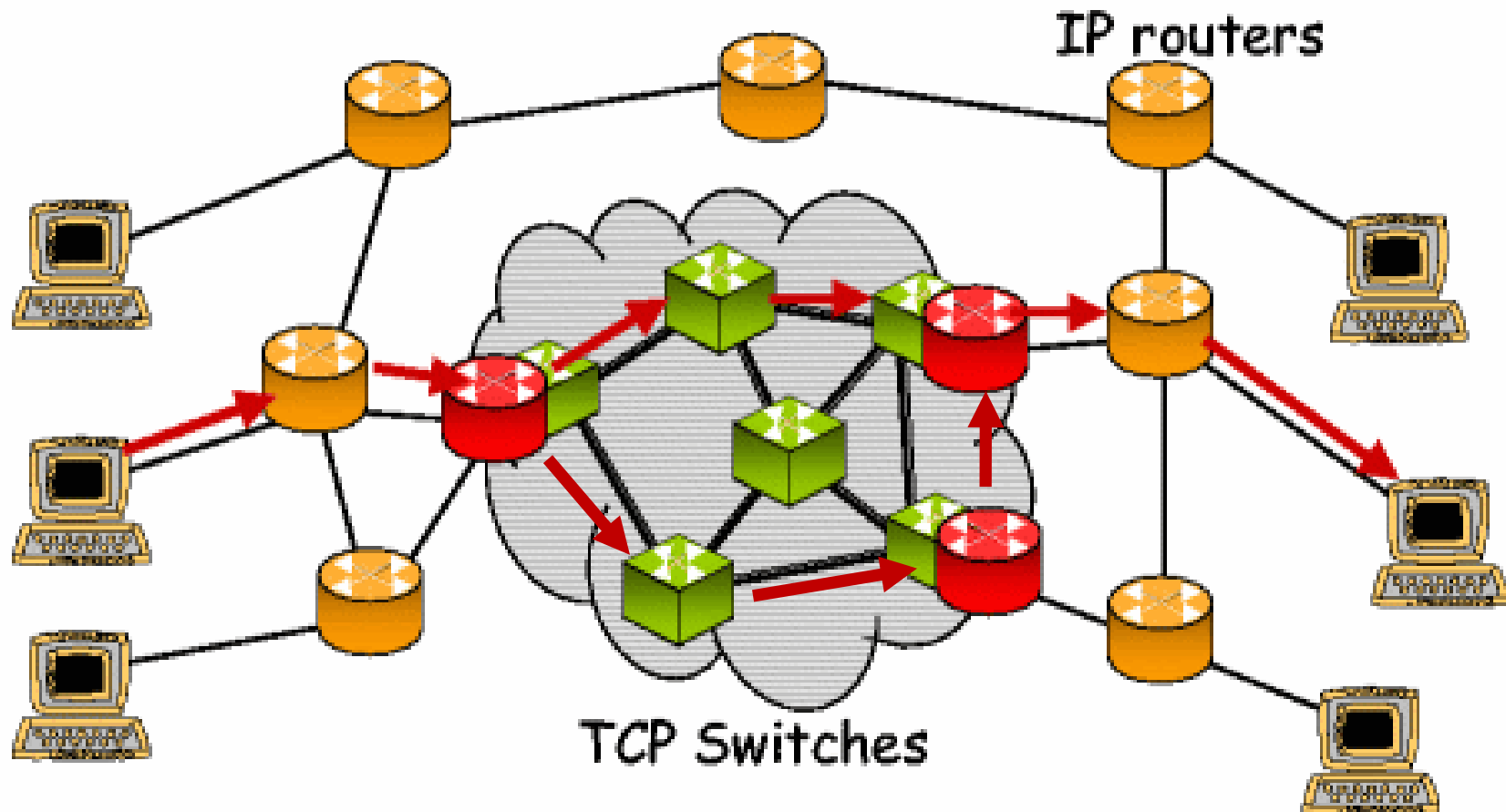
Not just in developing world!

# Too many technologies; too heterogeneous!

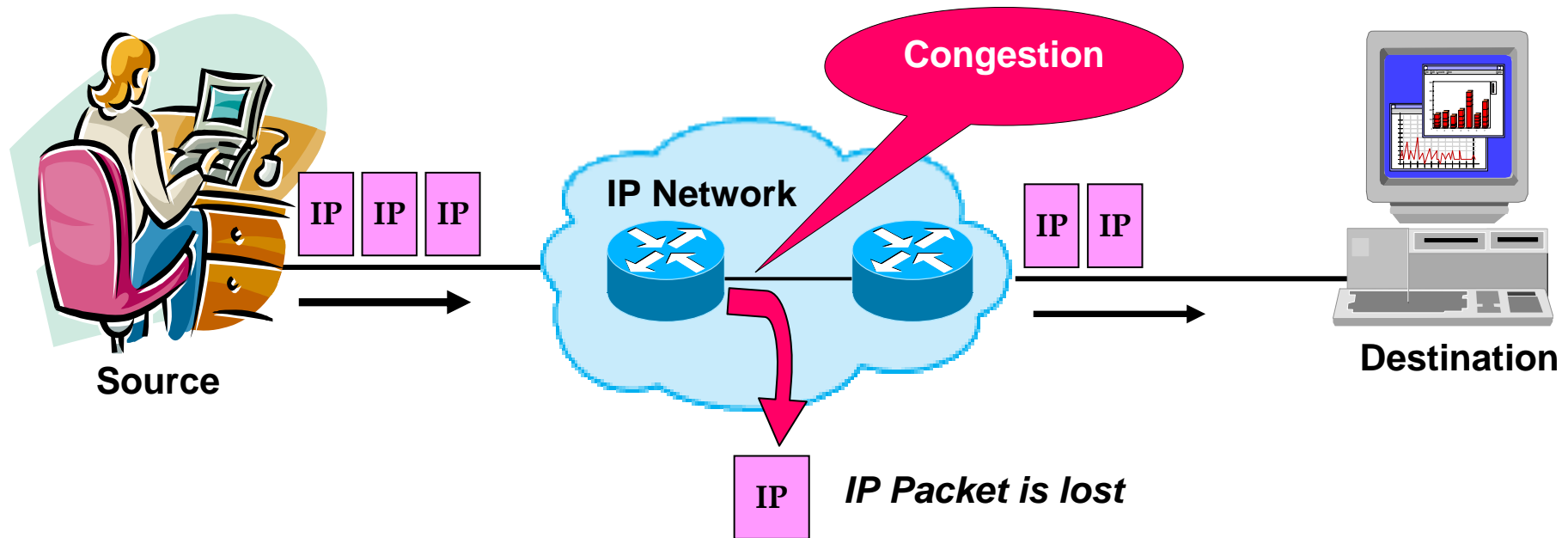


# Too complex. Why?

- Circuit switching vs. Packet switching

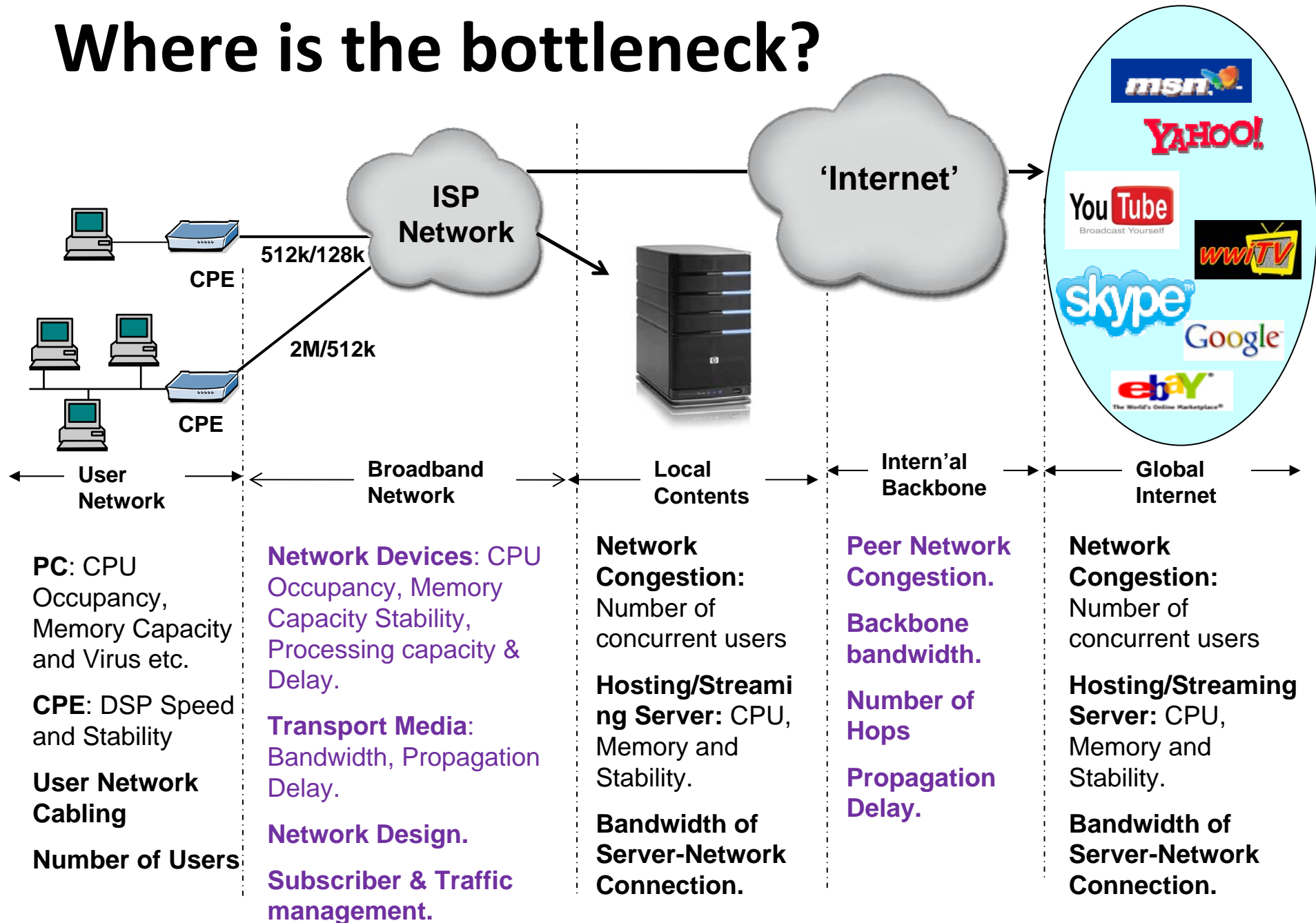


# The congested nodes drop packets when they cannot transmit; have to resend them...

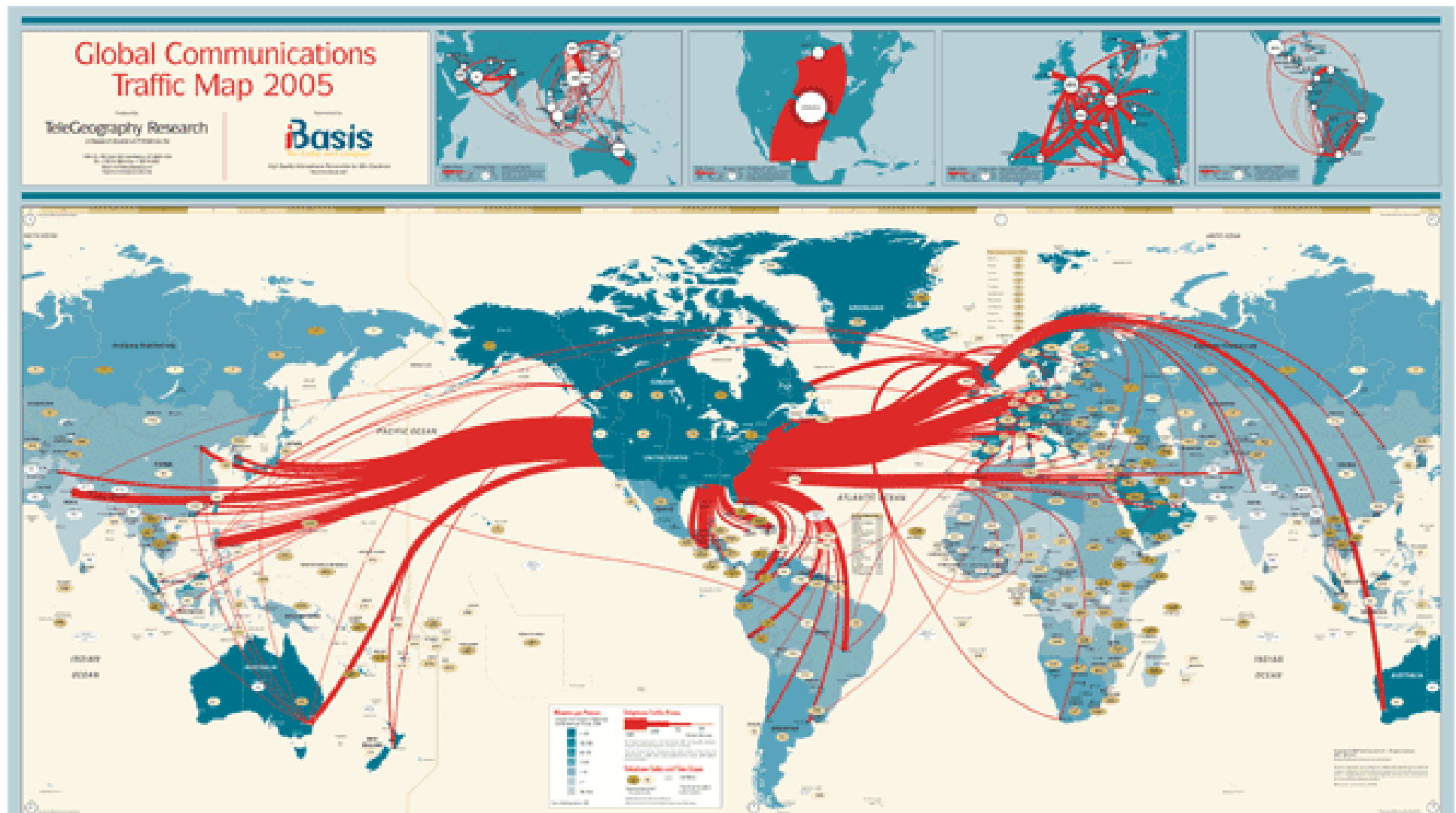


- Let every body send.
- Try to deliver, what the network can ... and
- if not possible, drop!

# Where is the bottleneck?



# 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%**

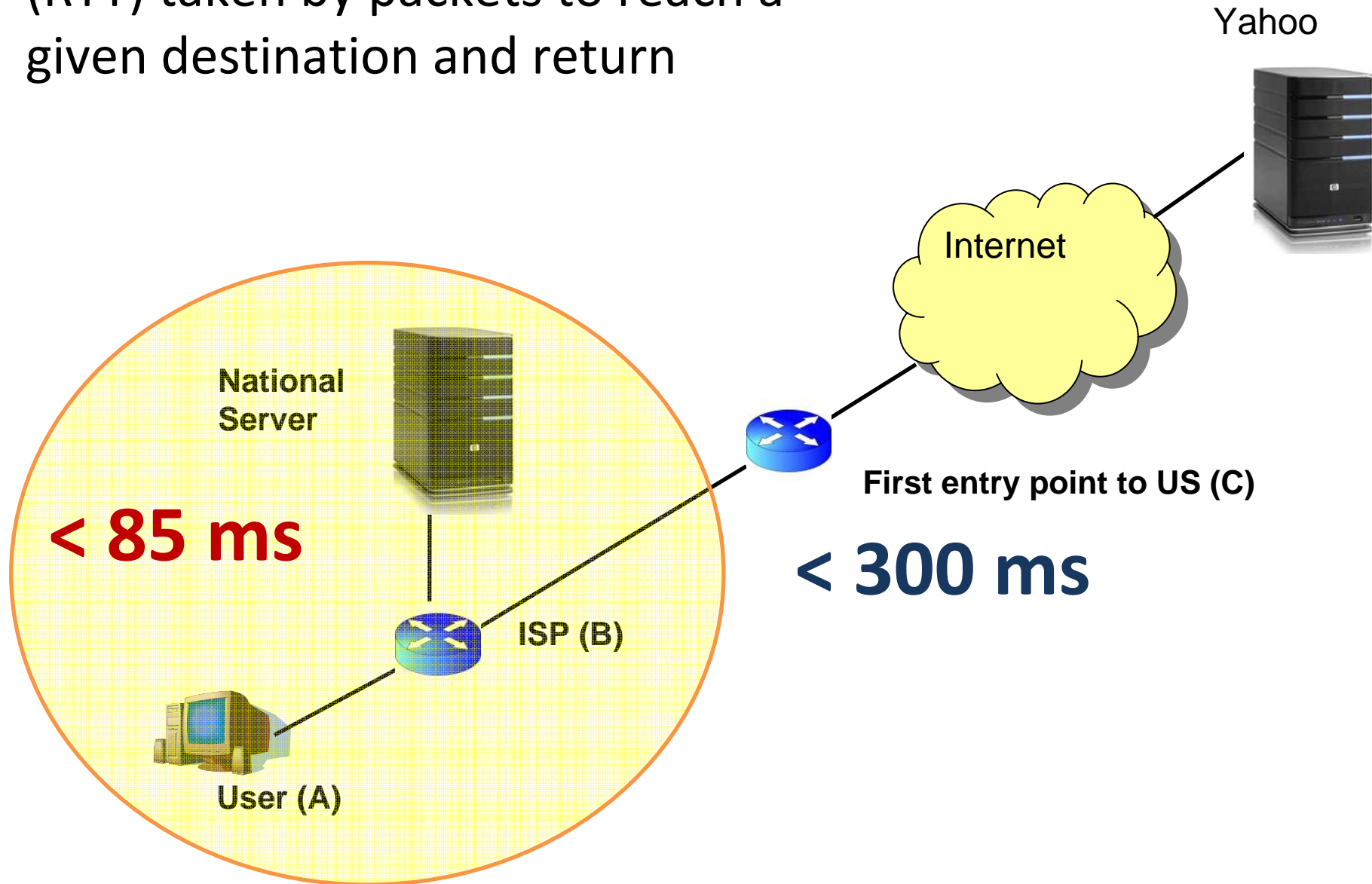
(Excluding pre-announced maintenance periods)

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

**Should be less than 90%**

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

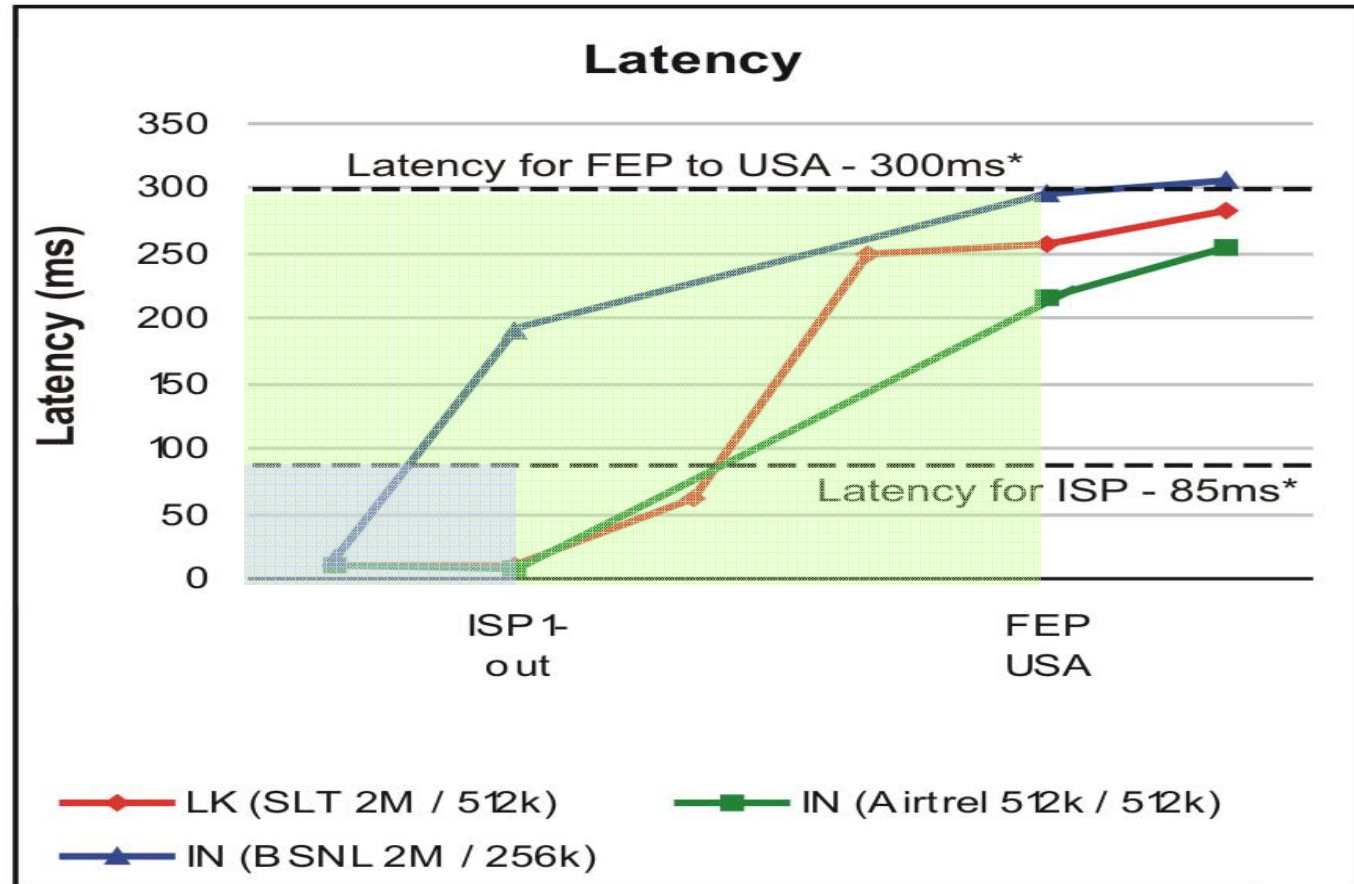
Network Latency: Round Trip Time (RTT) taken by packets to reach a given destination and return



# 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

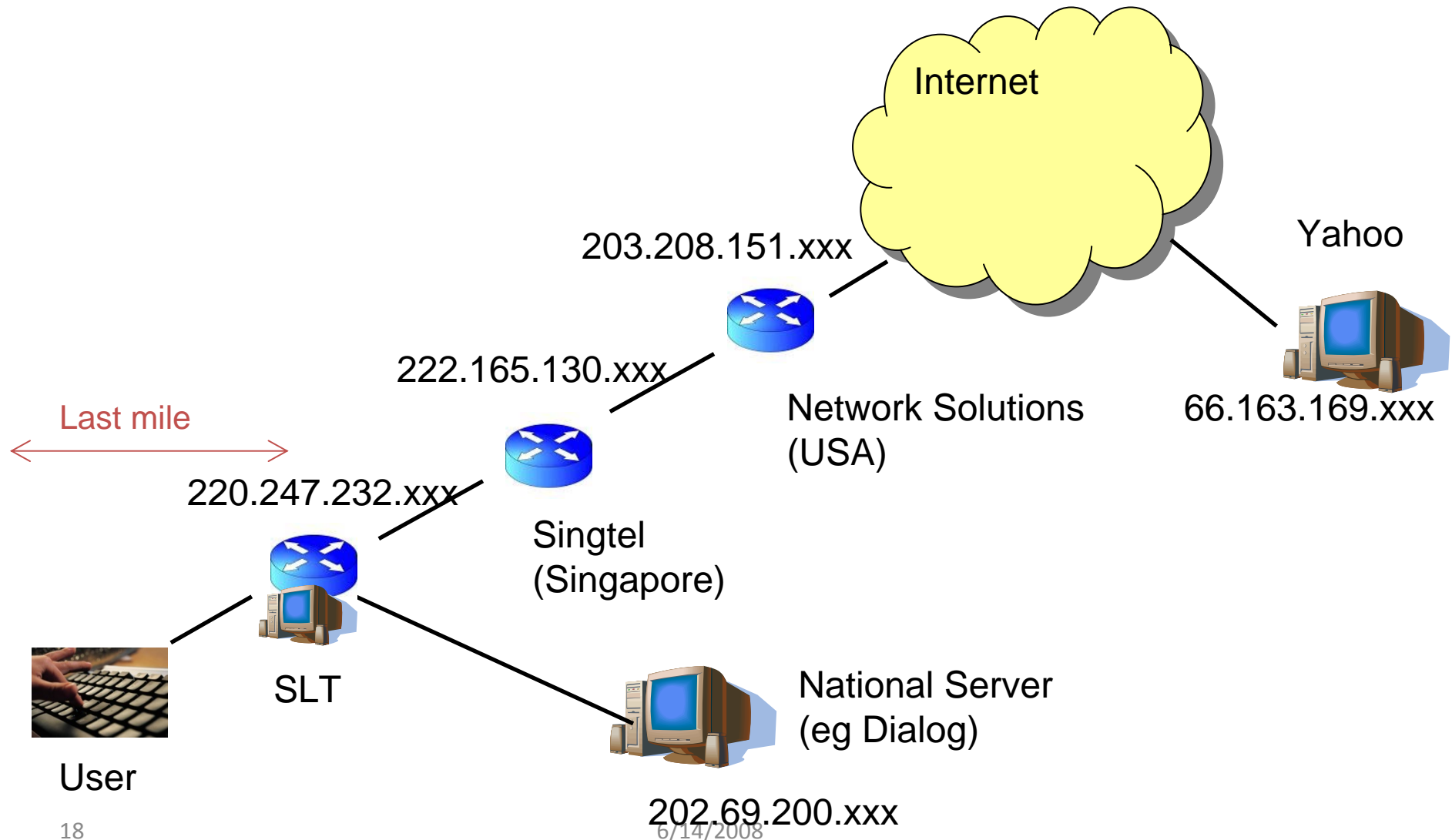
# Relevance of Metrics

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

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

6/14/2008

# Network Diagram of a Test

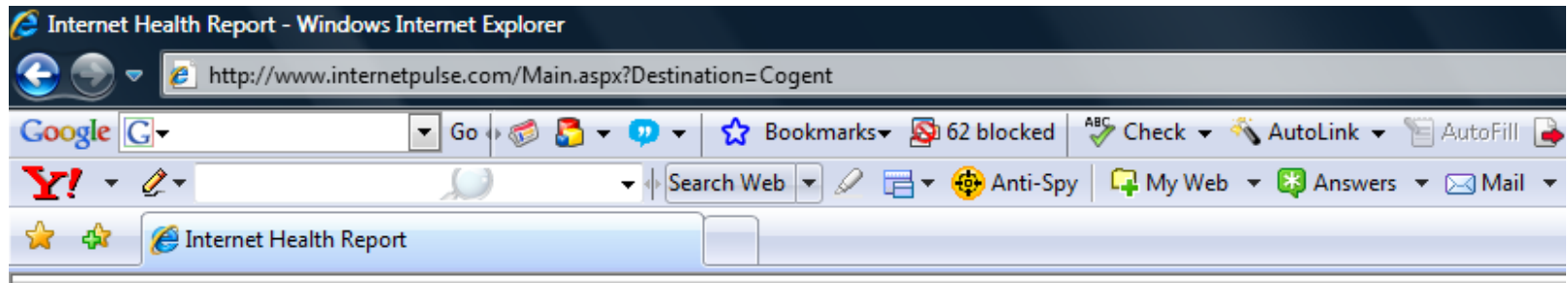


## What's next?

- A decentralised approach based on 'Volunteer Computing'\*
- Automating the manual test process (otherwise too resource consuming and cumbersome)
- Need to conduct tests from multiple points (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.



**Focus:** From:  To:  Metric:  Period:

**View:**

Example:  
[www.internetpulse.com](http://www.internetpulse.com)

Origin

All Metrics - Cogent - Last 1 Hour

	Latency	Network Availability	Packet Loss
<a href="#">AT&amp;T</a>	38	100	0
<a href="#">Savvis</a>	25	100	0
<a href="#">SBC</a>	28	100	0
<a href="#">Sprint</a>	24	100	0
<a href="#">XO</a>	30	100	0
<a href="#">Cogent</a>	22	100	0.72
<a href="#">Verizon</a>	39	100	0
<a href="#">Level3</a>	33	100	0
<a href="#">Internap</a>	37	100	0
<a href="#">IHR</a>	38	100	0
<a href="#">NTTcom</a>	56	100	0
<a href="#">Global Crossing</a>	42	100	2.08
<a href="#">Qwest</a>	42	100	4.21

Healthy < 90ms Latency. 
 Warning < 180ms Latency. 
 Critical > 180ms Latency.



Thank You!

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