

# Broadband Quality of Service Experience in Bhutan

May 2011

Thimphu



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# What gets measured gets improved. But who can measure BB quality?

- The regulator
  - All networks can be monitored/measured
  - Can order operators to change performance
  - May or may not make data available to consumers
- The operators
  - Only their own network
- Users/consumers
  - Only their own ISP
  - But useful only if comparison possible

# Different tools for consumers to measure BB quality

- Several existing methods
  - SpeedNet, etc.
  - Emphasis on download and upload speeds
- New method: “AT-tester” software
  - Methodology and software developed by IIT-Madras
  - Additional metrics other than throughput
  - Software freely available at [www.bradbandasia.info](http://www.bradbandasia.info)
  - Testing results automatically uploaded to same web site; viewable by all

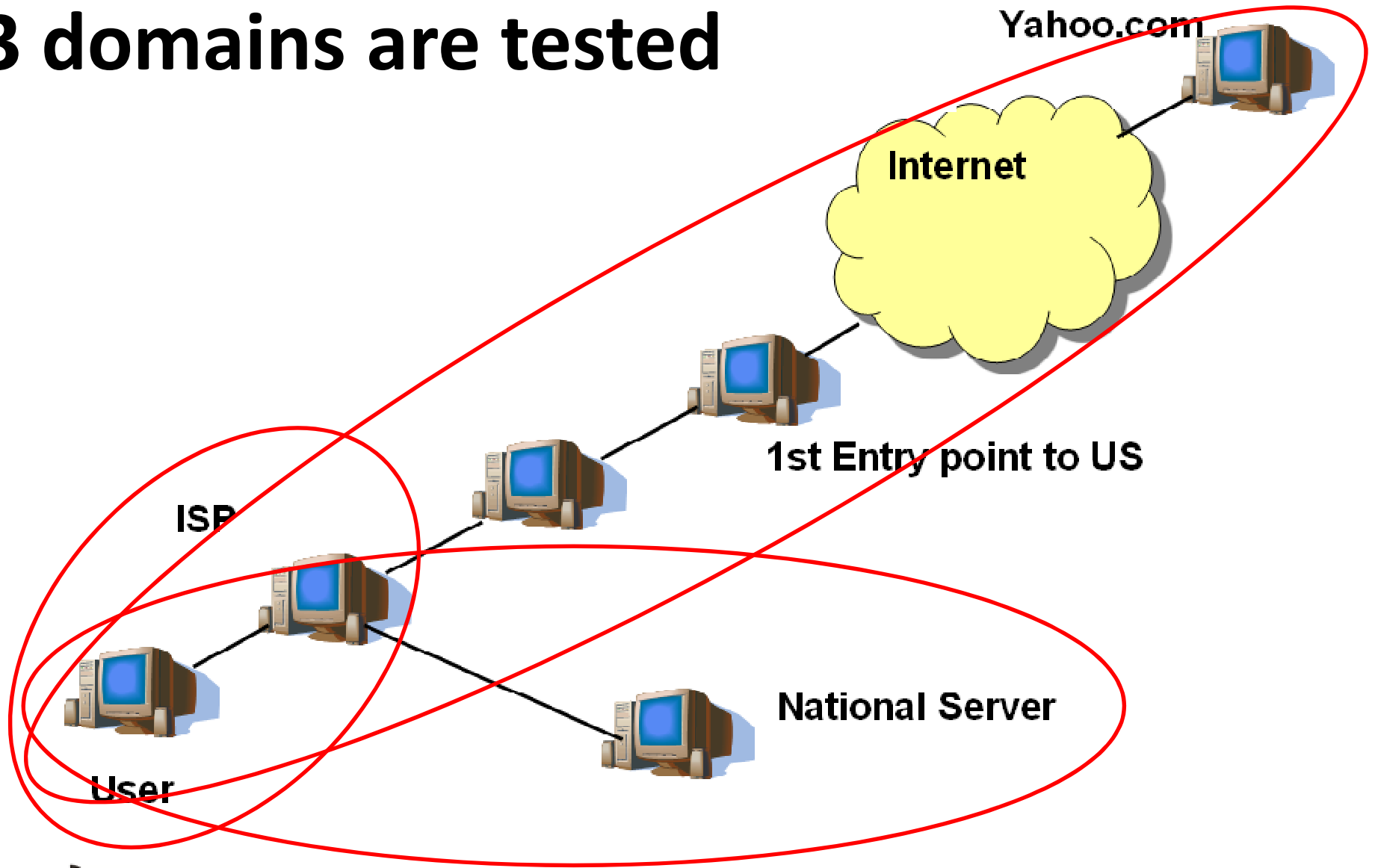
# What is measured: metrics explained

- Upload and download speeds
  - Measured in kilo (or mega or giga) bits per second.  
Basic measure of speed
- Round Trip Time (RTT)
  - Time taken for a packet to reach a destination and return
- Jitter
  - Average Variation of RTT
- Packet Loss
  - Number of packets (as %) which do not reach the destination

# Why different metrics?

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

# 3 domains are tested



# More on methodology...

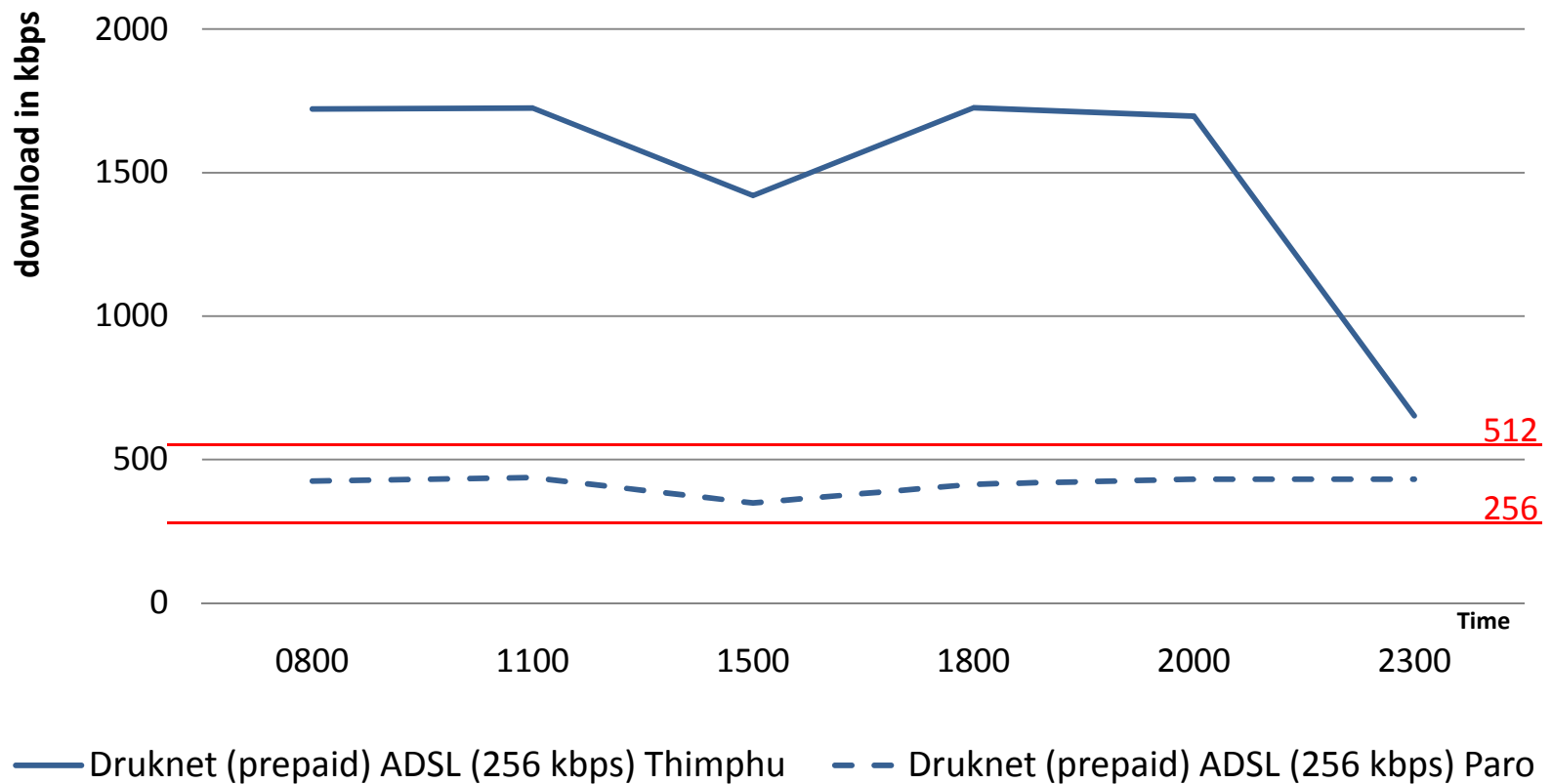
- Multiple packages tested
  - Leased lines, ADSL, Mobile internet
- 3 domains tested
  - Within ISP, national, international (USA)
- At multiple times of the day
  - 6 times, spread out through the day
  - Include Peak and off-peak
- Each time, multiple readings
  - Outliers eliminated
- Multiple locations in the country
  - Thimphu, Paro
  - Inside commercial premises (due to availability)

# **Results from April 2011**



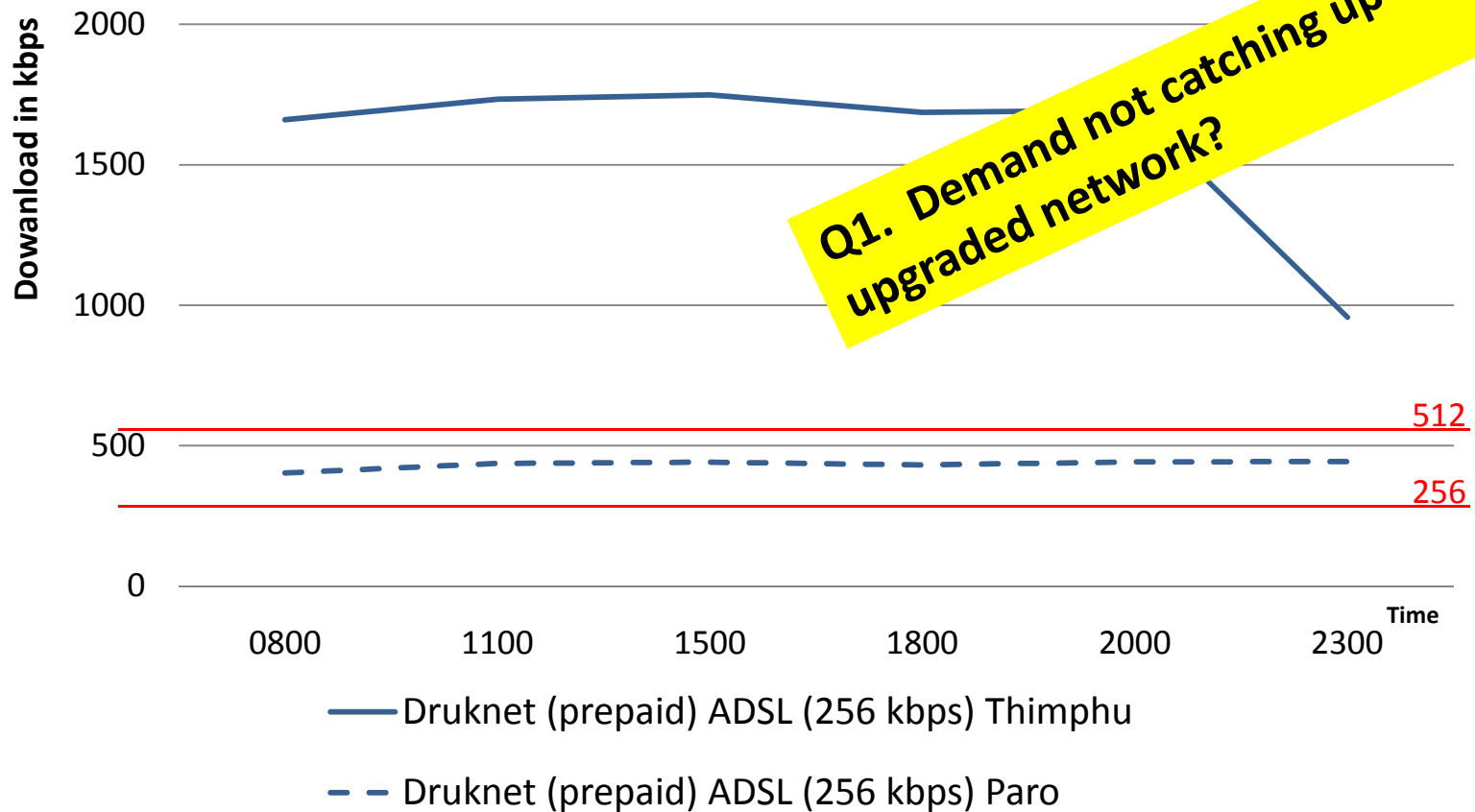
# 1. ADSL “over-delivers” within ISP domain...

Download in kbps- from ISP - ADSL packages



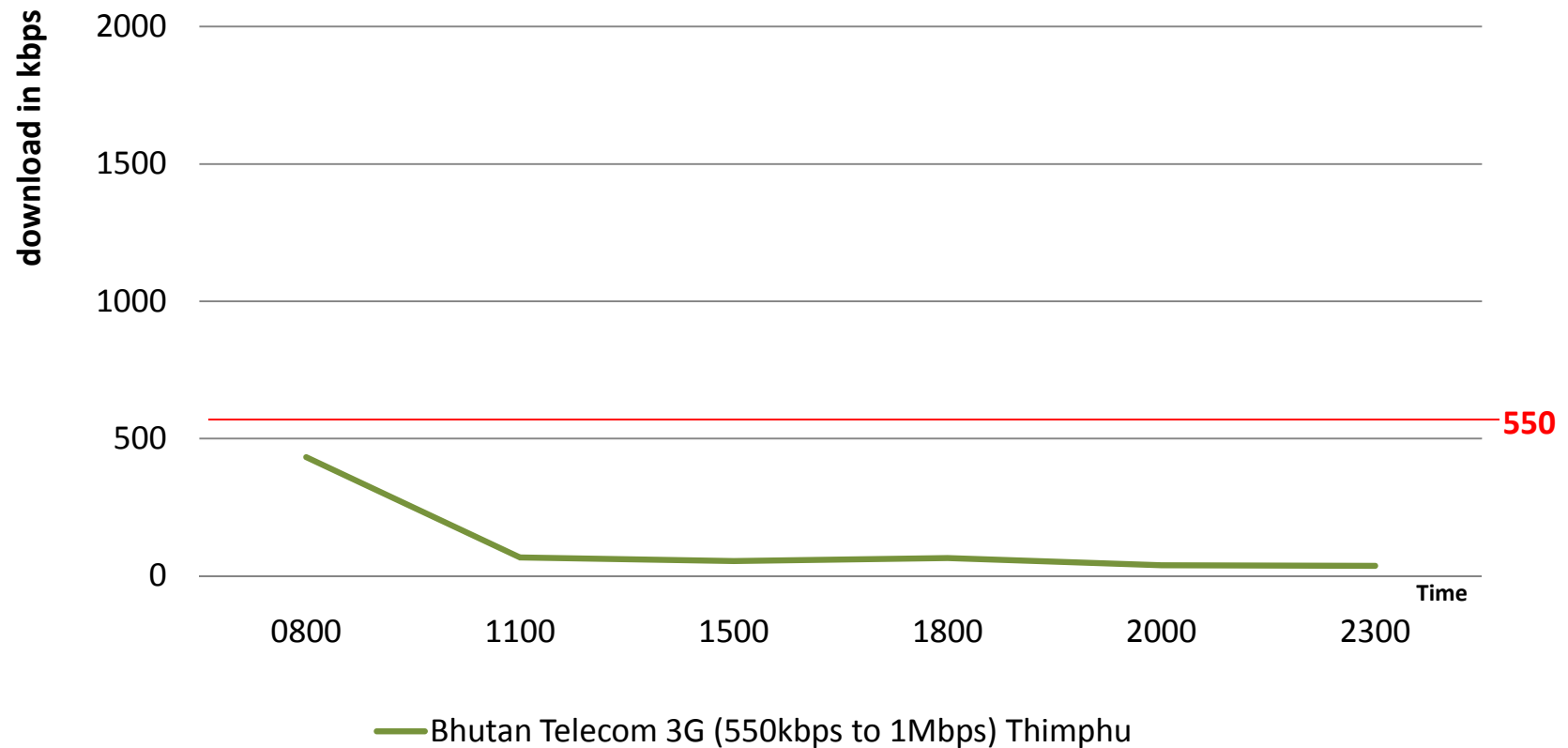
# .... and in international domain

Download in kbps- International -ADSL packages



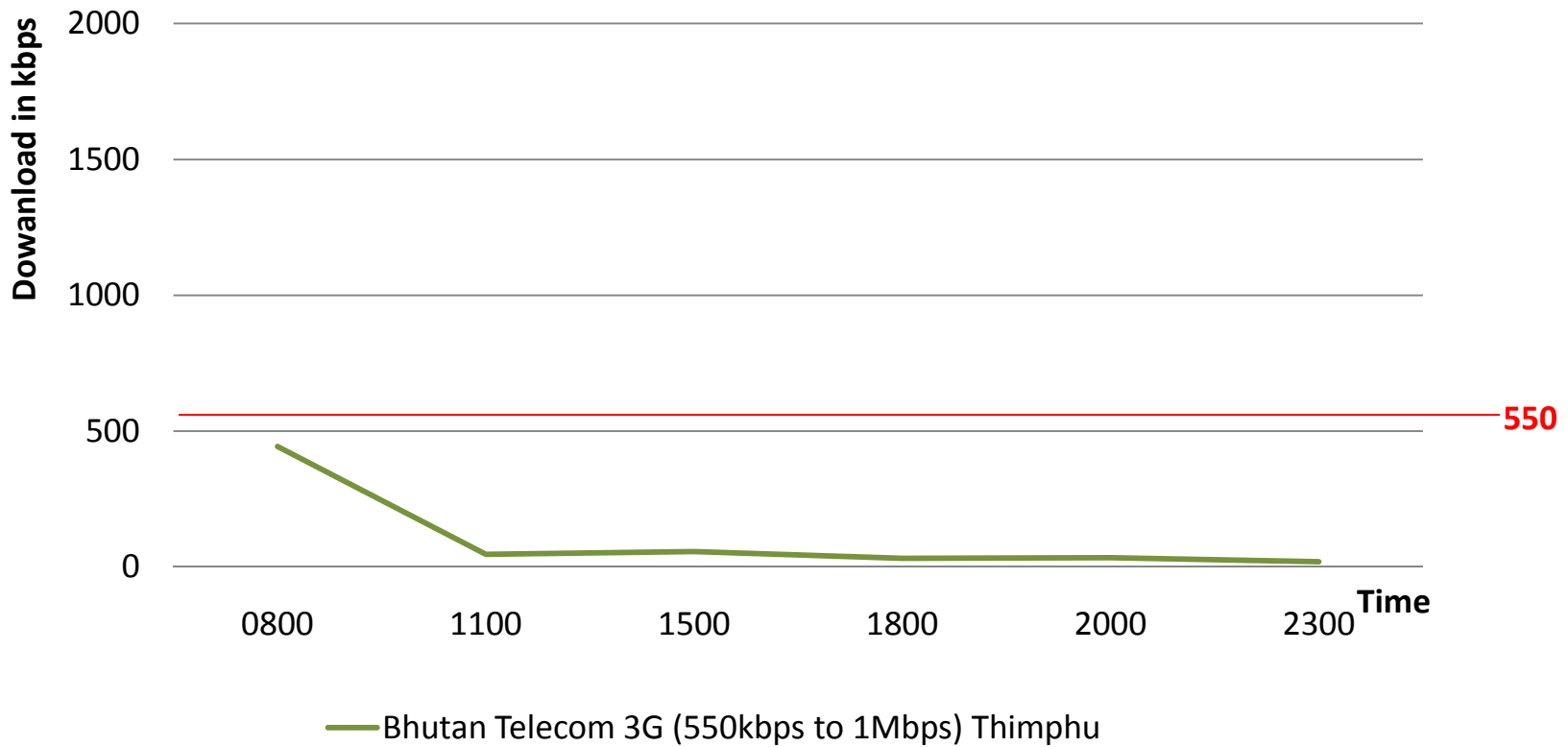
## 2. Mobile BB underperforms in ISP domain....

Download in kbps- ISP – 3G



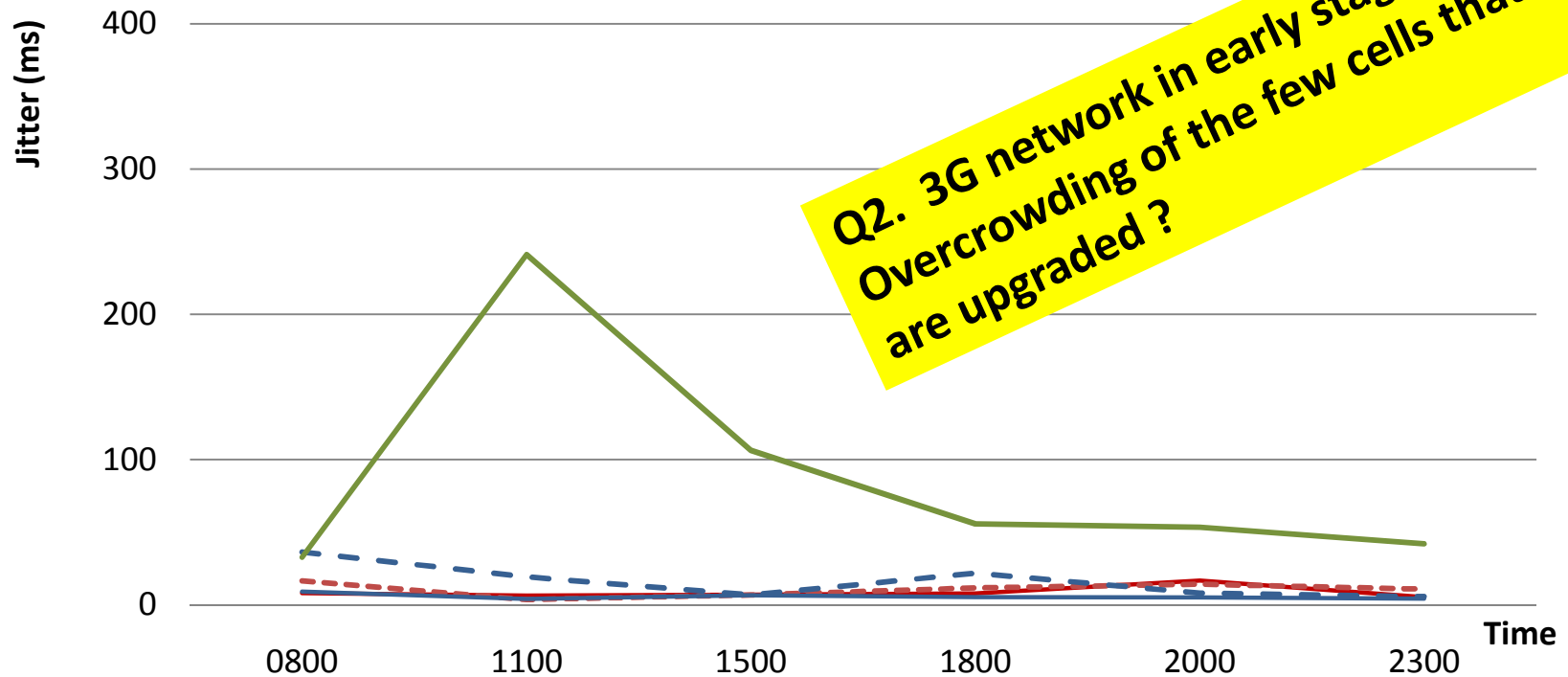
# ...and in international domain

Download in kbps- International - 3G



# ...and makes current 3G BB less suitable for streaming/VOIP but

Jitter when pinged to an International server

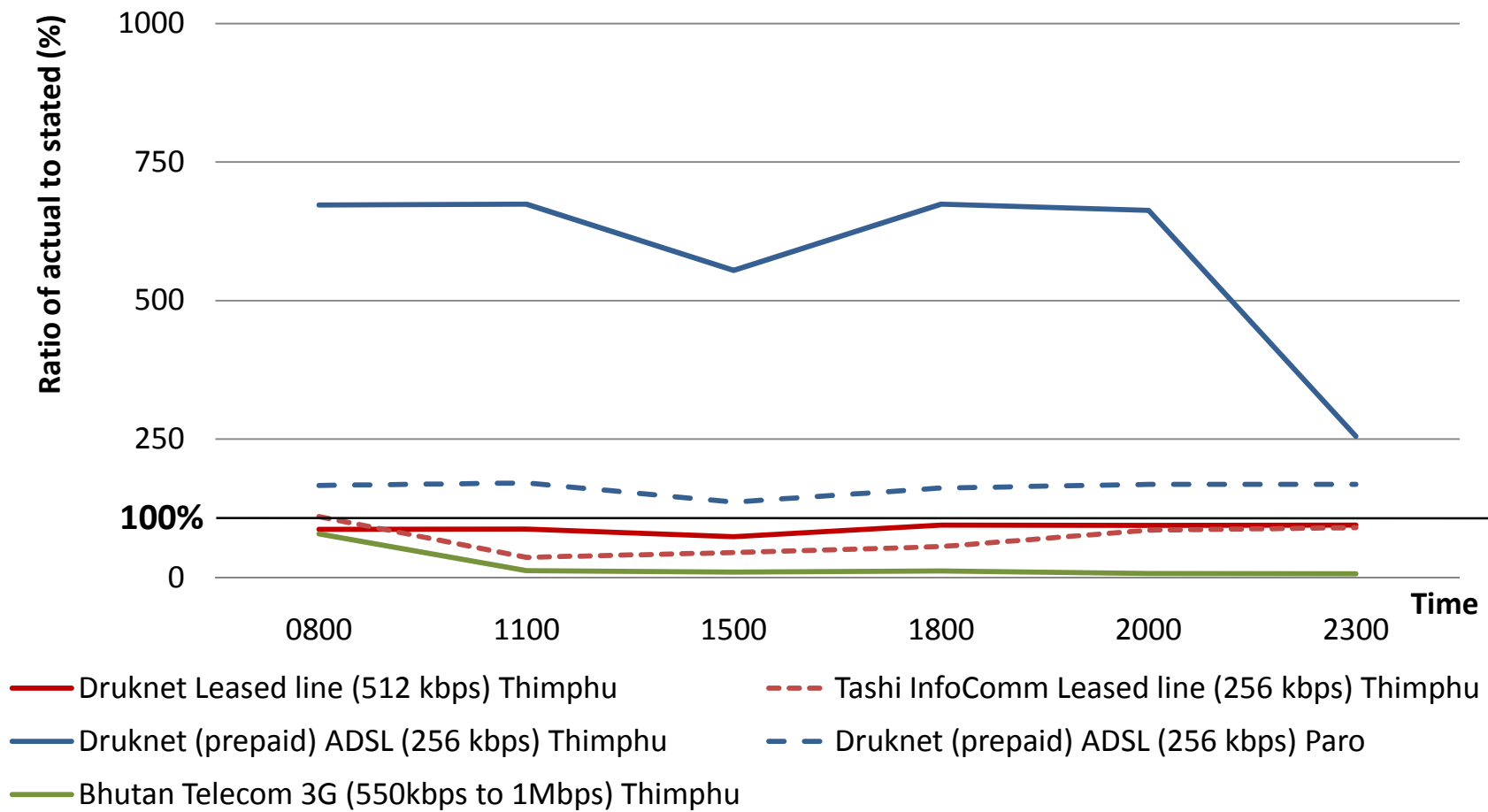


Q2. 3G network in early stage. Overcrowding of the few cells that are upgraded ?

- Druknet Leased line (512 kbps) Thimphu
- - - Tashi InfoComm Leased line (256 kbps) Thimphu
- Druknet (prepaid) ADSL (256 kbps) Thimphu
- - - Druknet (prepaid) ADSL (256 kbps) Paro
- Bhutan Telecom 3G (550kbps to 1Mbps) Thimphu

### 3. For all packages, actual performance vs. stated shows huge variations within ISP Domain...

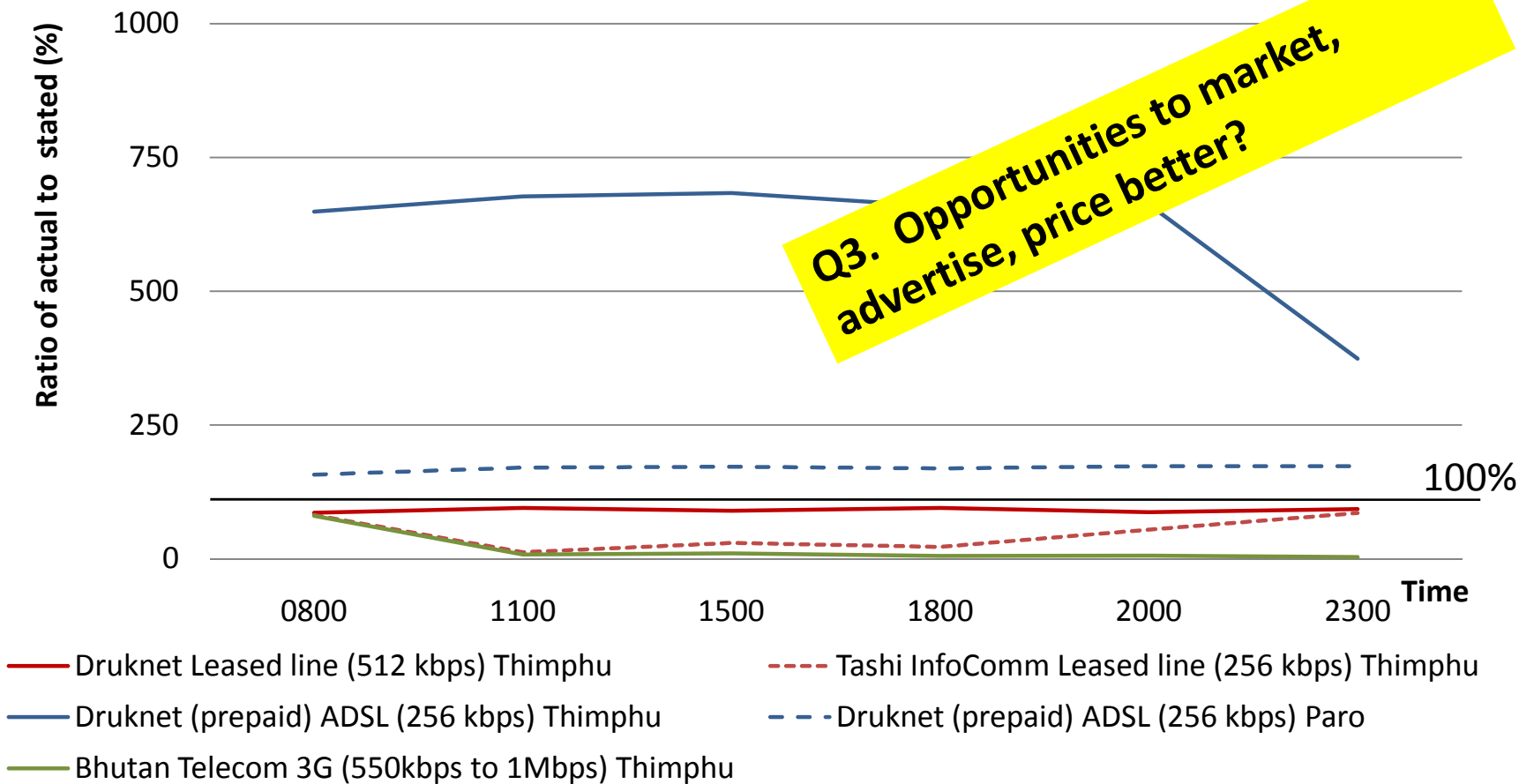
Ratio of actual to stated speed – ISP server



note: 3G speed taken as 550 kbps

# ... and in international domain

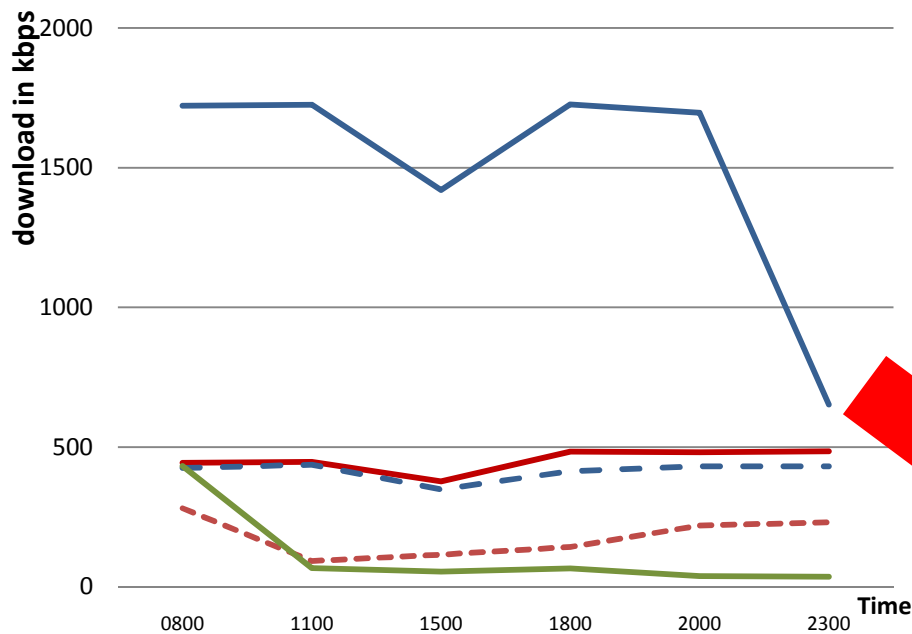
Ratio of actual to stated speed - International server



note: 3G speed taken as 550 kbps

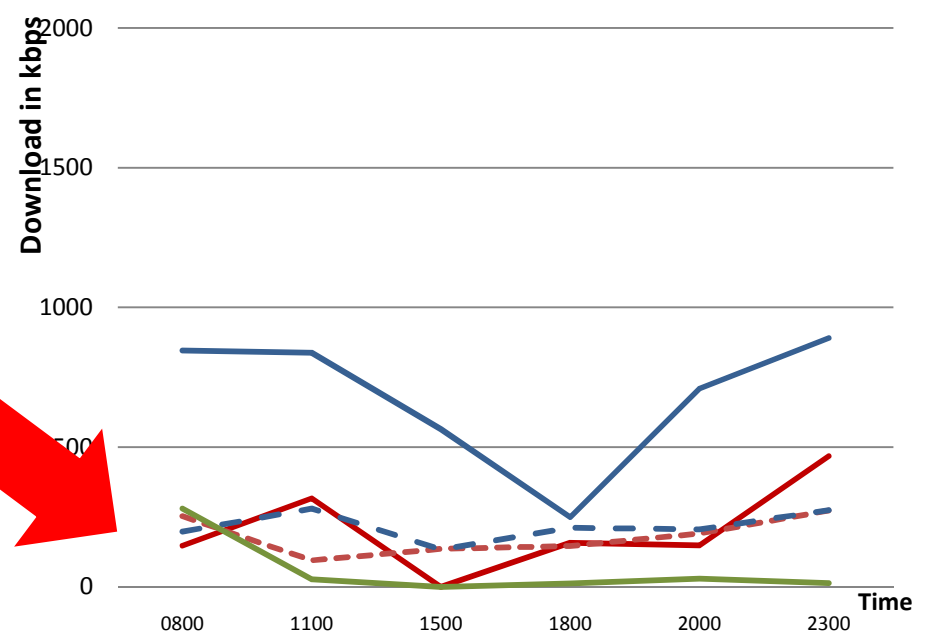
# 4. Performance drops going from ISP domain to National domain (another ISP) as seen by download speeds.....

Download in kbps- ISP (All packages)



- Druknet Leased line (512 kbps) Thimphu
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- Druknet (prepaid) ADSL (256 kbps) Thimphu
- - - Druknet (prepaid) ADSL (256 kbps) Paro
- Bhutan Telecom 3G (550kbps to 1Mbps) Thimphu

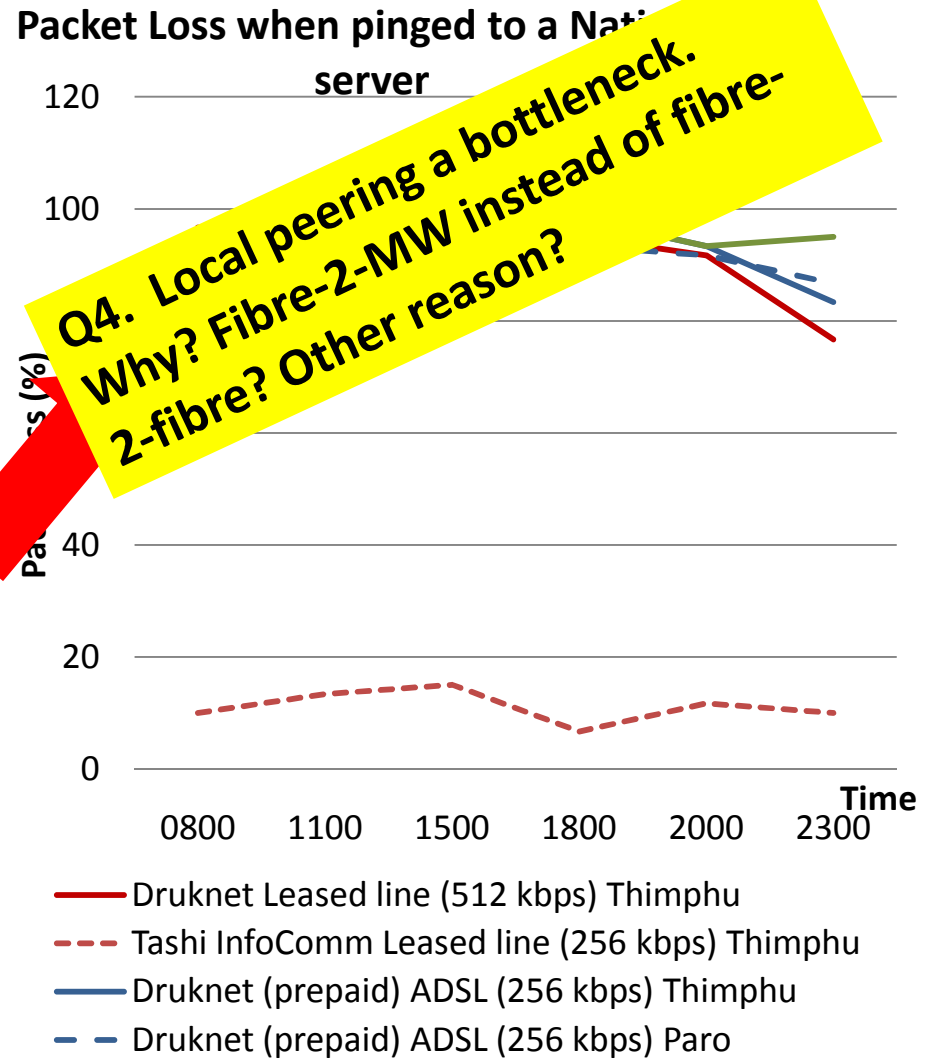
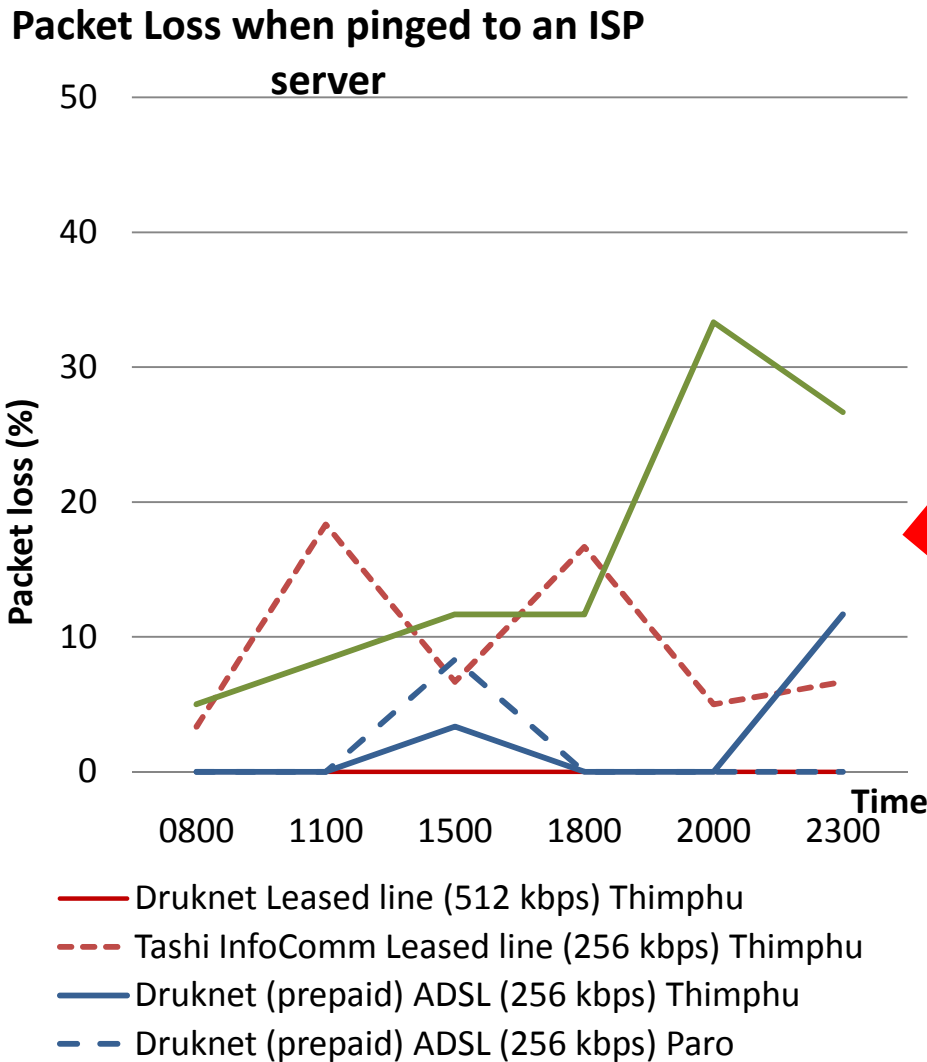
Download in kbps- National (All packages)



- Druknet Leased line (512 kbps) Thimphu
- - - Tashi InfoComm Leased line (256 kbps) Thimphu
- Druknet (prepaid) ADSL (256 kbps) Thimphu
- - - Druknet (prepaid) ADSL (256 kbps) Paro
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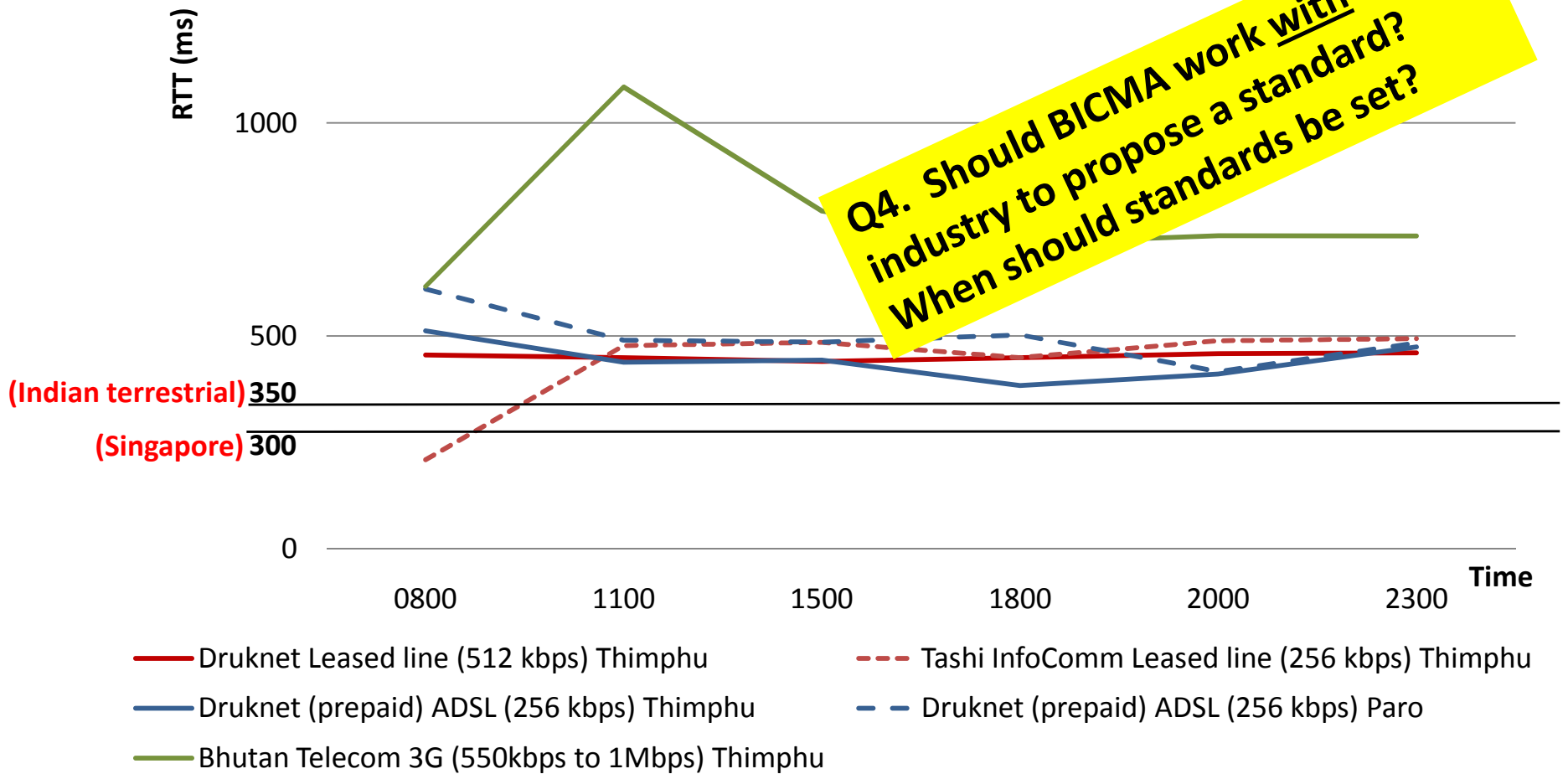
# ...and by the increase in packet loss



**Q4. Local peering a bottleneck. Why? Fibre-2-MW instead of fibre-2-fibre? Other reason?**

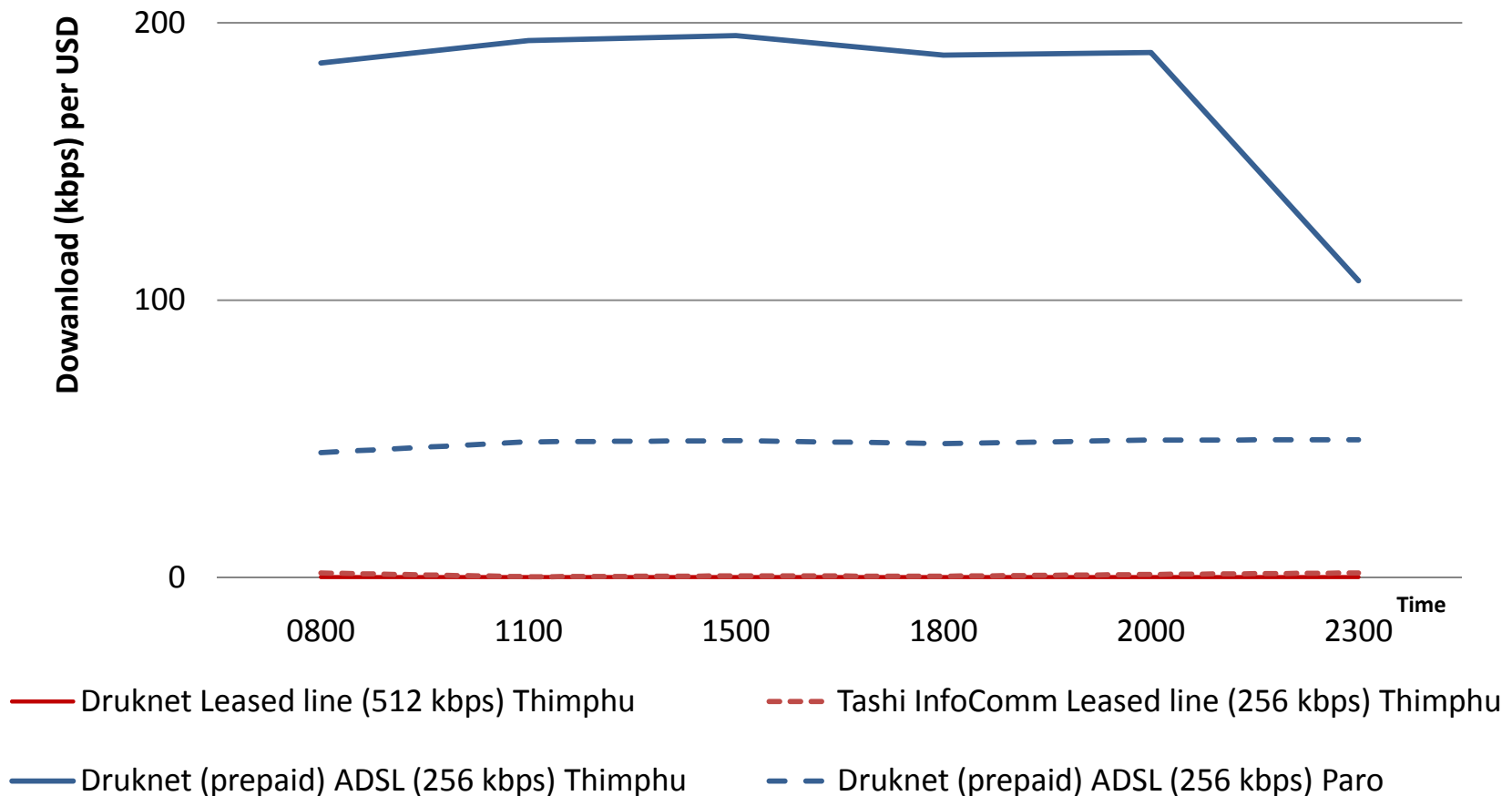
# 5. Int'l Round Trip Time (RTT) too high compared regulated standards in India, Singapore...

RTT when pinged to an International server

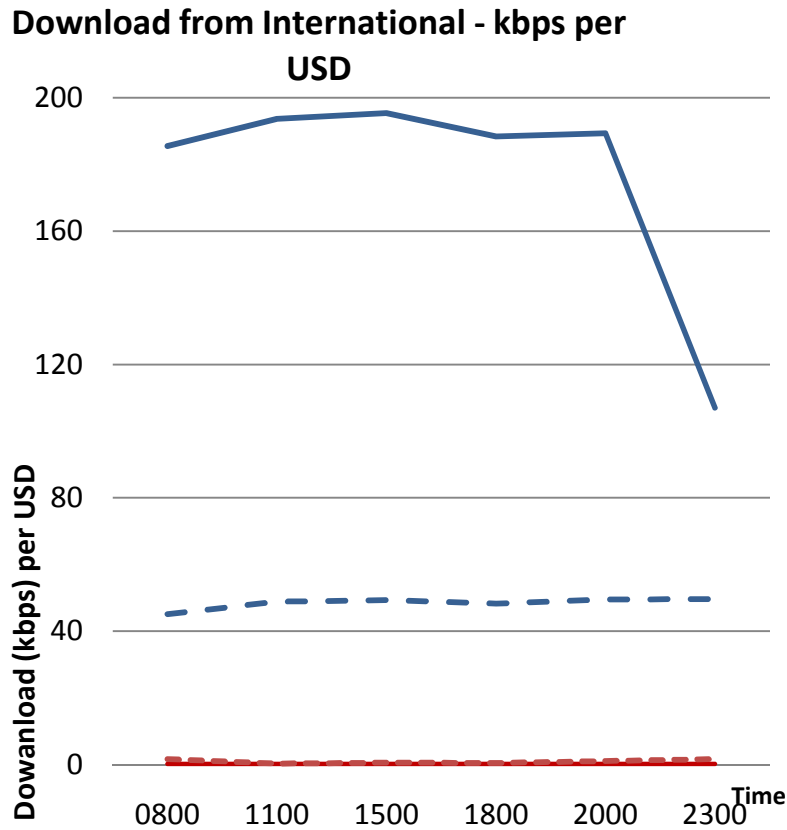


## 6. Low value for money from many technologies for users most of the time (international domain)

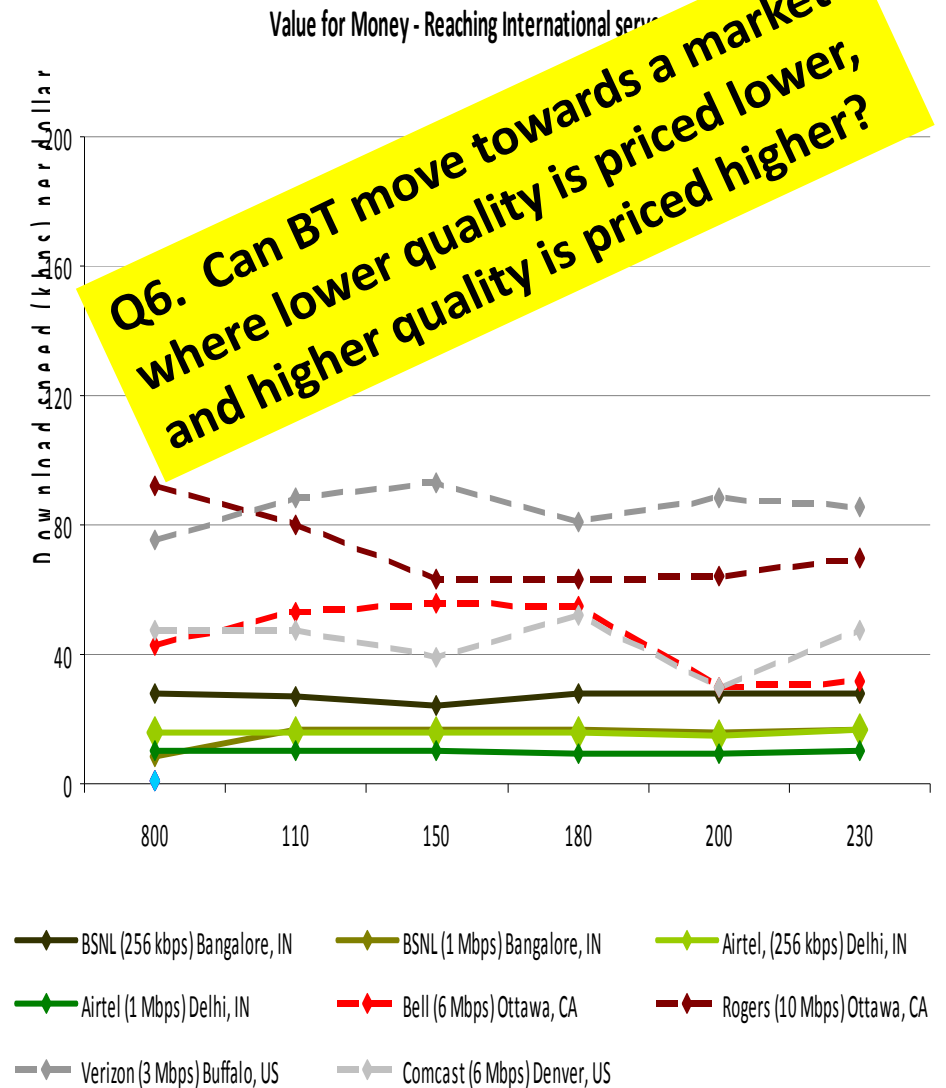
Download from International - kbps per USD



# Compared to other countries also, many BT packages give low value for money. But not all



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- - - Druknet (prepaid) ADSL (256 kbps) Paro



- BSNL (256 kbps) Bangalore, IN
- BSNL (1 Mbps) Bangalore, IN
- Airtel (256 kbps) Delhi, IN
- Airtel (1 Mbps) Delhi, IN
- Bell (6 Mbps) Ottawa, CA
- Rogers (10 Mbps) Ottawa, CA
- Verizon (3 Mbps) Buffalo, US
- Comcast (6 Mbps) Denver, US

# What can Bhutan do?

- Consumers
  - Download AT-Tester from [www.bradbandasia.info](http://www.bradbandasia.info) (already configured for BT)
  - Run the tests (automatic, no interventions required)
  - Make purchase decisions based on this
- BICMA
  - Publicize the availability of software and the results (to empower consumer)
  - Use software as a tool for diagnosis
- Operators
  - Over time develop differentiated products for consumers
- All stakeholders need to recognize this is early stages
  - light touch regulation
  - more collaboration (vs. command & control)
  - consumer centric thinking

**Thank You.**

helani@lirneasia.net

# Test locations

Druknet ADSL (256 kbps), Tashi Comm leased line (256 kbps) and Bhutan telecom 3G were tested at:

Athang ICTech,  
Yarkay Plaza,  
Chang Lam,  
Thimphu

Druknet Leased line (512 kbps) was tested at:

JICA Bhutan Office,  
Doybum Lam/ Memorial Chorten,  
Thimphu, Bhutan.  
P .O.Box- 217

Druknet ADSL (256 kbps) was tested at

Tsheryoen's Cafe,  
Paro Town(Opp. Telecom office),  
Paro, Bhutan

# Tested Packages

	Price in USD	Price in Nu	conversion rate
Druknet Leased line (512 kbps) Thimphu	3166.90	141166.67	44.58
Tashi InfoComm Leased line (256 kbps) Thimphu	134.60	6000.00	44.58
Druknet (prepaid) ADSL (256 kbps) Thimphu	8.95	399.00	44.58
Druknet (prepaid) ADSL (256 kbps) Paro	8.95	399.00	44.58
Bhutan Telecom 3G (550kbps to 1Mbps) Thimphu	0.04	1.65	44.58