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## BROADBAND QUALITY OF SERVICE EXPERIENCE (QoSE) INDICATORS<sub>i</sub>

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**Q3 2011**  
06 OCTOBER 2011

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## 1 Introduction

Price is not the only dimension that interests broadband users and regulators. The quality experienced by the user is integrally connected to price and plays a prominent role when benchmarking broadband packages in the market.

The AT-Tester (developed based on a methodology defined in collaboration with a team headed by Professor Timothy Gonsalves of IIT Madras) is a tool that tests different parameters of quality that affect a user’s online experience, described further in section 2. This report presents the results 18 packages tested in nine cities in South and South East Asia.

## 2 Dimensions of Quality of Service (QoS) tested

<p><b>Throughput (Kbps)</b></p>	<p>Referred to as the “actual amount of useful data sent on a transmission”<sup>ii</sup>. <b>Defined by the ITU as “an amount of user information transferred in a period of time” (ITU-T X.641 (97), 6.3.3.16)</b>, more commonly referred to as download or upload speeds.</p> <p>A key advertised metric in broadband services is the download speed. It defines how much information a user can receive from a local or international server. Upload speed defines the speed at which the user can send information to local or international servers. It plays a significant role in responsiveness and real-time applications like VoIP (Voice over Internet Protocol).</p> <p>Throughput, or download and upload speeds, varies depending on the location of the server that holds the content. If the location is local, such as an ISP server, the throughput may be higher than it would be if the location is international.</p> <p>Therefore the testing has included throughput for both local (ISP) and international (yahoo.com) servers.</p>
<p><b>Latency (ms)</b></p>	<p>Referred to as “delays when voice packets transverse the network”<sup>iii</sup>. It is measured in milliseconds by using the Round Trip Time (RTT). This is significant in systems that require two-way interactive communication, such as voice telephony or in systems that use Transmission Control Protocol (TCP) where the RTT directly affects the throughput rate. .</p> <p>Latency less than 300 ms is considered acceptable in this report</p> <p><b>The ITU definition states that “Latency means transmission delay for FEC (Forwarding Equivalence Class) encoding, decoding, interleaving and de-interleaving” (ITU-T G.972 (04), 3025).</b></p>
<p><b>Jitter (ms)</b></p>	<p>Referred to as “uneven latency and packet loss”<sup>iv</sup>. It is the variation of end-to-end delay from one packet to the next within the same packet stream/connection/flow. Jitter is more relevant for real-time traffic like VoIP.</p> <p>E.g. Radio quality voice requires less than 1 ms Jitter, toll-quality voice requires less than 20 ms jitter and normal VoIP requires jitter to be less than 30 ms. Beyond 30 ms, the performance of VoIP will degrade.<sup>v</sup></p> <p>In this report we consider jitter less than 50ms as acceptable.</p> <p><b>Also defined by ITU as “Short-term non-cumulative variations of the significant instants of a digital signal from their ideal positions in time” (ITU-T G.701 (93), 2024).</b></p>
<p><b>Packet Loss (%)</b></p>	<p>Referred to as the number of packets (as a percentage) that does not reach the destination. Degradation can result in noticeable performance loss with streaming technologies, VoIP and video conferencing.</p> <p>Packet loss less than 3% is considered good in this report.</p> <p><b>ITU states that “in general, IP-based networks do not guarantee delivery of packets. Packets will be dropped under peak loads and during periods of congestion. NOTE – in case of multimedia services,</b></p>

**3 Results of QoSE testing<sup>vi</sup>**
**Fixed Broadband  
Packages and colour keys**

Type	Region	Country	City	Provider	Label	Advertised Speed (kbps)	Price in USD	
Fixed line	South Asia	Bangladesh	Dhaka	Qubee	Qubee (1 Mbps) Dhaka, BD	1000	9.49	
			Dhaka	Banglalion	Banglalion (512 kbps) Dhaka, BD	512	4.07	
		Bhutan	Thimphu	Druknet	Druknet (512 kbps) Thimphu, BH	512	8.13	
		India	Bangalore	Airtel	Airtel (2 Mbps) Bangalore, IN	2000	13.12	
			Bangalore	BSNL	BSNL (256 kbps) Bangalore, IN	256	10.09	
			Chennai	Airtel	Airtel (2 Mbps) Chennai, IN	2000	13.12	
			Chennai	BSNL	BSNL (256 kbps) Chennai, IN	256	5.05	
			Mumbai	Airtel	Airtel ( 2 Mbps) Mumbai, IN	2000	13.12	
			Mumbai	MTNL	MTNL (320 kbps) Mumbai, IN	320	7.98	
			New Delhi	Airtel	Airtel (2 Mbps) New Delhi, IN	2000	13.12	
			New Delhi	MTNL	MTNL (512 kbps) New Delhi, IN	512	8.06	
		Sri Lanka	Colmbo	SLT	SLT (2 Mbps) Colombo, LK	2000	44.46	
		South East Asia	Indonesia	Jakarta	Telkom	Telkom Speed (512 kbps) Jakarta, ID	512	32.66

Note: All packages were tested at six time slots – 0800, 1100, 1500, 1800, 2000 and 2300 hours.

### 3.1 Fixed Broadband – Throughput (kbps)<sup>vii</sup>

Figure 1 - Download from an International server

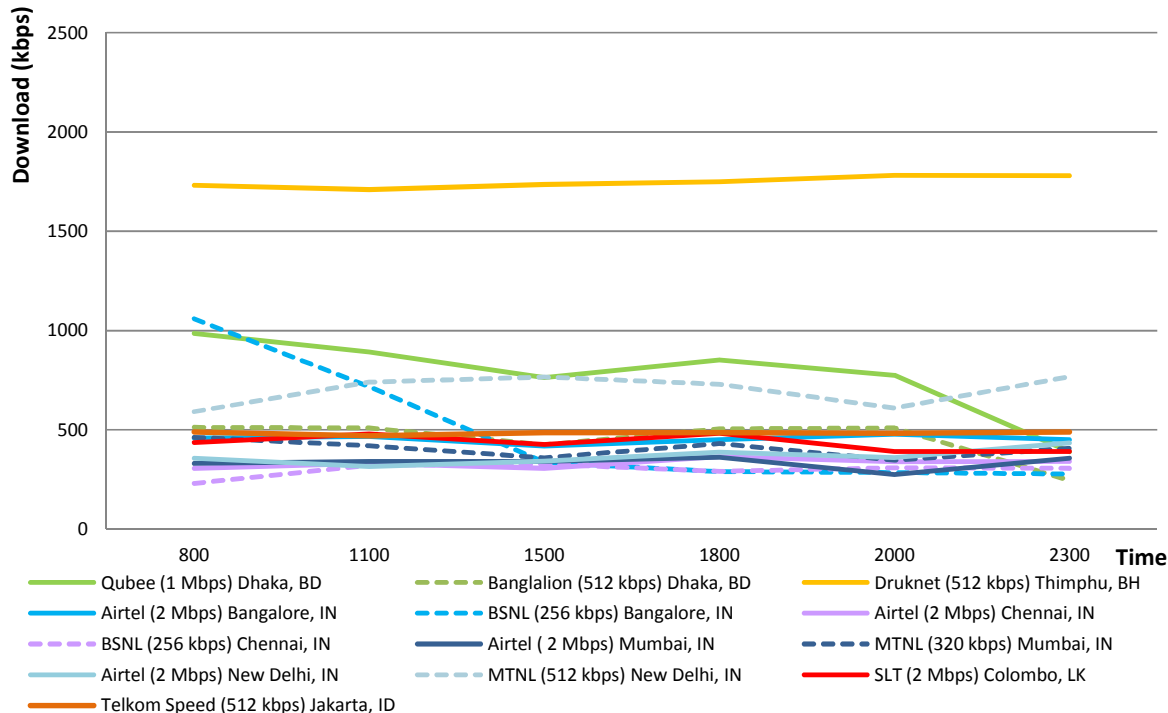


Figure 2 - Download from an International server - kbps per dollar

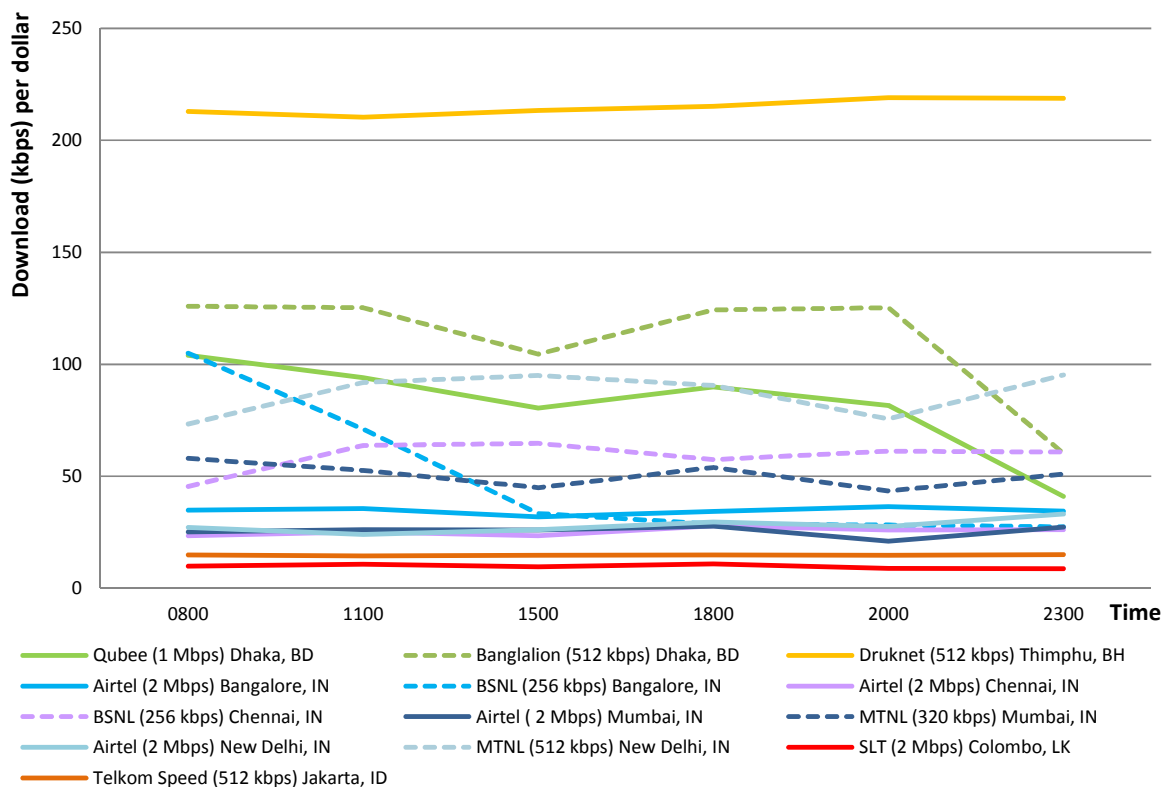


Figure 3 - Download from an International server –Delivered vs. Advertised

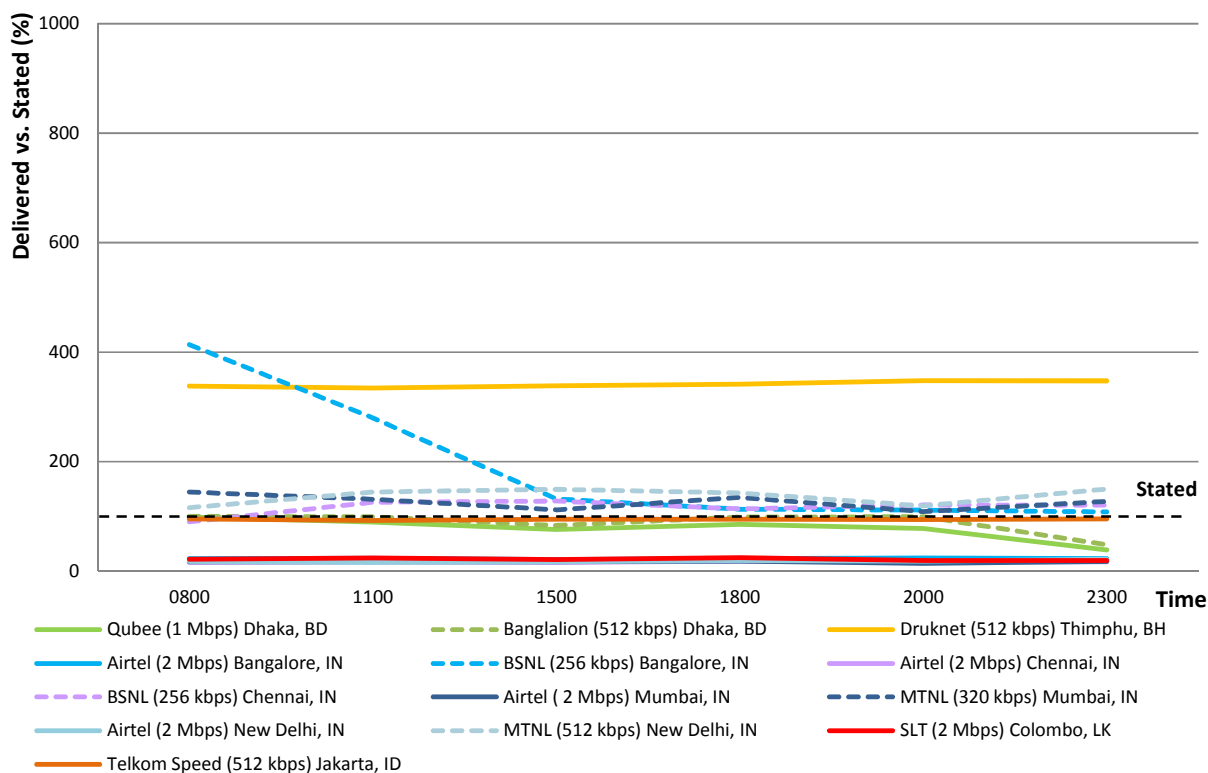


Figure 4 - Upload to an International server

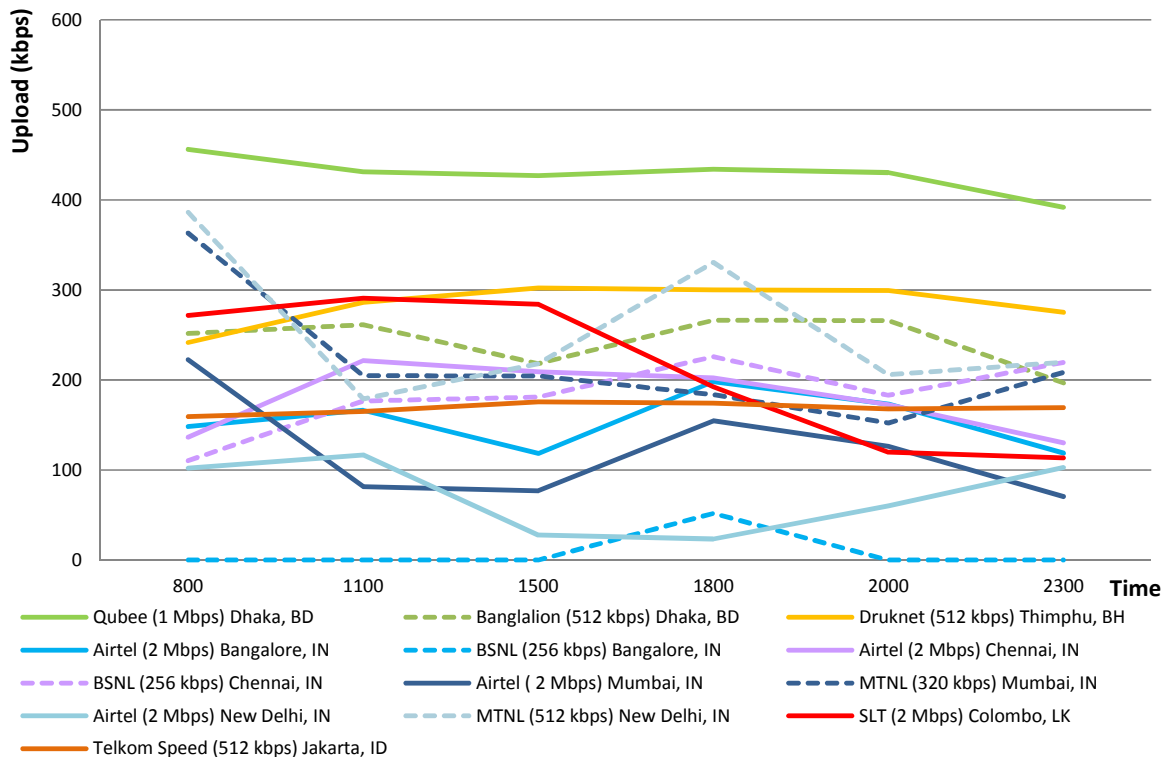
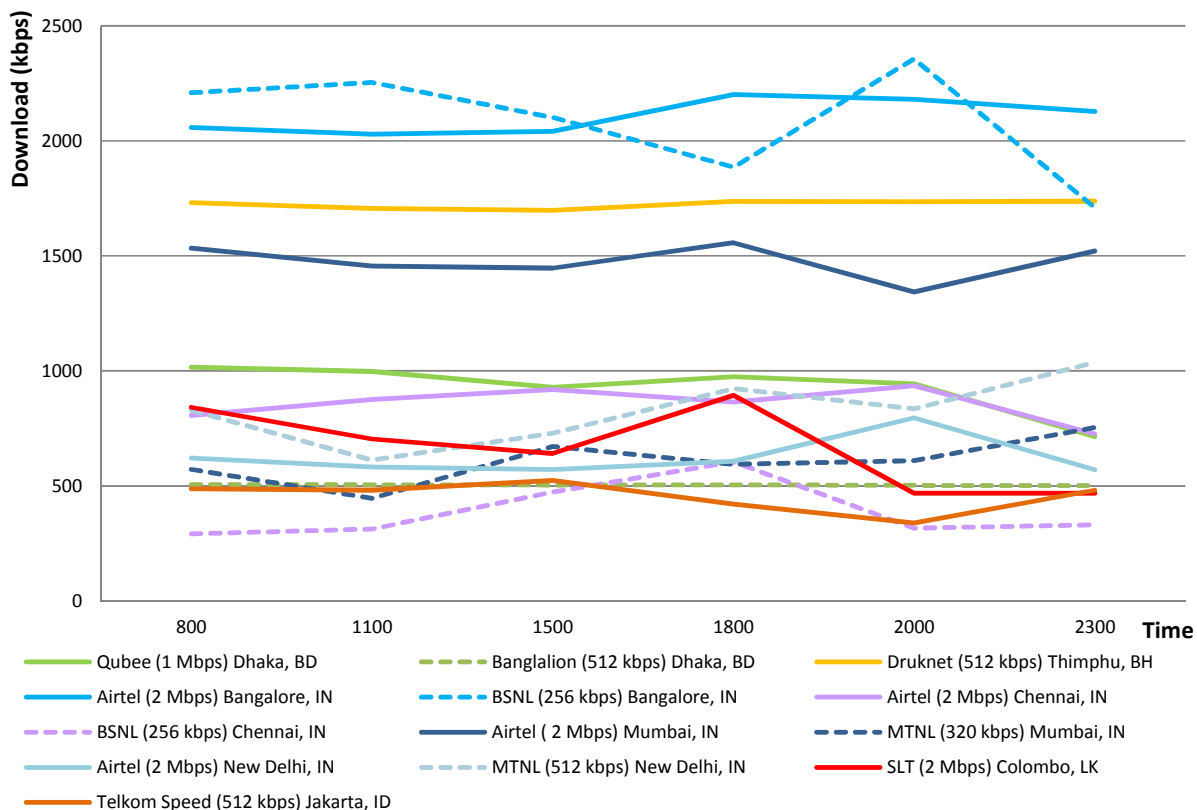
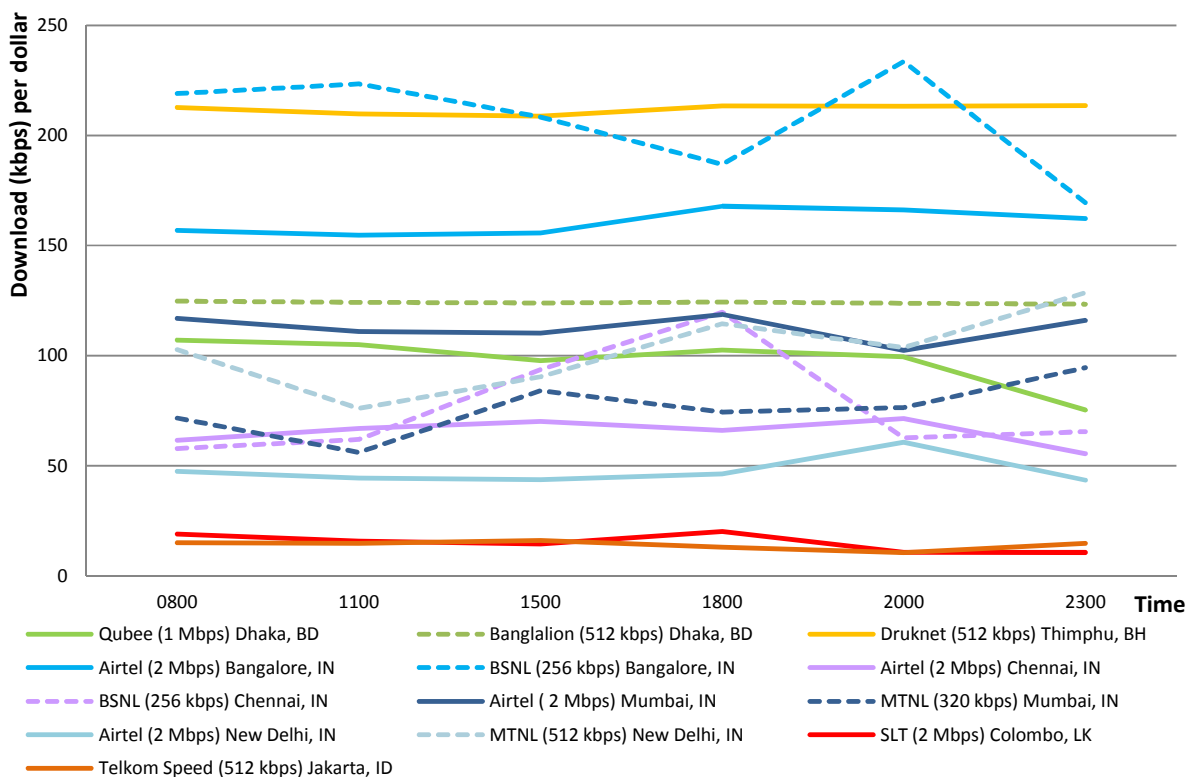


Figure 5 - Download from a local server (ISP)



www.lirneasia.net

Figure 6 - Download from a local server (ISP) - kbps per dollar<sup>viii</sup>



www.broadbandasia.info

NP: See annex for data

Figure 7 - Download from a local server (ISP) - Delivered vs. Advertised

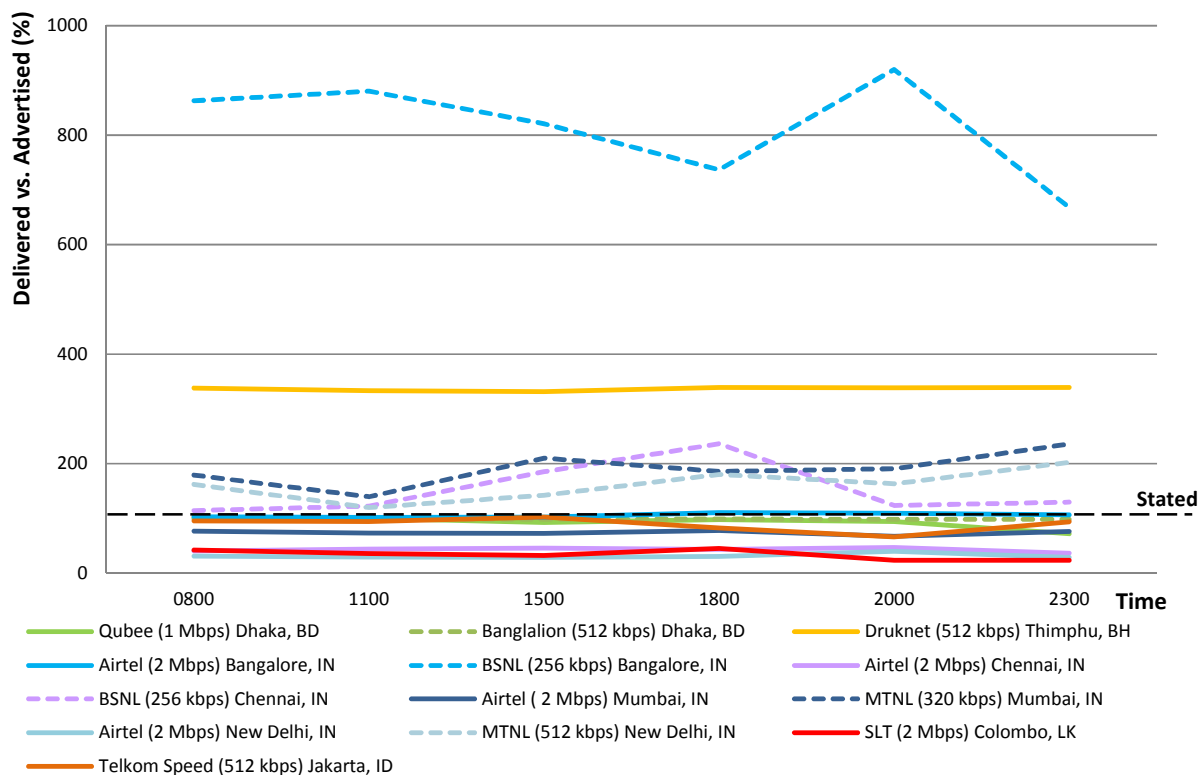
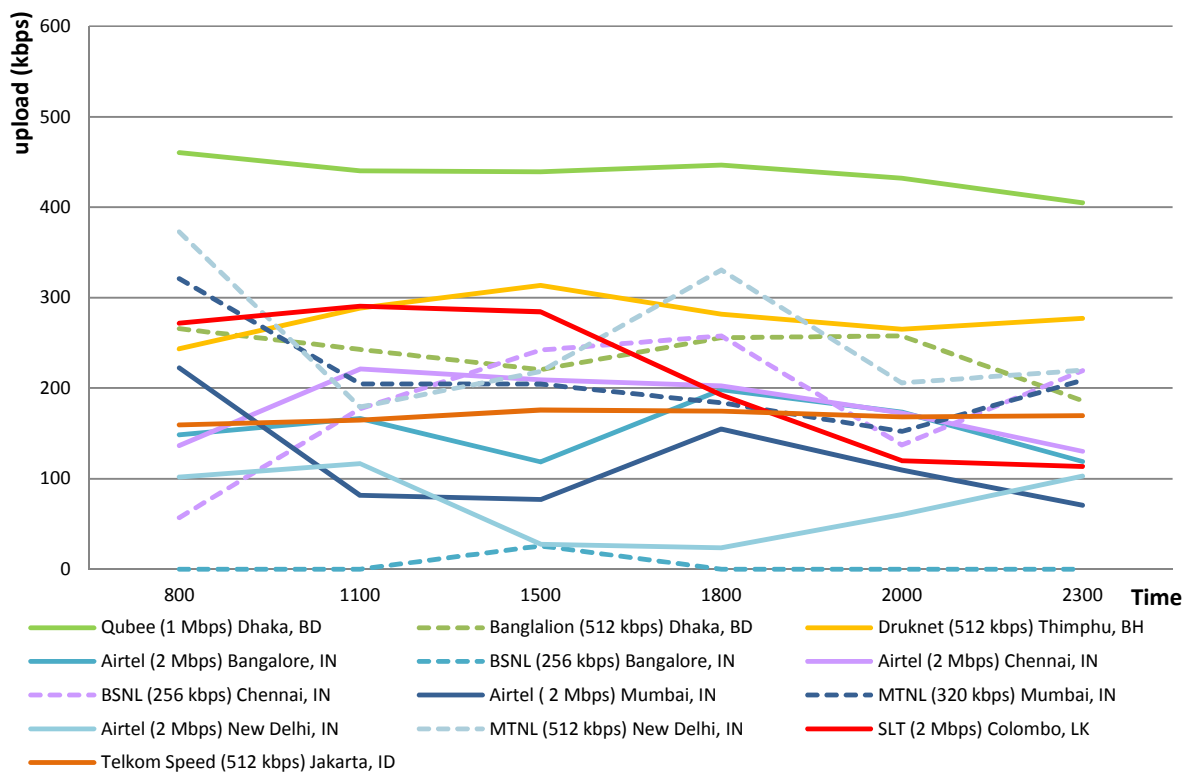


Figure 8 - Upload to a local server (ISP)



### 3.2 Fixed Broadband - Jitter<sup>ix</sup> and Packet Loss<sup>x</sup>

Figure 9 - Jitter when pinged to an International server

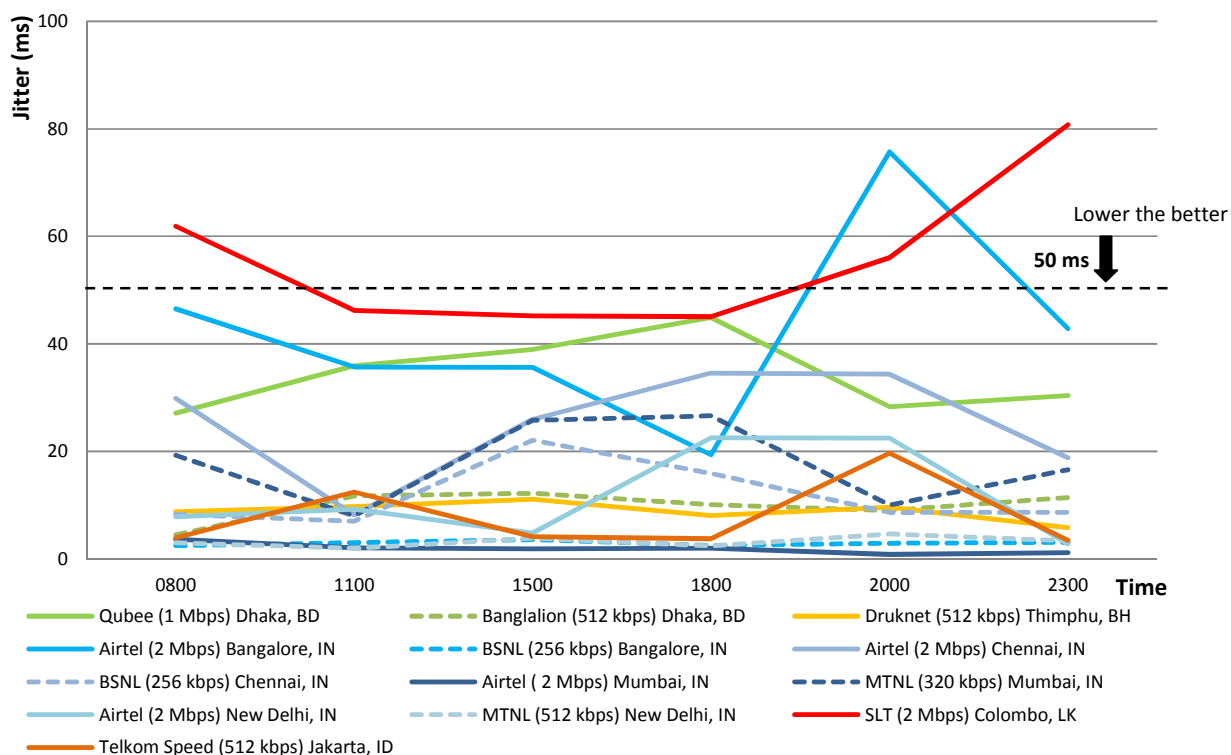
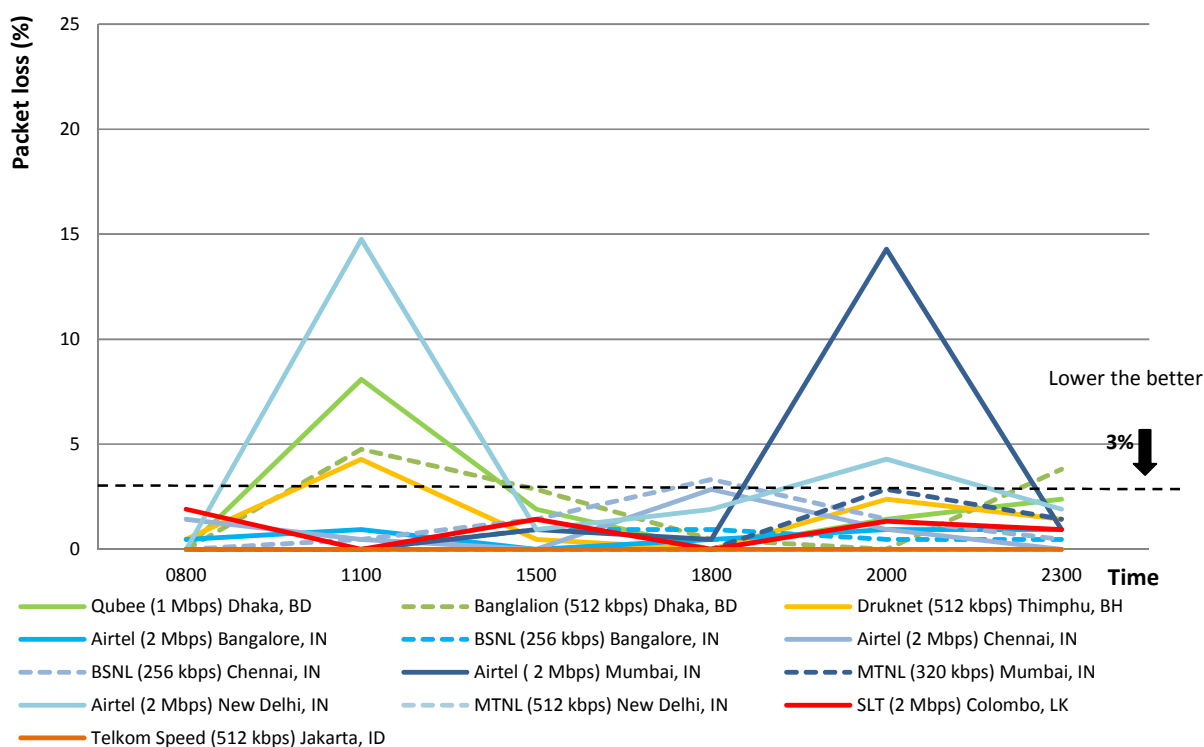
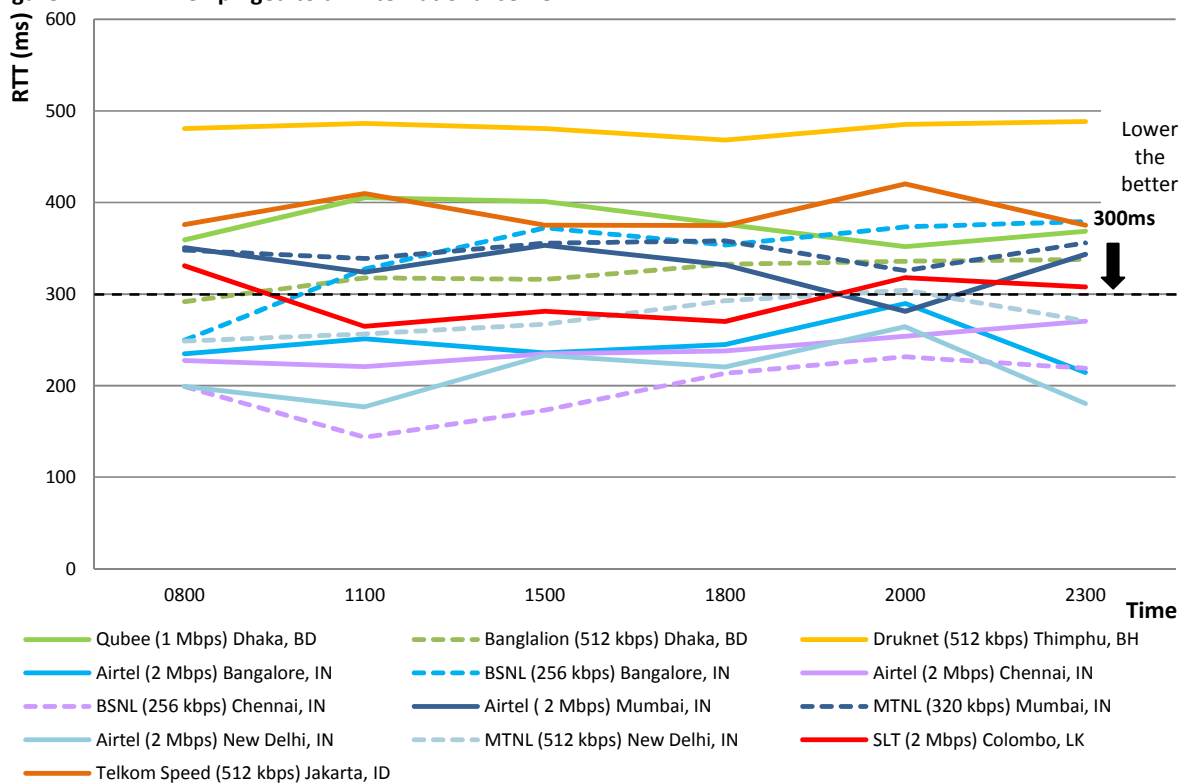


Figure 10 - Packet loss when pinged to an International server



### 3.3 Fixed Broadband - Latency<sup>xi</sup>

Figure 11 - RTT when pinged to an International server



**Broadband via USB Modem**
**Packages and color keys**

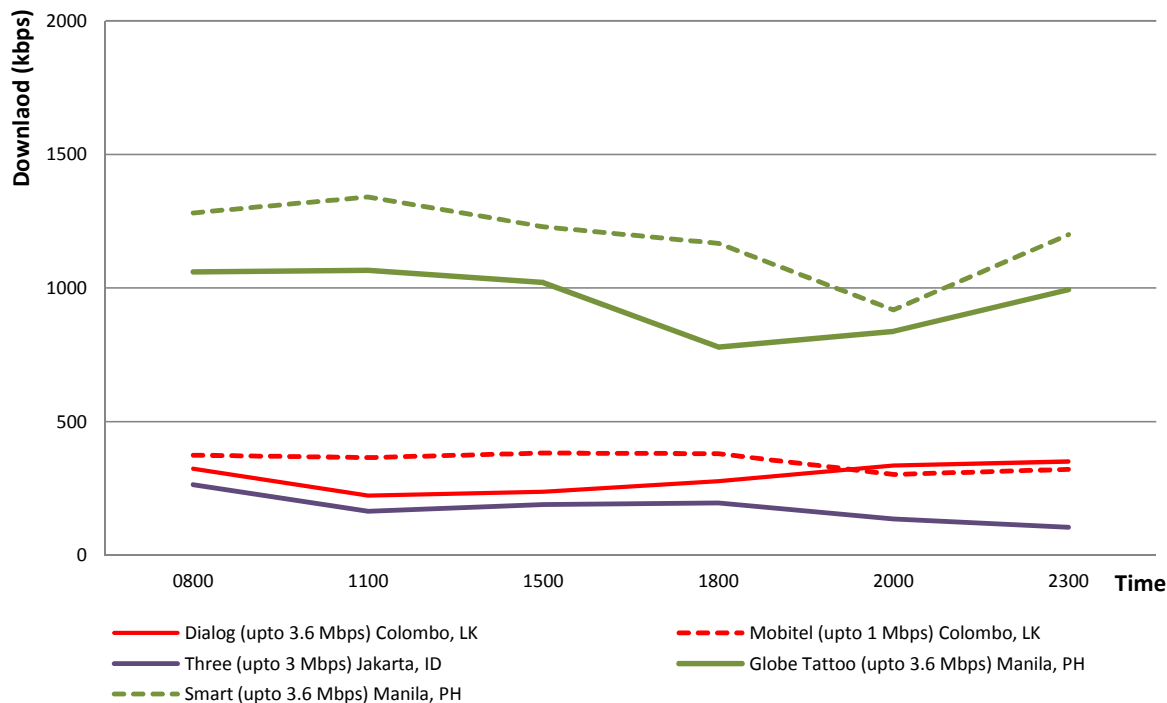
Type	Region	Country	City	Provider	Label	Advertised Speed (kbps)
Mobile Connection	South Asia	Sri Lanka	Colombo	Dialog	Dialog (upto 3.6 Mbps) Colombo, LK	3600
			Colombo	Mobitel	Mobitel (upto 1 Mbps) Colombo, LK	1000
	South East Asia	Indonesia	Jakarta	Telkomsel	Three (upto 3 Mbps) Jakarta, ID	3000
		Philippines	Manila	Globe	Globe Tattoo (upto 3.6 Mbps) Manila, PH	3600
				Smart	Smart (upto 3.6 Mbps) Manila, PH	3600

**Note:**

1. Tests were carried out using 3G/HSDPA USB modems plugged in to personal computers. No mobile handsets were used. The speeds may vary when laptops are used while in motion.
2. As these tests were carried out while stationary
3. Dialog, Mobitel and Telkomsel are post paid packages whereas Globe and Smart are prepaid packages

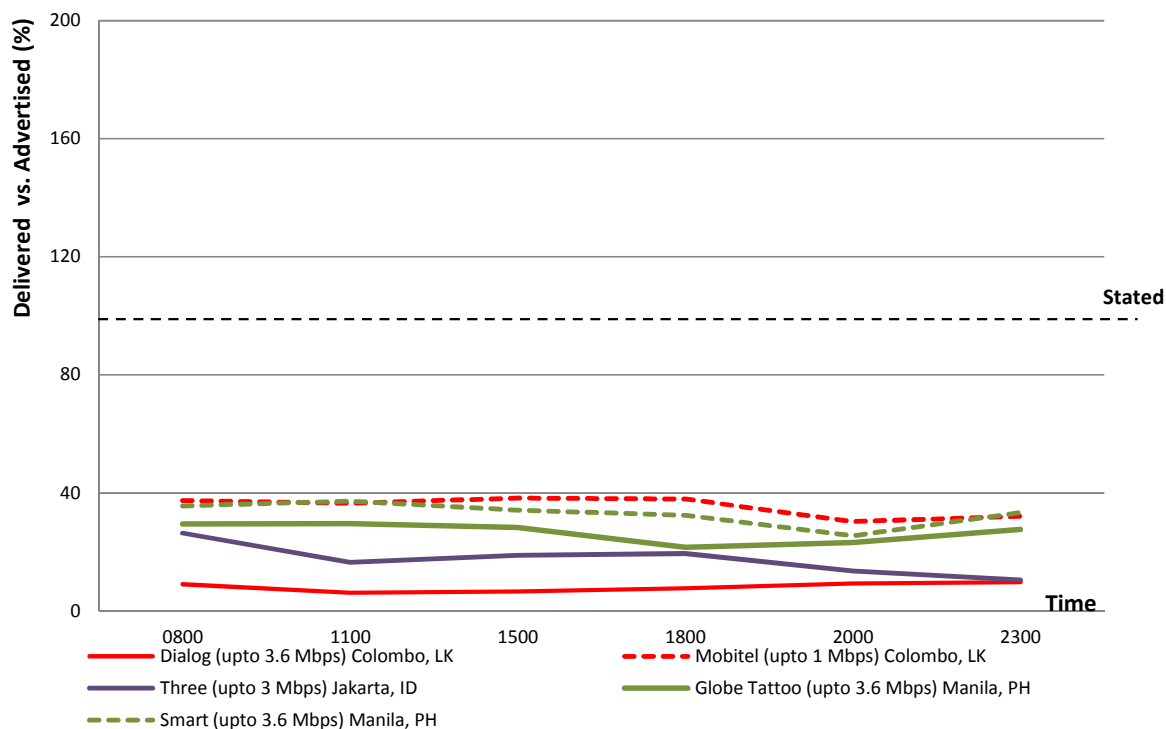
### 3.4 Broadband via USB Modem– Throughput (kbps)

Figure 12 - Download from an International server



www.lirneasia.net

Figure 13 - Download from an International server - Delivered vs. Advertised



www.broadbandasia.info

Figure 14 - Upload to an International server

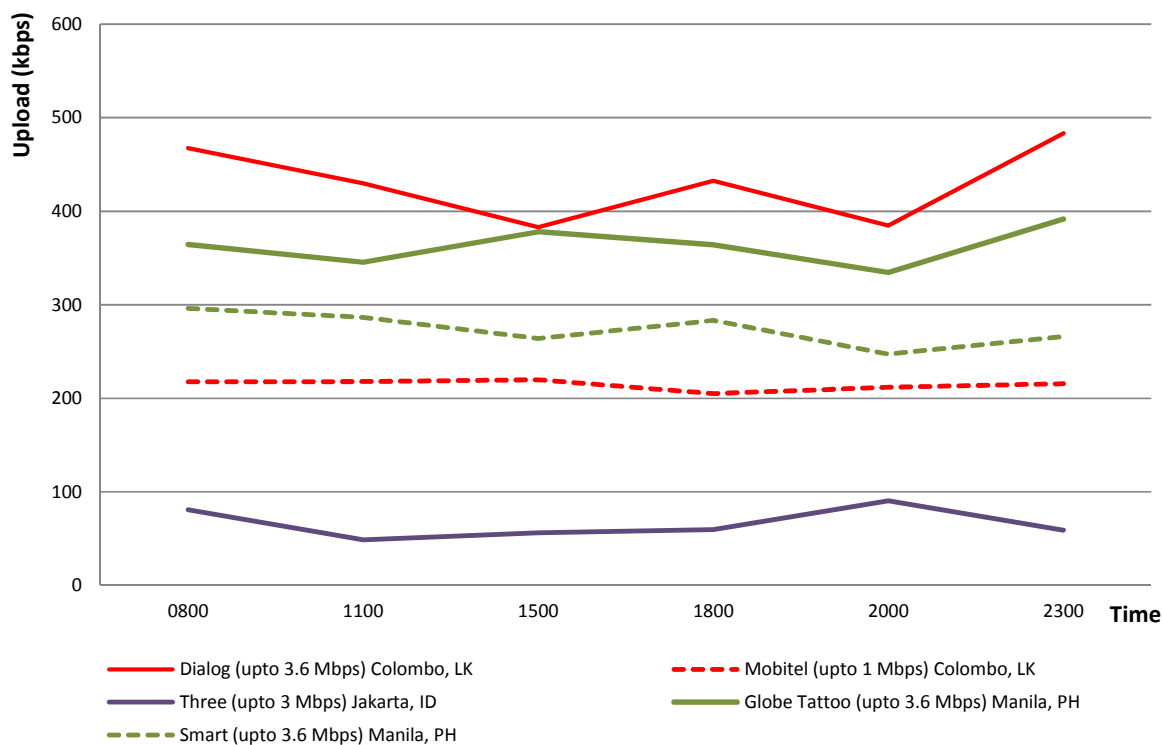


Figure 15 - Download from a local server (ISP)

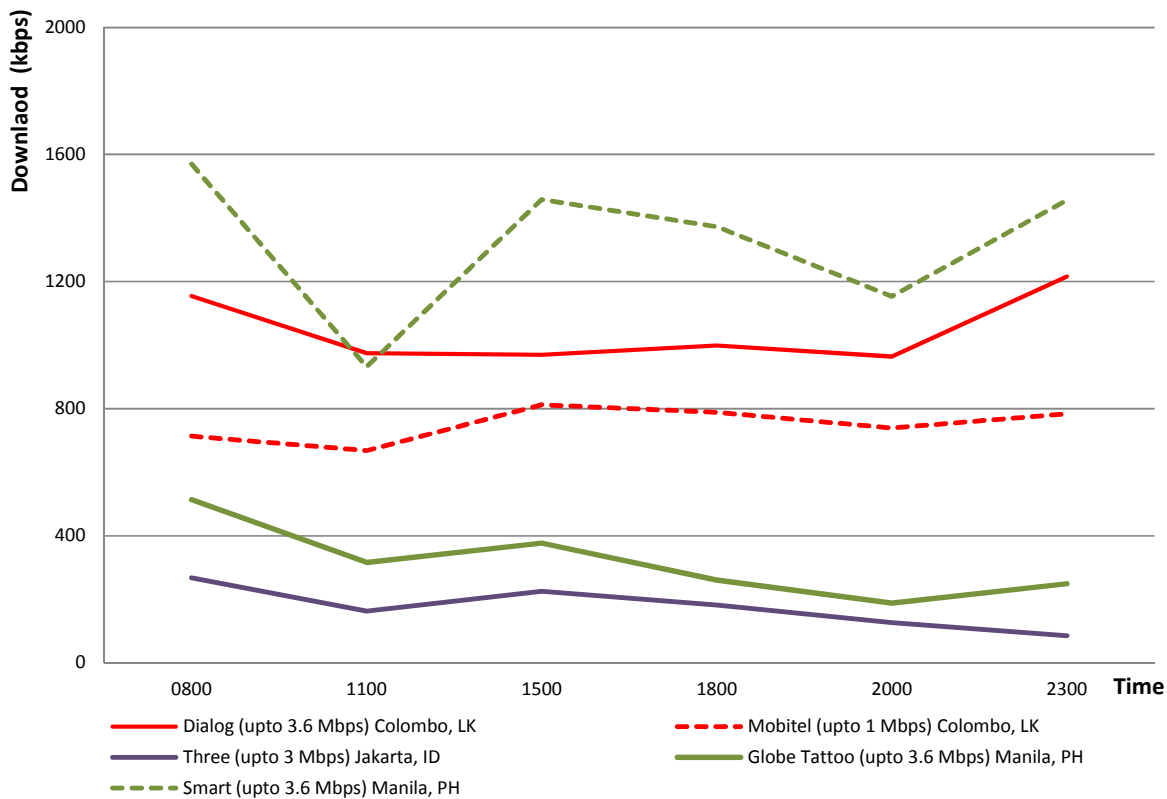


Figure 16 - Download from a local server (ISP) - Delivered vs. Advertised

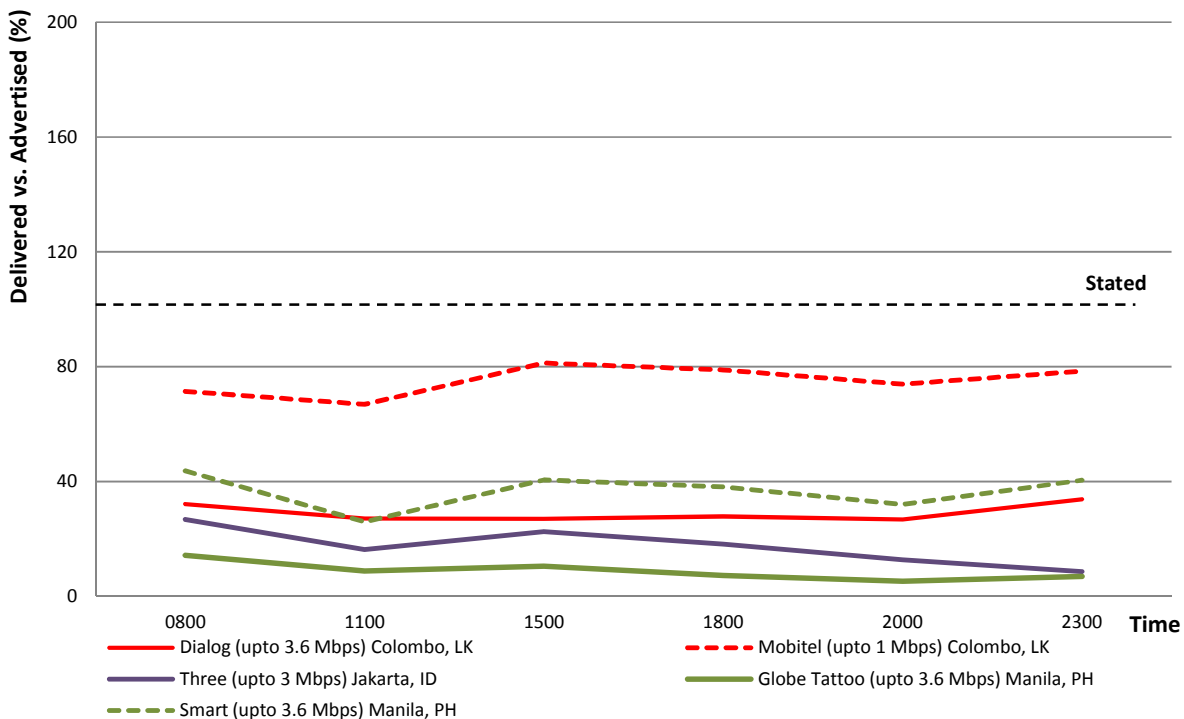
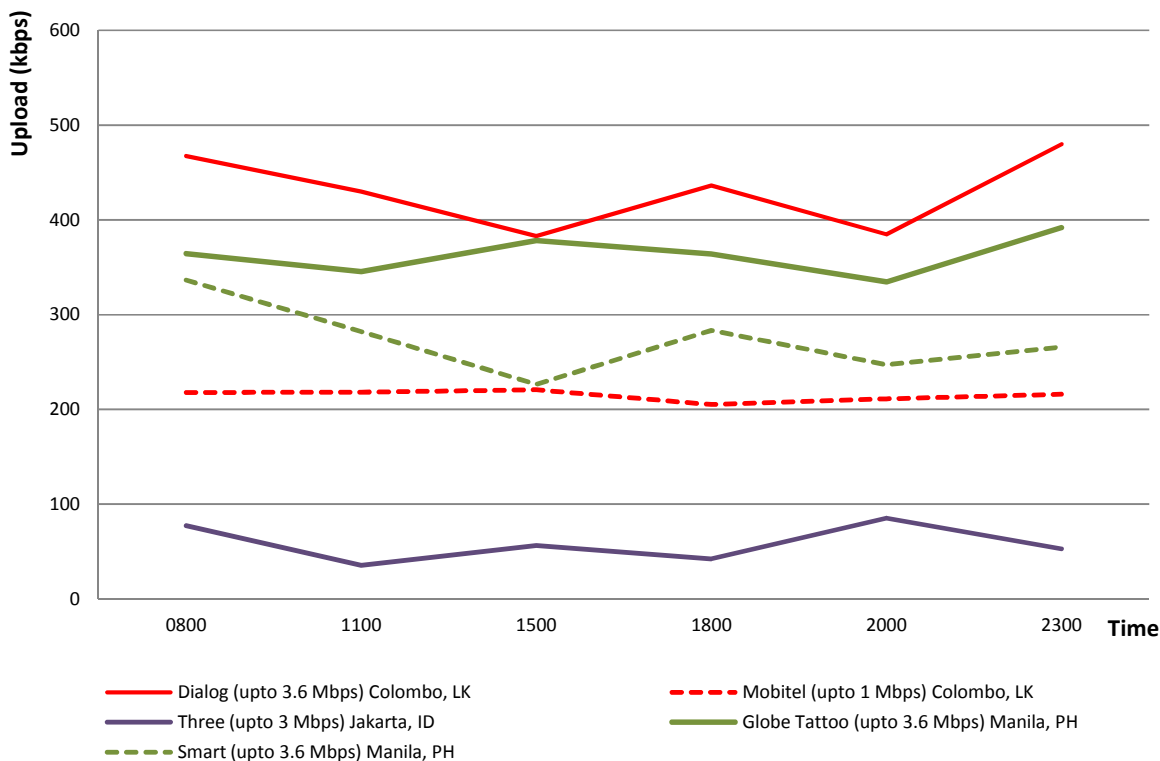


Figure 17 - Upload to a local server (ISP)



### 3.5 Broadband via USB Modem - Jitter<sup>xii</sup> and Packet Loss<sup>xiii</sup>

Figure 18 - Jitter when pinged to an International server

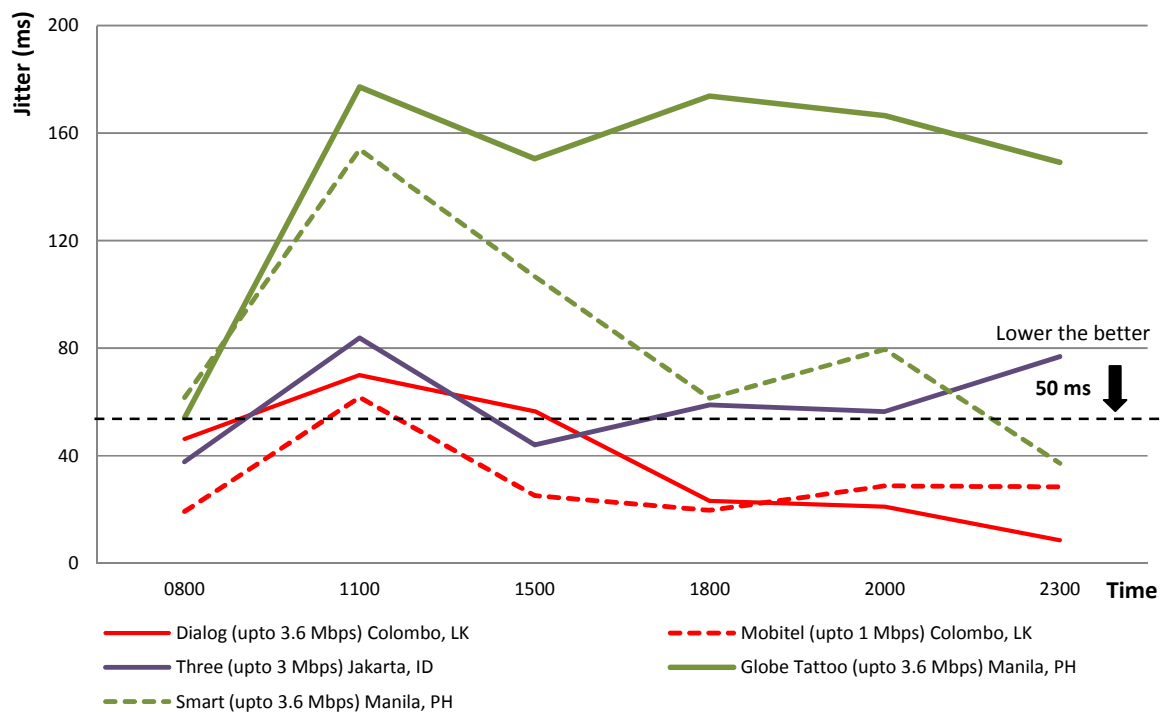
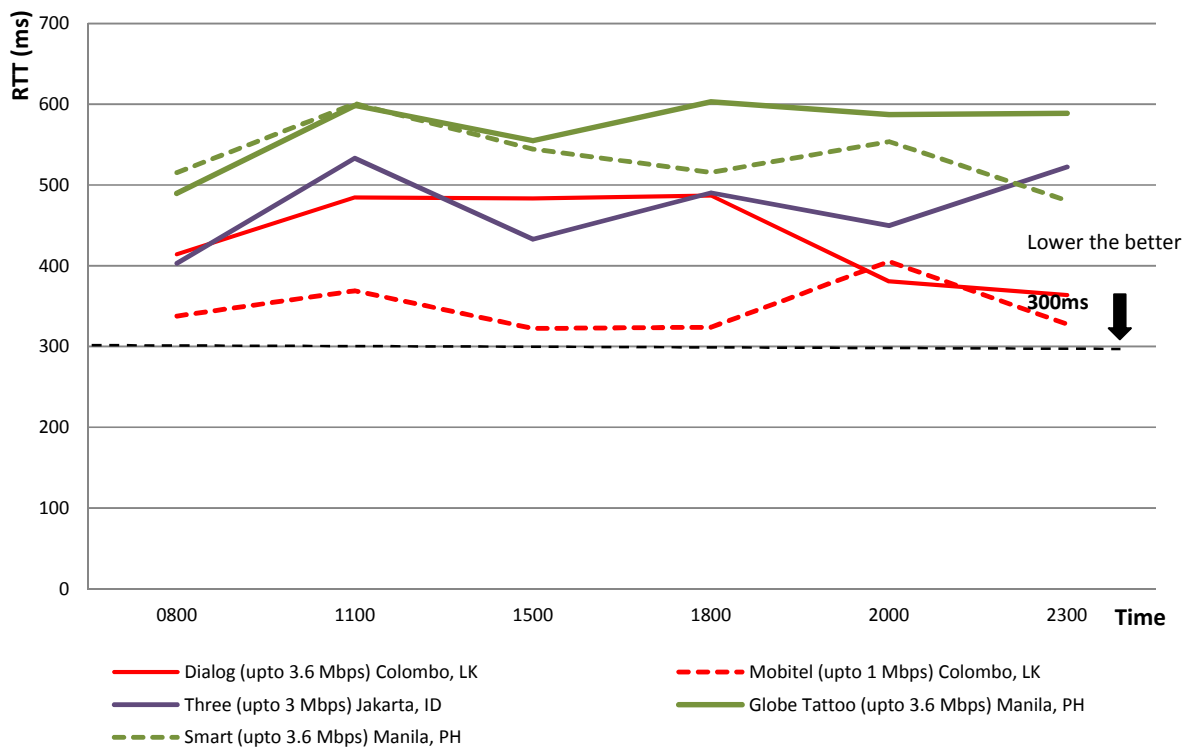


Figure 19 - Packet loss when pinged to an International server



## 3.6 Broadband via USB Modem - Latency<sup>xiv</sup>

Figure 20 - RTT when pinged to an International server



## 4 Annexes

Table 1 - kbps per dollar - International server

Time/ Package	0800	1100	1500	1800	2000	2300
Qubee (1 Mbps) Dhaka, BD	103.93	93.99	80.41	89.86	81.67	40.99
Banglalion (512 kbps) Dhaka, BD	125.87	125.22	104.55	124.36	125.25	60.26
Druknet (512 kbps) Thimphu, BH	212.80	210.24	213.30	215.06	218.95	218.79
Airtel (256 kbps) Bangalore, IN	45.39	46.35	41.45	44.62	47.44	44.73
BSNL (256 kbps) Bangalore, IN	104.93	71.07	33.42	28.71	28.25	27.49
Airtel (2 Mbps) Chennai, IN	23.34	25.19	23.39	27.84	25.92	26.03
BSNL (256 kbps) Chennai, IN	45.52	63.74	64.74	57.49	61.26	60.76
Airtel ( 2 Mbps) Mumbai, IN	25.17	26.07	26.01	27.67	20.98	27.24
MTNL (320 kbps) Mumbai, IN	57.94	52.61	44.95	53.97	43.50	50.94
Airtel (2 Mbps) New Delhi, IN	27.21	24.02	26.08	29.55	27.54	33.07
MTNL (512 kbps) New Delhi, IN	73.35	91.82	94.94	90.48	75.55	95.18
SLT (2 Mbps) Colombo, LK	9.82	10.77	9.57	10.86	8.82	8.79
Telkom Speed (512 kbps) Jakarta, ID	14.98	14.39	14.85	14.88	14.78	14.99

Table 2 - kbps per dollar –Local server (ISP)

Time/ Package	0800	1100	1500	1800	2000	2300
Qubee (1 Mbps) Dhaka, BD	107.09	105.08	97.76	102.58	99.44	75.32
Banglalion (512 kbps) Dhaka, BD	124.67	124.21	123.86	124.27	123.71	123.40
Druknet (512 kbps) Thimphu, BH	212.75	209.78	208.80	213.37	213.30	213.54
Airtel (256 kbps) Bangalore, IN	204.02	201.13	202.46	218.29	216.16	211.03
BSNL (256 kbps) Bangalore, IN	219.01	223.45	208.32	186.93	233.50	169.51
Airtel (2 Mbps) Chennai, IN	61.48	66.77	70.11	65.96	71.32	55.41
BSNL (256 kbps) Chennai, IN	57.80	61.95	93.66	119.70	62.54	65.50
Airtel ( 2 Mbps) Mumbai, IN	116.90	110.95	110.26	118.65	102.38	115.98
MTNL (320 kbps) Mumbai, IN	71.66	55.97	84.04	74.38	76.43	94.45
Airtel (2 Mbps) New Delhi, IN	47.36	44.43	43.64	46.30	60.72	43.48
MTNL (512 kbps) New Delhi, IN	102.68	75.96	90.39	114.40	103.59	128.50
SLT (2 Mbps) Colombo, LK	18.94	15.85	14.42	20.10	10.52	10.53
Telkom Speed (512 kbps) Jakarta, ID	14.97	14.75	16.04	12.91	10.39	14.73

## 5 Notes

i <http://lrneasia.net/projects/2010-12-idrc-main-project/indicators-continued/benchmarks/>

ii Dodd, A. (2005), "The Essential Guide to Telecommunication" Fourth Edition, Pearson Education, p. 14

iii Dodd, A. (2005), "The Essential Guide to Telecommunication" Fourth Edition, Pearson Education, p. 60

iv Dodd, A. (2005), "The Essential Guide to Telecommunication" Fourth Edition, Pearson Education, p. 60

v Connection Magazine, <http://www.connectionsmagazine.com/articles/5/049.html>, CISCO Press Article

vi The connections were tested on:

Qubee (1 Mbps) Dhaka, BD	September 20, 2011 - September 26, 2011
Banglalion (512 kbps) Dhaka, BD	September 20, 2011 - September 26, 2011
Druknet (512 kbps) Thimphu, BH	September 19, 2011 - September 25, 2011
Airtel (256 kbps) Bangalore, IN	September 19, 2011 - September 25, 2011
BSNL (256 kbps) Bangalore, IN	September 19, 2011 - September 25, 2011
Airtel (2 Mbps) Chennai, IN	September 19, 2011 - September 25, 2011
BSNL (256 kbps) Chennai, IN	September 19, 2011 - September 25, 2011
Airtel ( 2 Mbps) Mumbai, IN	September 19, 2011 - September 25, 2011
MTNL (320 kbps) Mumbai, IN	September 19, 2011 - September 25, 2011
Airtel (2 Mbps) New Delhi, IN	September 19, 2011 - September 25, 2011
MTNL (512 kbps) New Delhi, IN	September 19, 2011 - September 25, 2011
SLT (2 Mbps) Colombo, LK	September 20, 2011 - September 26, 2011
Telkom Speed (512 kbps) Jakarta, ID	September 20, 2011 - September 27, 2011
Dialog (upto 3.6 Mbps) Colombo, LK	September 20, 2011 - September 26, 2011
Mobitel (upto 1 Mbps) Colombo, LK	September 20, 2011 - September 26, 2011
Three (upto 3 Mbps) Jakarta, ID	September 21, 2011 - September 27, 2011
Globe Tattoo (upto 3.6 Mbps) Manila, PH	September 19, 2011 - September 26, 2011
Smart (upto 3.6 Mbps) Manila, PH	September 19, 2011 - September 26, 2011

vii The speeds at which the subscriber can receive traffic from the ISP server and a commonly used International server. (e.g. yahoo.com). It plays a significant role in responsiveness and real-time applications like VoIP.

viii Tariff of the packages are converted in to USD for comparison.

ix Jitter is the variation of end-to-end delay from one packet to the next within the same packet stream/ connection/ flow. It is increasingly relevant in real-time traffic like VoIP and should ideally be zero.

x The number of packets (in %) that does not reach the destination. This can result in highly noticeable performance issues with streaming technologies.

xi The time taken for traffic to reach a particular destination.

xii Jitter is the variation of end-to-end delay from one packet to the next within the same packet stream/ connection/ flow. It is increasingly relevant in real-time traffic like VoIP and should ideally be zero.

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