BROADBAND QUALITY OF SERVICE EXPERIENCE (QOSE) INDICATORSi

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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 of diagnostics carried out in selected South Asian and South East Asian cities.

2 Dimensions of Quality of Service (QoS) tested

Throughput (Kbps)	Referred to as the "actual amount of useful data sent on a transmission"[ii]. **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)**, more commonly referred to as download or upload speeds.
	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).
	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.
	Therefore the testing has included throughput for both local (ISP) and international (yahoo.com) servers.
Latency (ms)	Referred to as "delays when voice packets transverse the network"[iii]. 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. .
	Latency less than 300 ms is considered acceptable in this report
	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).
Jitter (ms)	Referred to as "uneven latency and packet loss"[iv]. 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.
	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.[v]
	In this report we consider jitter less than 50ms as acceptable.
	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).
Packet Loss (%)	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. Packet loss less than 3% is considered good in this report.
	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, when a late packet finally arrives, it will be considered lost" (ITU-T H.360 (04), 5.3.2.2).

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3 Results of QoSE testing

Fixed Broadband

Packages and colour keys

Type	Region	Country	City	Provider	Label	Advertised Speed (kbps)
Fixed	South Asia	Bangladesh	Dhaka	Banglalion	Banglalion (512 kbps) - Dhaka, BD	512
		Bangladesh	Dhaka	Qubee	Qubee (1 Mbps) - Dhaka, BD	1000
		India	Bangalore	BSNL	BSNL (2 Mbps) - Bangalore, IN	2000
		India	Chennai	BSNL	BSNL (2 Mbps) - Chennai, IN	2000
		India	New Delhi	Airtel	Airtel (2 Mbps) - New Delhi, IN	2000
		Maldives	Male	Dhiraagu	Dhiraagu Fixed BB (512 kbps) - Male, MV	512
		Pakistan	Karachchi	PTCL	PTCL (4 Mbps) - Karachchi, PK	4000
	South East Asia	Indonesia	Jakarta	Telkom	Telkom (512 kbps) - Jakarta, ID	512

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

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3.1 Download Speed

Figure 1 - Download from an International server

Banglalion (512 kbps) - Dhaka, BD
Qubee (1 Mbps) - Dhaka, BD
BSNL (2 Mbps) - Bangalore, IN
BSNL (2 Mbps) - Chennai, IN
Airtel (2 Mbps) - New Delhi, IN
Dhiraagu Fixed BB (512 kbps) - Male, MV
PTCL (4 Mbps) - Karachchi, PK
Telkom (512 kbps) - Jakarta, ID
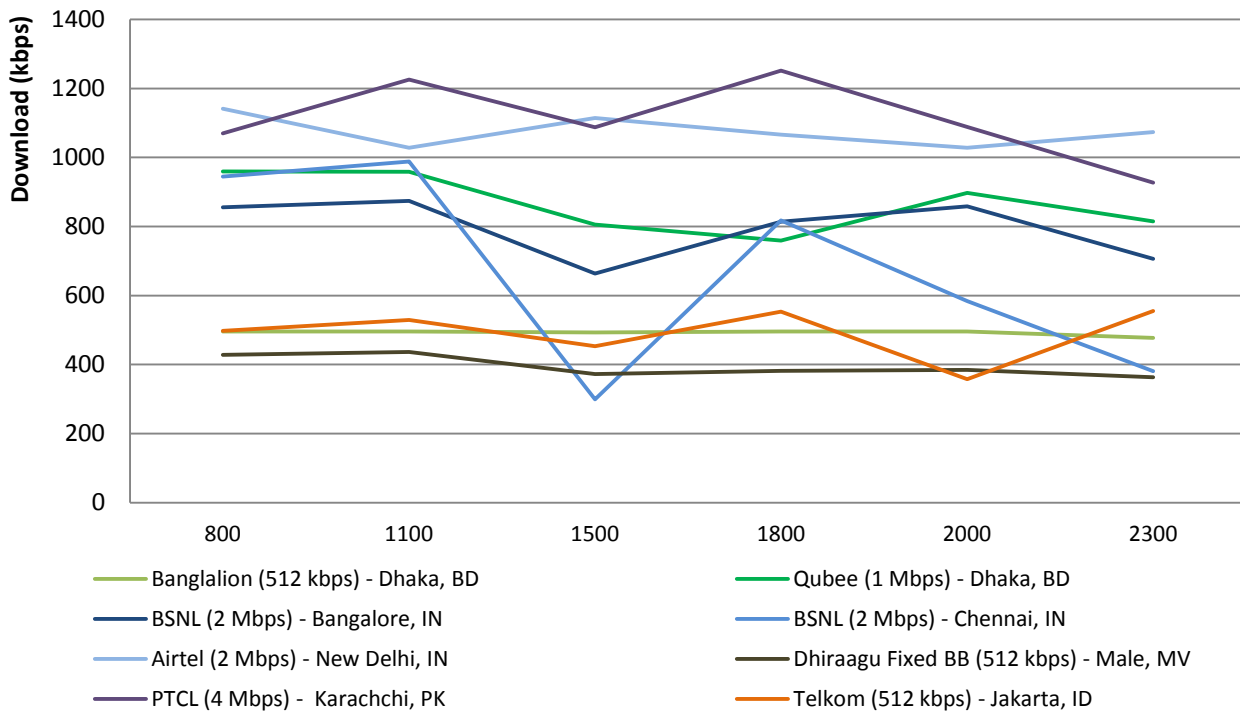
Figure 2 - Download from an International server – Actual vs. Advertised

Banglalion (512 kbps) - Dhaka, BD
Qubee (1 Mbps) - Dhaka, BD
BSNL (2 Mbps) - Bangalore, IN
BSNL (2 Mbps) - Chennai, IN
Airtel (2 Mbps) - New Delhi, IN
Dhiraagu Fixed BB (512 kbps) - Male, MV
PTCL (4 Mbps) - Karachchi, PK
Telkom (512 kbps) - Jakarta, ID

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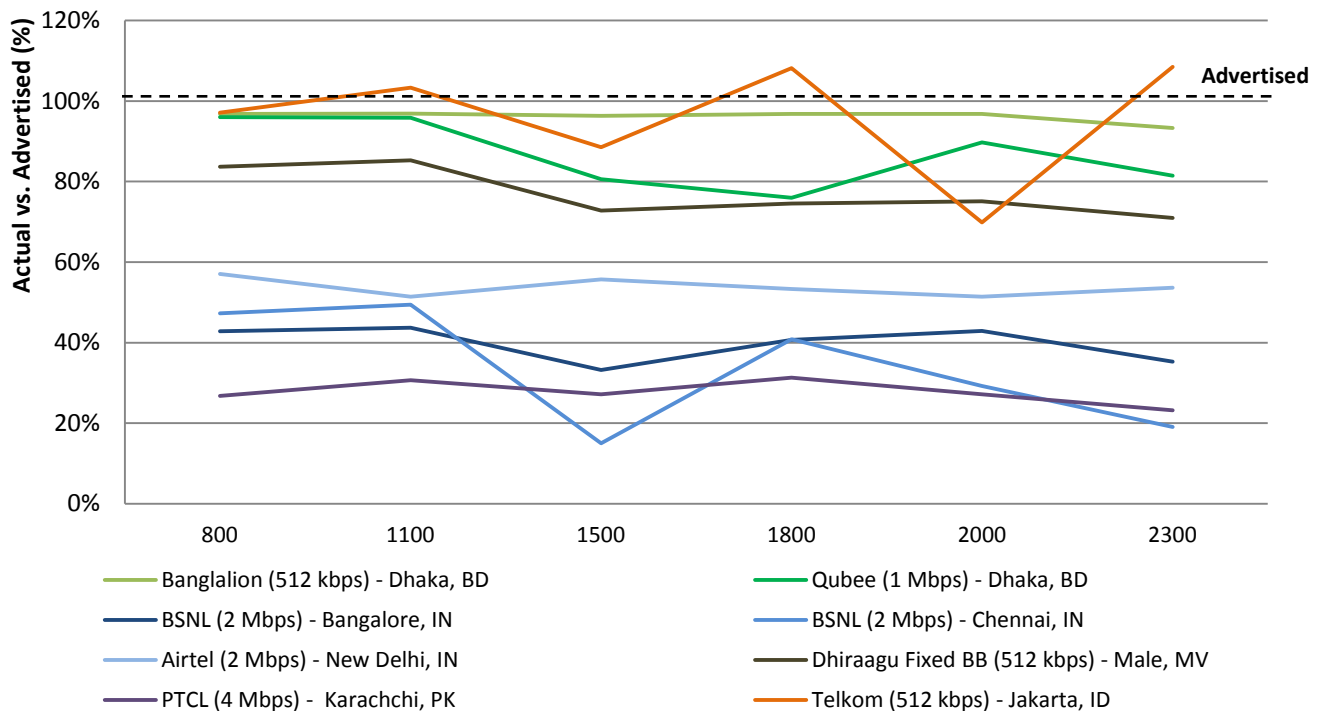
3.2   Fixed Broadband - Latency[vi] / Round Trip Time (RTT)
Figure 3 - RTT when pinged to an International server

	Banglalion (512 kbps) - Dhaka, BD		Qubee (1 Mbps) - Dhaka, BD
	BSNL (2 Mbps) - Bangalore, IN		BSNL (2 Mbps) - Chennai, IN
	Airtel (2 Mbps) - New Delhi, IN		Dhiraagu Fixed BB (512 kbps) - Male, MV
	PTCL (4 Mbps) - Karachchi, PK		Telkom (512 kbps) - Jakarta, ID

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B ROADBAND ENCHMARKS

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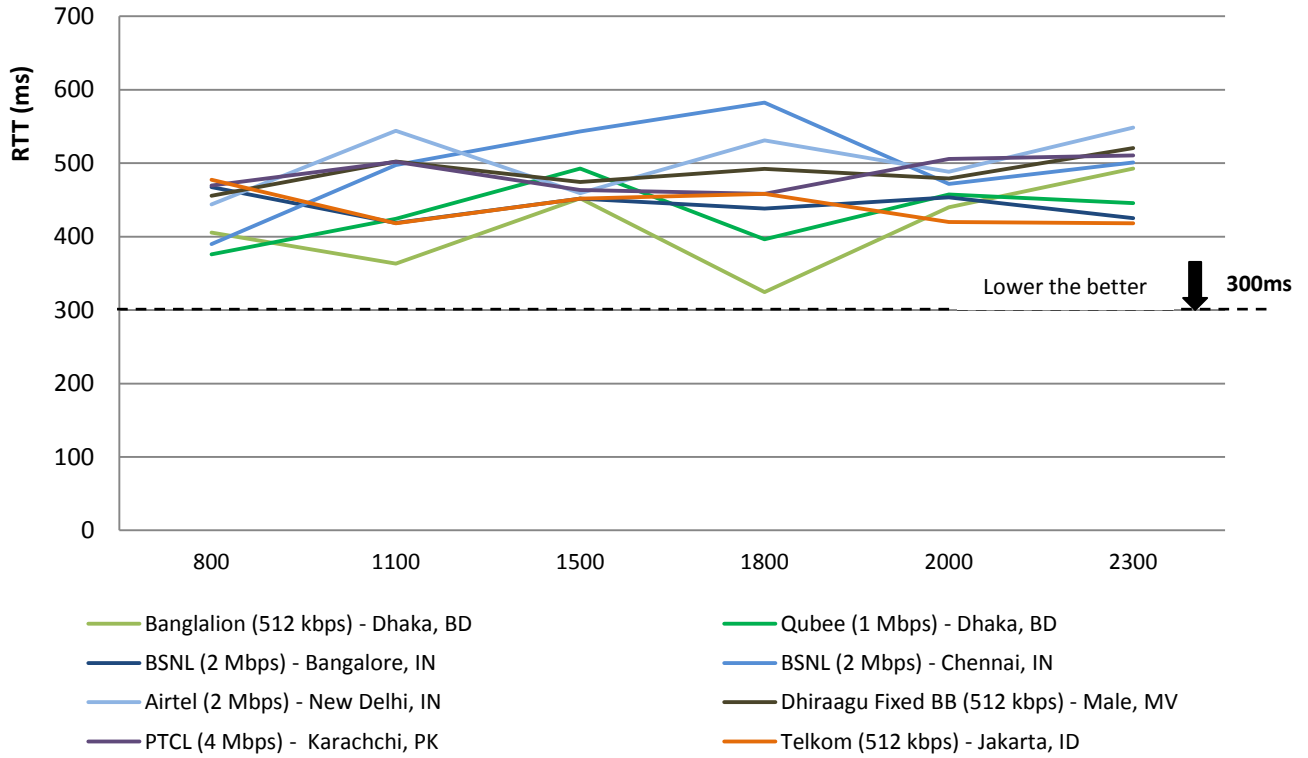
Mobile broadband (via USB Modem)

Packages and color keys

Type	Region	Country	City	Provider	Label	Advertised Speed (kbps)
Mobile	South Asia	India	Chennai	Tata	Tata (3.1 Mbps) - Chennai, IN	3100
		Maldives	Male	Dhiraagu	Dhiraagu Mobile BB (1 Mbps) - Male, MV	1000
		Sri Lanka	Colombo	Dialog	Dialog (2.1 Mbps) - Colombo, LK	3600
		Sri Lanka	Colombo	Mobitel	Mobitel (3.6 Mbps) - Colombo, LK	3600
	South East Asia	Indonesia	Jakarta	Telkomsel	Telkomsel 3G (7.2 Mbps) - Jakarta, ID	7200
		Philippines	Manila	Globe	Globe Prepaid (3.6 Mbps) - Manila, PH	3600
		Philippines	Manila	Smart	Smart (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. Tata, Dhiraagu, Dialog, Mobitel and Telkomsel are post paid packages whereas Globe and Smart are prepaid packages

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3.3   Mobile Broadband via USB Modem – Download Speeds

Figure 4 - Download from an International server
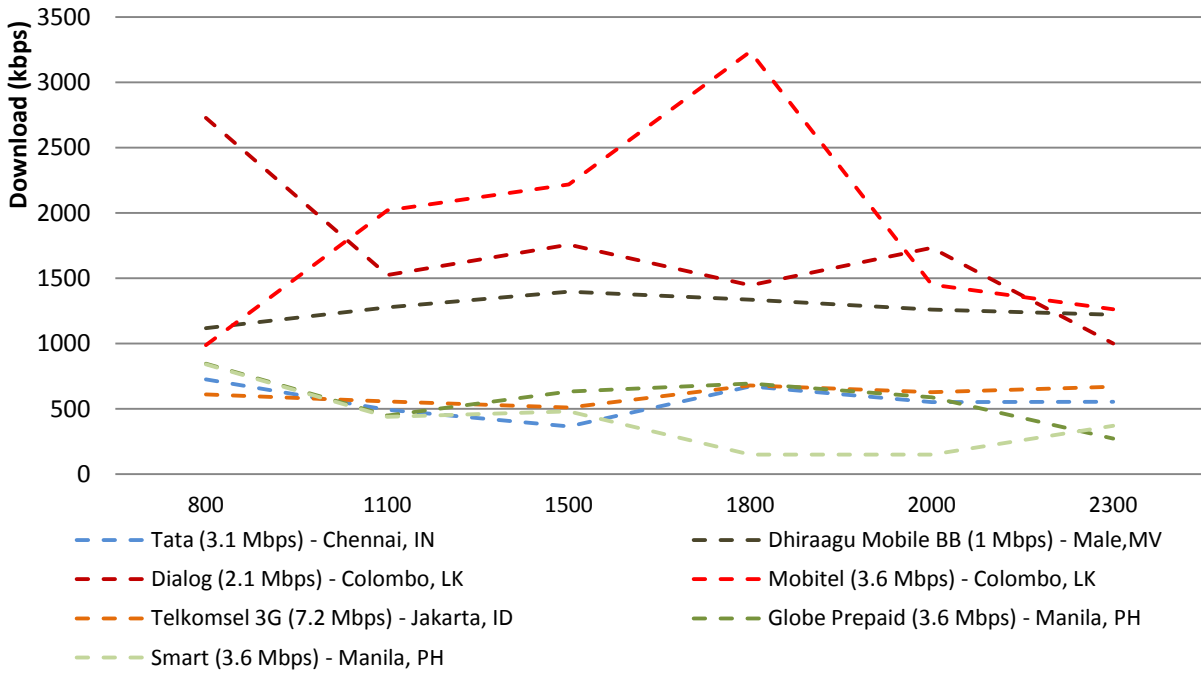
Figure 5 - Download from an International server - Actual vs. Advertised

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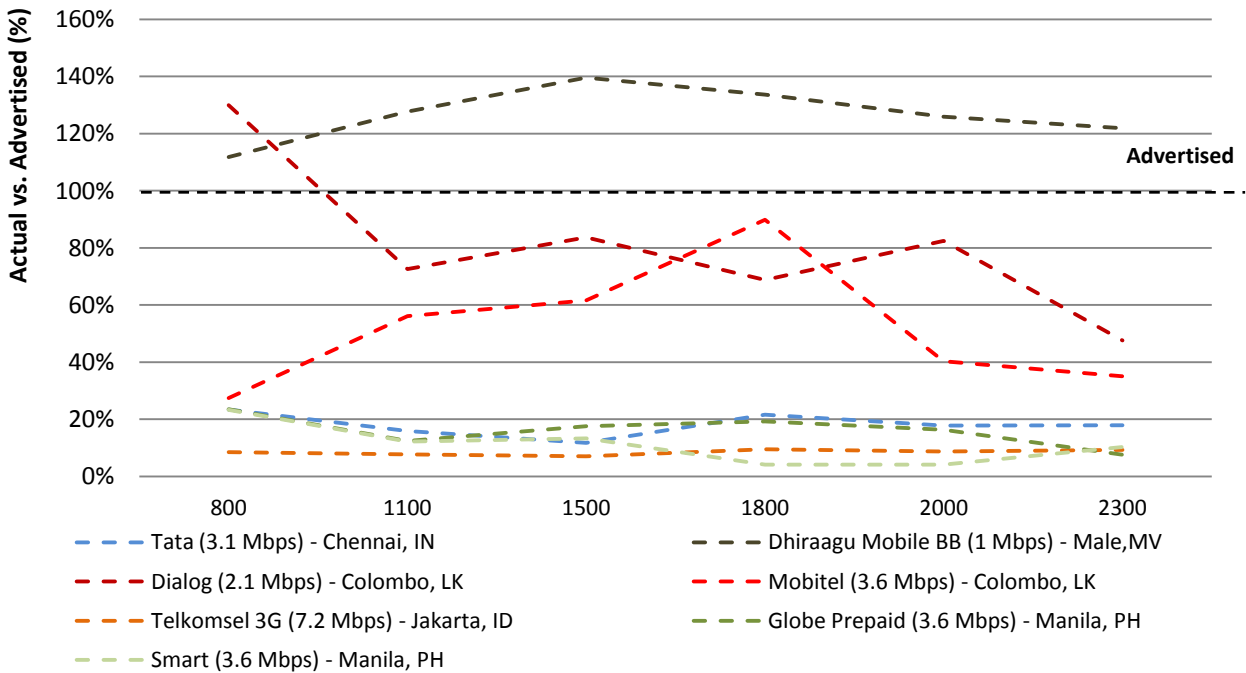
3.4 Broadband via USB Modem - Latency[vii] / Round Trip Time (RTT)
Figure 6 - RTT when pinged to an International server

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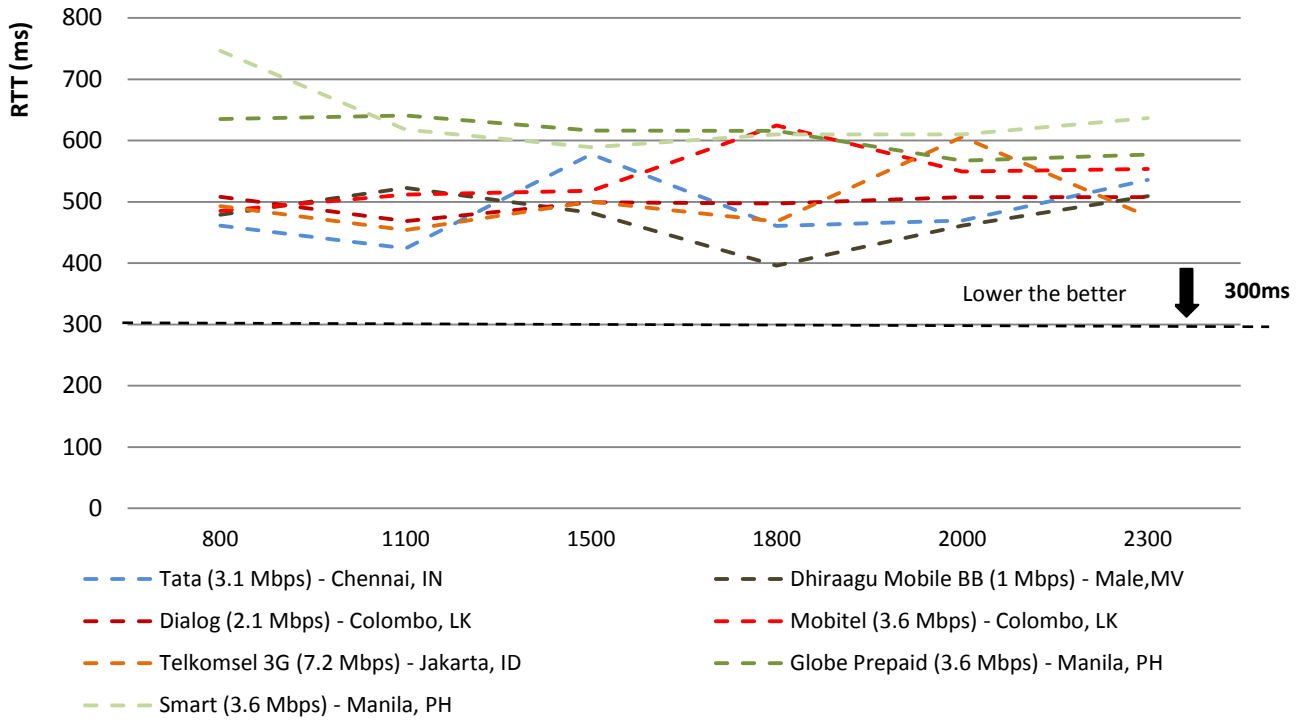
ISP vs. International Comparisons

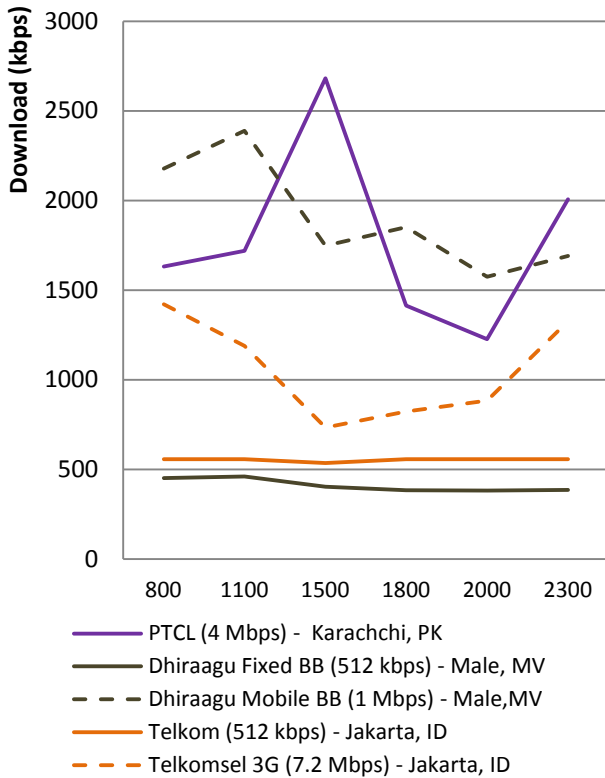**Figure 7 - Download from a local server (within ISP network)**

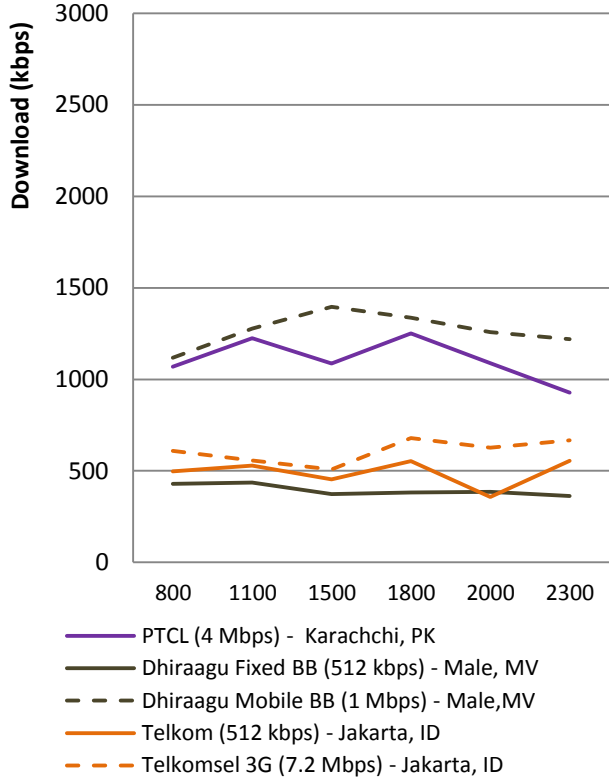**Figure 8 - Download from an International server**

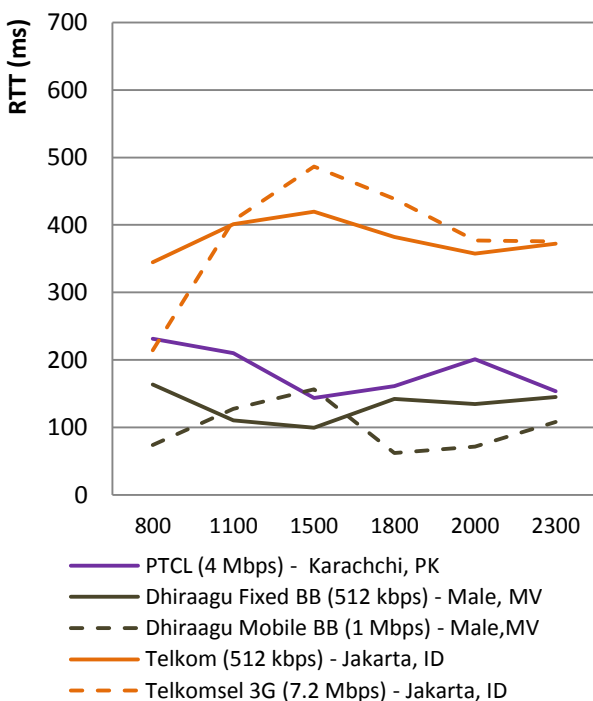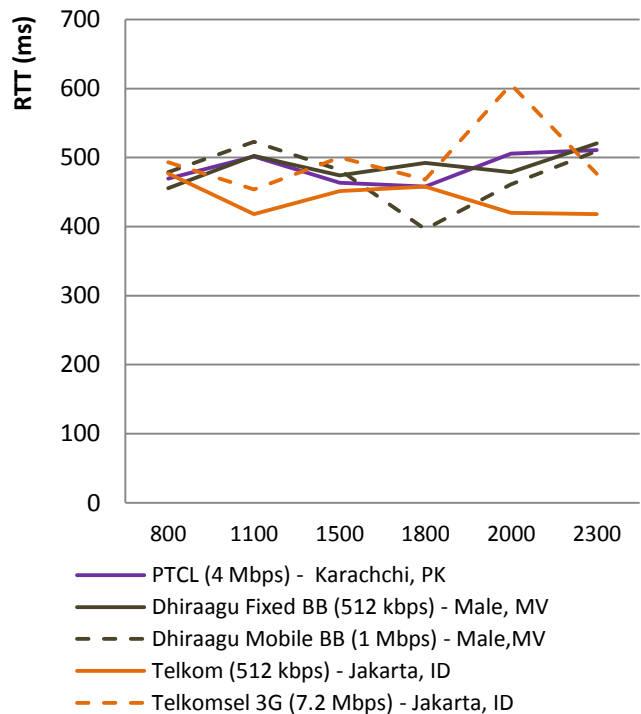**Figure 9 - RTT when pinged to a local server (within ISP network)** **Figure 10 - RTT when pinged to an International server**

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4   Notes

i http://lirneasia.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 time taken for traffic to reach a particular destination.

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