هيـئــة تـنـظيـم الاتصـالات
Telecommunications Regulatory Authority

Broadband Quality of Service Analysis Report

Reference No. TOD/0710/010
Published July 12, 2010

Public Document

Table of contents

Introduction

1. Internet access has become increasingly important to Consumer and Business users alike within the Kingdom of Bahrain. The Economic Vision 2030 and supporting National Economic Strategy 2009 - 2014 both identify explicitly the need for more readily available affordable broadband services and indentify specific actions that should be undertaken to ensure that the appropriate infrastructure is made available with the Kingdom of Bahrain over the coming few years.

2. At present consumers do not have readily available to them data relating to the actual achieved quality of service achieved by each of the Kingdom's Internet Service Providers (ISPs). Whilst ISP do provide the basic level of information required to allow customers to make decisions relating to price, download speed and download threshold, they do not make available information relating to the actual download and upload speeds achieved on average for each ISP. TRA considers that at a minimum consumers should be able to make informed decisions with respect to understanding what is likely to be provided by each ISP.

3. On April 30, 2009 the Telecommunications Regulatory Authority (TRA) launched a Request for Proposal (RFP) soliciting proposals from experienced companies to design and implement a test platform to monitor and measure the performance of the Kingdom's ISPs. The contract was awarded to Epitiro Ltd in July 2009.

4. Epitiro implemented and tuned its monitoring platform in the Kingdom of Bahrain during quarter 4, 2009 and quarter 1, 2010. Epitiro started monitoring and measuring live broadband connection on April 1, 2010. In total nine (9) ISPs have been connected to the Epitiro system.

5. This report represents the first report based on the data gathered from the Broadband Quality of Service monitoring platform. It is the intention of TRA to publish periodic reports based on this and subsequent data gathered from the Broadband Quality of Service monitoring platform. These reports will provide consumers with accurate independently gathered and verified data concerning the actual quality of service that each of the ISPs offer thereby ensuring that appropriate information is provided to consumers and that consumers decisions are informed by such independently verified facts.

Measurements Methods Overview

6. The primary objective of the Broadband Quality of Service monitoring platform is to conduct a pre-defined set of tests each hour of the day, 7 days a week, 52 weeks of the year using standard fixed network broadband connections supplied by each of the Kingdom's ISPs. The results of these tests are transmitted in near real time to, and stored in, a centralised database server.

7. From each ISP two internet connections have been purchased and are monitored using the Epitiro Broadband Quality of Service monitoring platform. Standardised tests are conducted between the probes that have been deployed on each of the broadband connections under this test programme. The tests involve requests being sent towards a standard specified list of of public websites as well as dedicated servers located in the Kingdom of Bahrain, USA and Europe.

8. To ensure the accuracy of the information gathered each probe is constantly monitored and any issues identified are recorded and resolved remotely by Epitiro.

9.   Diagram 1 below provides a overview of the system that has been implemented. For the sake of simplicity only three of the nine ISPs connected to the platform and only one of the Epitiro Ltd endpoints have been illustrated.
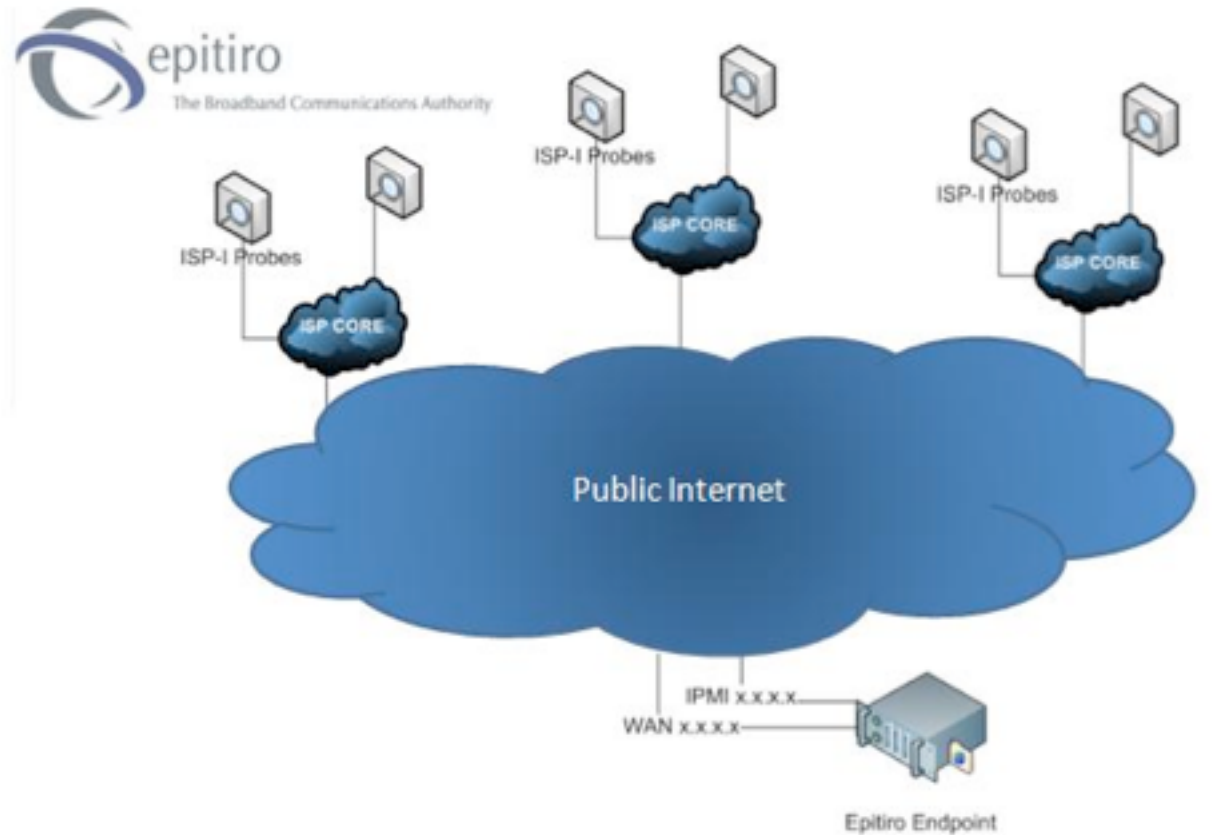
Diagram 1 - Broadband Quality of Service test platform overview

Chart 1 - TCP Download Speed (average) (1 Mbps services)

Mbps

0.90

0.68

0.45

0.23

0

Time

00:00 02:00 04:00 06:00 08:00 10:00 12:00 14:00 16:00 18:00 20:00 22:00

— 2 Connect ADSL (1 Mb unlimited)
— Batelco ADSL (1 Mbps medium user)
— Etisalcom ADSL (1 Mbps eDSL)
— Kalaam (1 Mbps KlikADSL)
— Lightspeed ADSL (1 Mbps Home 1000)
— Neutel cable (1 Mbps Nue Net)
— Orbit Satellite (1 Mbps Satnet 3)
— 1 Mbps ADSL Industry Average
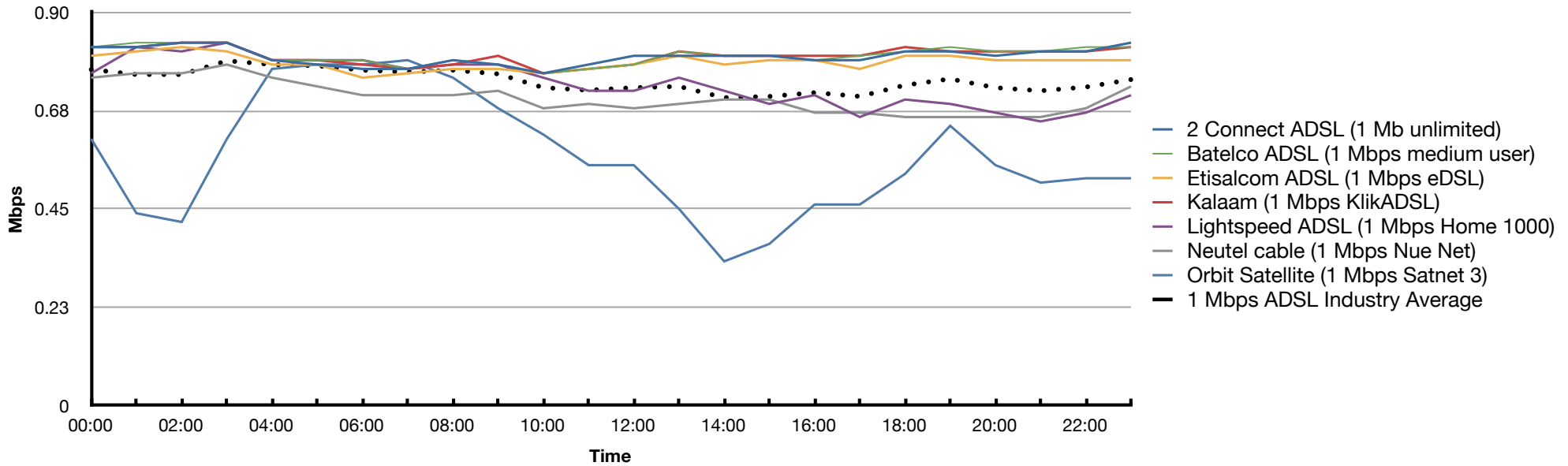
Chart 2 - TCP Download Speed (Average) (2 Mbps WiMax services)

Mbps

1.40

1.05

0.70

0.35

0

Time

00:00 02:00 04:00 06:00 08:00 10:00 12:00 14:00 16:00 18:00 20:00 22:00

— Mena WiMax (2 Mbps Boost Mena Home)
— Zain WiMax (2 Mbps Zain@Home)
— 2 Mbps WiMax Industry Average
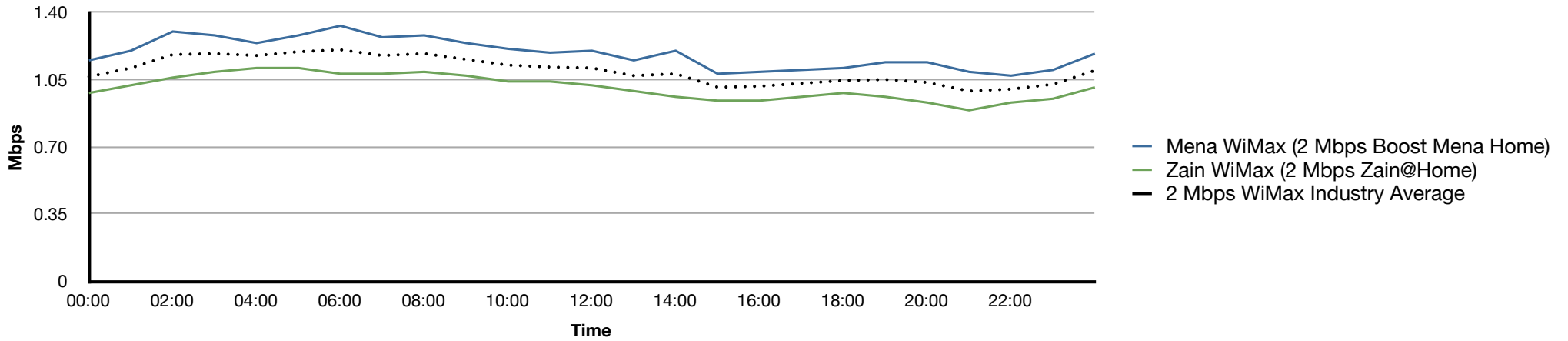
Table 1 - TCP Download Speed (average)
01 April 2010 - 30 june 2010 between 00:00:00 and 24:00:00

	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24 Hour average
2 Connect ADSL (1 Mb unlimited)	0.82	0.82	0.83	0.83	0.79	0.78	0.77	0.77	0.79	0.78	0.76	0.78	0.80	0.80	0.80	0.80	0.79	0.79	0.81	0.81	0.80	0.81	0.81	0.83	0.80
Batelco ADSL (1 Mbps medium user)	0.82	0.83	0.83	0.83	0.79	0.79	0.79	0.77	0.79	0.78	0.76	0.77	0.78	0.81	0.80	0.80	0.79	0.80	0.81	0.82	0.81	0.81	0.82	0.82	0.80
Etisalcom ADSL (1 Mbps eDSL)	0.80	0.81	0.82	0.81	0.78	0.78	0.75	0.76	0.77	0.77	0.76	0.77	0.78	0.80	0.78	0.79	0.79	0.77	0.80	0.80	0.79	0.79	0.79	0.79	0.79
Kalaam (1 Mbps KlikADSL)	0.82	0.82	0.83	0.83	0.79	0.79	0.78	0.77	0.78	0.80	0.76	0.77	0.78	0.81	0.80	0.80	0.80	0.80	0.82	0.81	0.81	0.81	0.81	0.82	0.80
Lightspeed ADSL (1 Mbps Home 1000)	0.76	0.82	0.81	0.83	0.79	0.79	0.79	0.77	0.78	0.78	0.75	0.72	0.72	0.75	0.72	0.69	0.71	0.66	0.70	0.69	0.67	0.65	0.67	0.71	0.74
Neutel cable (1 Mbps Nue Net)	0.75	0.76	0.76	0.78	0.75	0.73	0.71	0.71	0.71	0.72	0.68	0.69	0.68	0.69	0.70	0.70	0.67	0.67	0.66	0.66	0.66	0.66	0.68	0.73	0.70
Orbit Satellite (1 Mbps Satnet 3)	0.61	0.44	0.42	0.61	0.77	0.78	0.78	0.79	0.75	0.68	0.62	0.55	0.55	0.45	0.33	0.37	0.46	0.46	0.53	0.64	0.55	0.51	0.52	0.52	0.57
Mena WiMax (2 Mbps Boost Mena Home)	1.15	1.20	1.30	1.28	1.24	1.28	1.33	1.27	1.28	1.24	1.21	1.19	1.20	1.15	1.20	1.08	1.09	1.10	1.11	1.14	1.14	1.09	1.07	1.10	1.19
Zain WiMax (2 Mbps Zain@Home)	0.98	1.02	1.06	1.09	1.11	1.11	1.08	1.08	1.09	1.07	1.04	1.04	1.02	0.99	0.96	0.94	0.94	0.96	0.98	0.96	0.93	0.89	0.93	0.95	1.01
1 Mbps ADSL Industry Average	0.77	0.76	0.76	0.79	0.78	0.78	0.77	0.76	0.77	0.76	0.73	0.72	0.73	0.73	0.70	0.71	0.72	0.71	0.73	0.75	0.73	0.72	0.73	0.75	0.74
2 Mbps WiMax Industry Average	1.07	1.11	1.18	1.19	1.18	1.20	1.21	1.18	1.19	1.16	1.13	1.12	1.11	1.07	1.08	1.01	1.02	1.03	1.05	1.05	1.04	0.99	1.00	1.03	1.10

TCP download measurements

TCP (Transfer Control Protocol) throughput tests measuring download speeds are conducted at a raw socket level (a socket that allows access to the underlying transport provider (ISP) that is supported by protocols such as IPv4 and IPv6) in order to test the full capacity of the connection. The probe is configured to initiate multiple TCP sessions and simultaneously use all of the open sessions for the transmission of data. This effectively "floods" the connection and reports the throughput capacity of the line.

The test is conducted using a server endpoint running proprietary software that is hosted in a well peered data centre. Whilst the port through which the test is typically conducted is configurable, it is normal for port 80 to be used since this minimises the possibility of the traffic being managed or throttled during the test by an ISP. Once the session has been initiated standard data files are transmitted from the endpoint server to the probe and measurements taken of the download throughput of the connection. The test probe measures the time taken to transfer data and the volume of data transferred in a specific time. From these measurements the TCP download speeds can be derived.

For the sake of comparison the graphs showing TCP Download speeds have been separated out the 1 Mbps (Chart 1) and 2 Mbps (Chart 2) connections. Also for ease of comprehension graphs depicted the average time it would take to download typical data file types have been created (Charts 3 and 4).

Table 2 - Average Download times for typical data types

		File Type and size in Mbytes			Download time in Minutes		
	24 Hour download speed	Mp3	Video clip	Movie	MP3 (5 MBytes)	Video clip (35 MBytes)	Movie (800 MBytes)
2 Connect ADSL (1 Mb unlimited)	0.80	5	35	800	0.83	5.84	133.5
Batelco ADSL (1 Mbps medium user)	0.80	5	35	800	0.83	5.83	133.2
Etisalcom ADSL (1 Mbps eDSL)	0.79	5	35	800	0.85	5.94	135.8
Kalaam (1 Mbps KlikADSL)	0.80	5	35	800	0.83	5.83	133.3
Lightspeed ADSL (1 Mbps Home 1000)	0.74	5	35	800	0.90	6.32	144.4
Neutel cable (1 Mbps Nue Net)	0.70	5	35	800	0.95	6.62	151.4
Orbit Satellite (1 Mbps Satnet 3)	0.57	5	35	800	1.17	8.18	187.0
Mena WiMax (2 Mbps Boost Mena Home)	1.19	5	35	800	0.56	3.94	90.0
Zain WiMax (2 Mbps Zain@Home)	1.01	5	35	800	0.66	4.62	105.7
1 Mbps ADSL Industry Average	0.74	5	35	800	0.90	6.28	143.6
2 Mbps WiMax Industry Average	1.10	5	35	800	0.61	4.25	97.2

Chart 4 - Average download time for different data file types
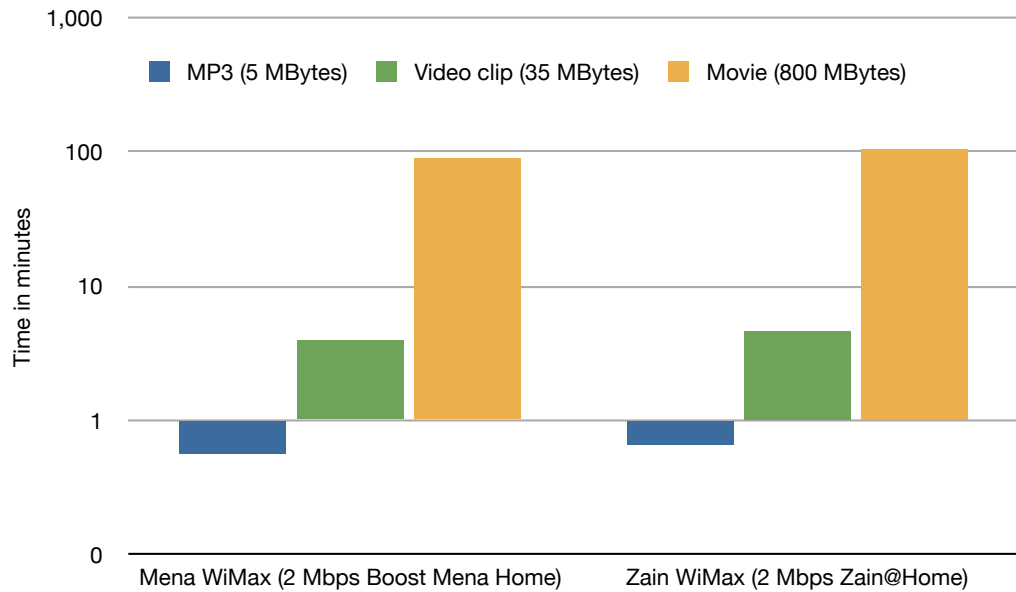
Chart 3 - Average download time for different data file types
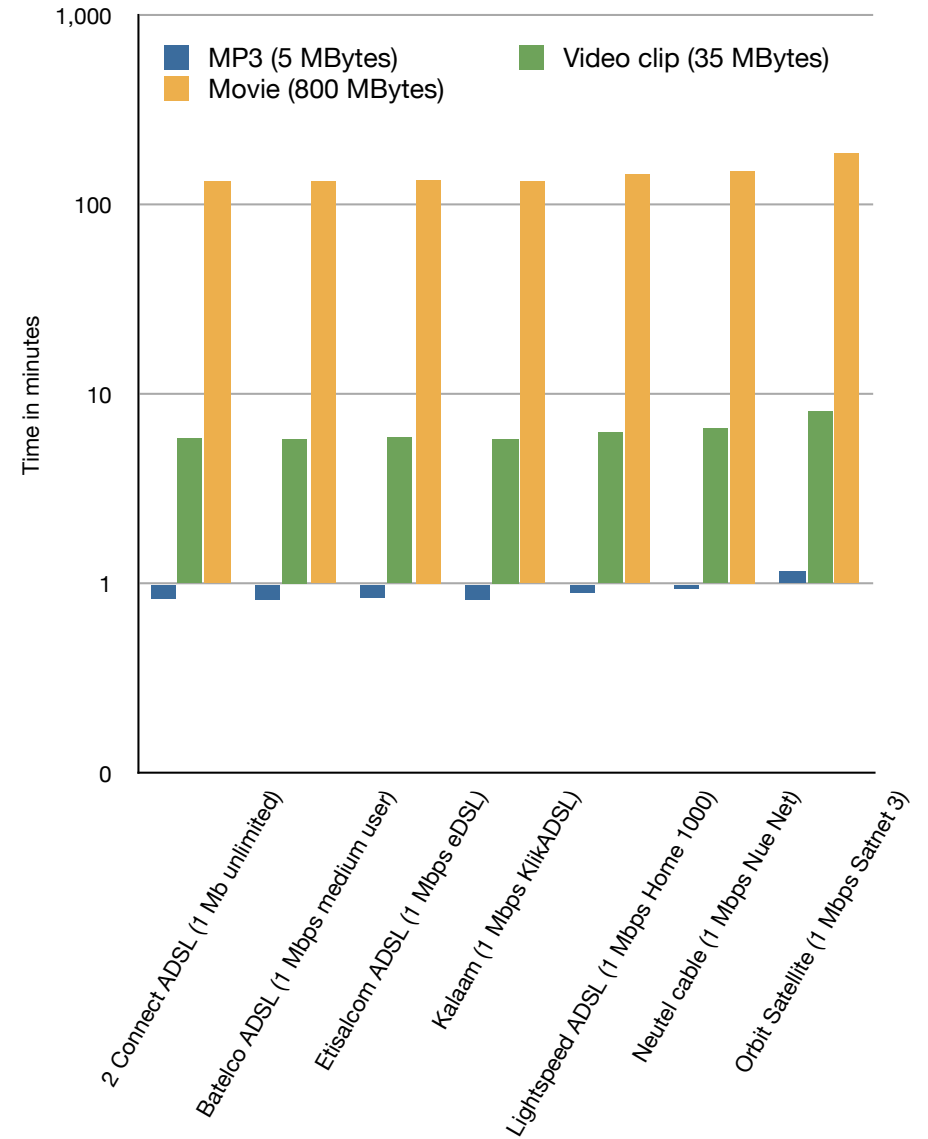
Chart 5 - TCP Upload Speed (average) (1 Mbps services)

Legend:
- 2 Connect ADSL (1 Mb unlimited)
- Batelco ADSL (1 Mbps medium user)
- Etisalcom ADSL (1 Mbps eDSL)
- Kalaam (1 Mbps KlikADSL)
- Lightspeed ADSL (1 Mbps Home 1000)
- Neutel cable (1 Mbps Nue Net)
- Orbit Satellite (1 Mbps Satnet 3)
- 1 Mbps ADSL Industry Average
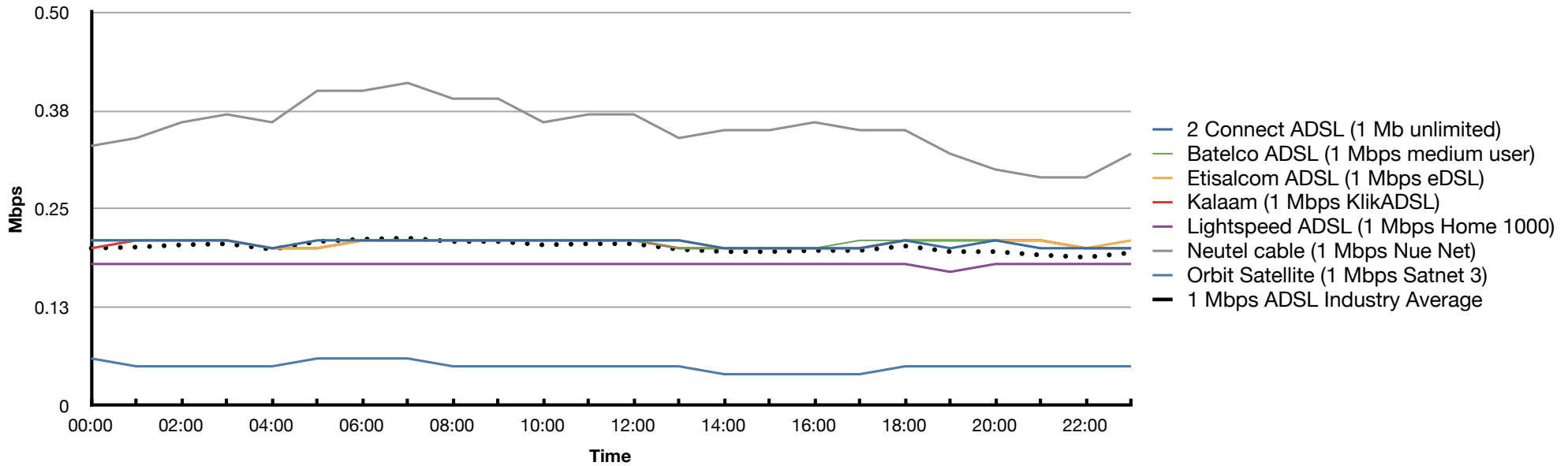
Chart 6 - TCP Upload Speed (Average) (2 Mbps WiMax services)

Legend:
- Mena WiMax (2 Mbps Boost Mena Home)
- Zain WiMax (2 Mbps Zain@Home)
- 2 Mbps WiMax Industry Average
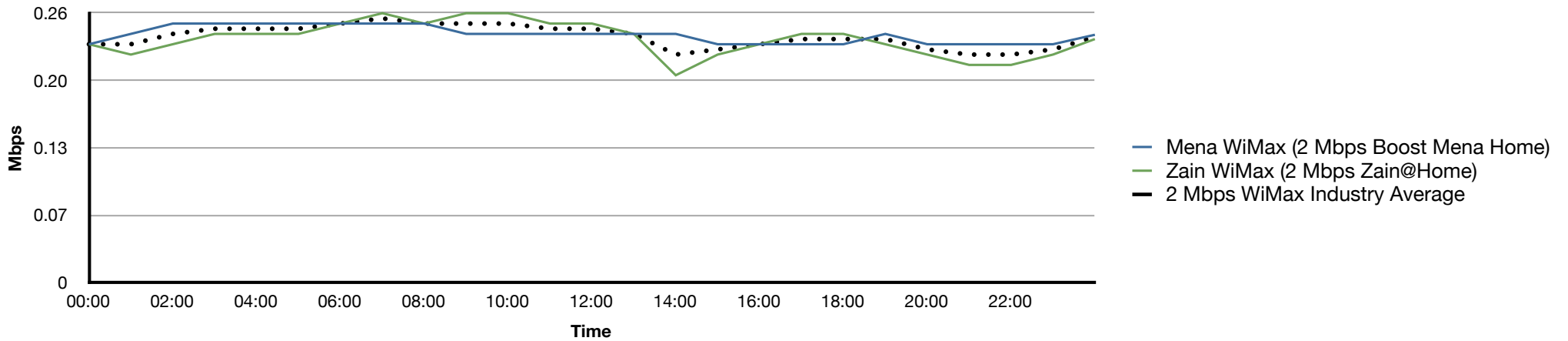
Table 3 - TCP Upload Speed (average)
01 April 2010 - 30 june 2010 between 00:00:00 and 24:00:00

	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24 Hour average
2 Connect ADSL (1 Mb unlimited)	0.21	0.21	0.21	0.21	0.20	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.20	0.20	0.20	0.20	0.21	0.20	0.21	0.20	0.20	0.20	0.21
Batelco ADSL (1 Mbps medium user)	0.21	0.21	0.21	0.21	0.20	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.20	0.20	0.20	0.20	0.21	0.21	0.21	0.21	0.20	0.20	0.20	0.21
Etisalcom ADSL (1 Mbps eDSL)	0.21	0.21	0.21	0.21	0.20	0.20	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.20	0.20	0.20	0.20	0.21	0.21	0.21	0.21	0.20	0.21	0.21
Kalaam (1 Mbps KlikADSL)	0.20	0.21	0.21	0.21	0.20	0.20	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.20	0.20	0.20	0.20	0.20	0.21	0.21	0.21	0.21	0.20	0.20	0.21
Lightspeed ADSL (1 Mbps Home 1000)	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.17	0.18	0.18	0.18	0.18	0.18
Neutel cable (1 Mbps Nue Net)	0.33	0.34	0.36	0.37	0.36	0.40	0.40	0.41	0.39	0.39	0.36	0.37	0.37	0.34	0.35	0.35	0.36	0.35	0.35	0.32	0.30	0.29	0.29	0.32	0.35
Orbit Satellite (1 Mbps Satnet 3)	0.06	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Mena WiMax (2 Mbps Boost Mena Home	0.23	0.24	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.24	0.23	0.23	0.23	0.23	0.24
Zain WiMax (2 Mbps Zain@Home)	0.23	0.22	0.23	0.24	0.24	0.24	0.25	0.26	0.25	0.26	0.26	0.25	0.25	0.24	0.20	0.22	0.23	0.24	0.24	0.23	0.22	0.21	0.21	0.22	0.24
1 Mbps ADSL Industry Average	0.20	0.20	0.20	0.21	0.20	0.21	0.21	0.21	0.21	0.21	0.20	0.21	0.21	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.19	0.19	0.20
2 Mbps WiMax Industry Average	0.23	0.23	0.24	0.25	0.25	0.25	0.25	0.26	0.25	0.25	0.25	0.25	0.25	0.24	0.22	0.23	0.23	0.24	0.24	0.24	0.23	0.22	0.22	0.23	0.24

TCP upload measurements

TCP (Transfer Control Protocol) throughput tests measuring upload speeds are conducted at a raw socket level (a socket that allows access to the underlying transport provider (ISP) that is supported by protocols such as IPv4 and IPv6) in order to test the full capacity of the connection. The probe is configured to initiate multiple TCP sessions and simultaneously use all of the open sessions for the transmission of data. This effectively "floods" the connection and reports the throughput capacity of the line.

The test is conducted using a server endpoint running proprietary software that is hosted in a well peered data centre. Whilst the port through which the test is typically conducted is configurable, it is normal for port 80 to be used since this minimises the possibility of the traffic being managed or throttled during the test by an ISP. Once the session has been initiated standard data files are transmitted from the probe to the endpoint server and measurements taken of the upload throughput of the connection. The test probe measures the time taken to transfer data and the volume of data transferred in a specific time. From these measurements the TCP upload speeds can be derived.

For the sake of comparison the graphs showing TCP upload speeds have been separated out the 1 Mbps (Chart 5) and 2 Mbps (Chart 6) connections. Also for ease of comprehension graphs depicted the average time it would take to download typical data file types have been created (Charts 7 and 8).

Table 4 - Average upload times for typical data types

		File Type and size in Mbytes			Upload time in Minutes		
	24 Hour download speed	**Mp3**	**Video clip**	**Movie**	**MP3 (5 MBytes)**	**Video clip (35 MBytes)**	**Movie (800 MBytes)**
2 Connect ADSL (1 Mb unlimited)	0.21	5	35	800	3.2	22.6	517.2
Batelco ADSL (1 Mbps medium user)	0.21	5	35	800	3.2	22.6	516.1
Etisalcom ADSL (1 Mbps eDSL)	0.21	5	35	800	3.2	22.5	515.1
Kalaam (1 Mbps KlikADSL)	0.21	5	35	800	3.2	22.7	518.2
Lightspeed ADSL (1 Mbps Home 1000)	0.18	5	35	800	3.7	26.0	594.0
Neutel cable (1 Mbps Nue Net)	0.35	5	35	800	1.9	13.2	302.2
Orbit Satellite (1 Mbps Satnet 3)	0.05	5	35	800	13.3	93.3	2,133.3
Mena WiMax (2 Mbps Boost Mena Home)	0.24	5	35	800	2.8	19.5	446.0
Zain WiMax (2 Mbps Zain@Home)	0.24	5	35	800	2.8	19.9	453.9
1 Mbps ADSL Industry Average	0.20	5	35	800	3.3	23.2	530.2
2 Mbps WiMax Industry Average	0.24	5	35	800	2.8	19.7	449.9

Chart 7 - Average upload time for different data file types (1 Mbps services)

Chart 8 - Average upload time for different data file types (2 Mbps WiMax services)
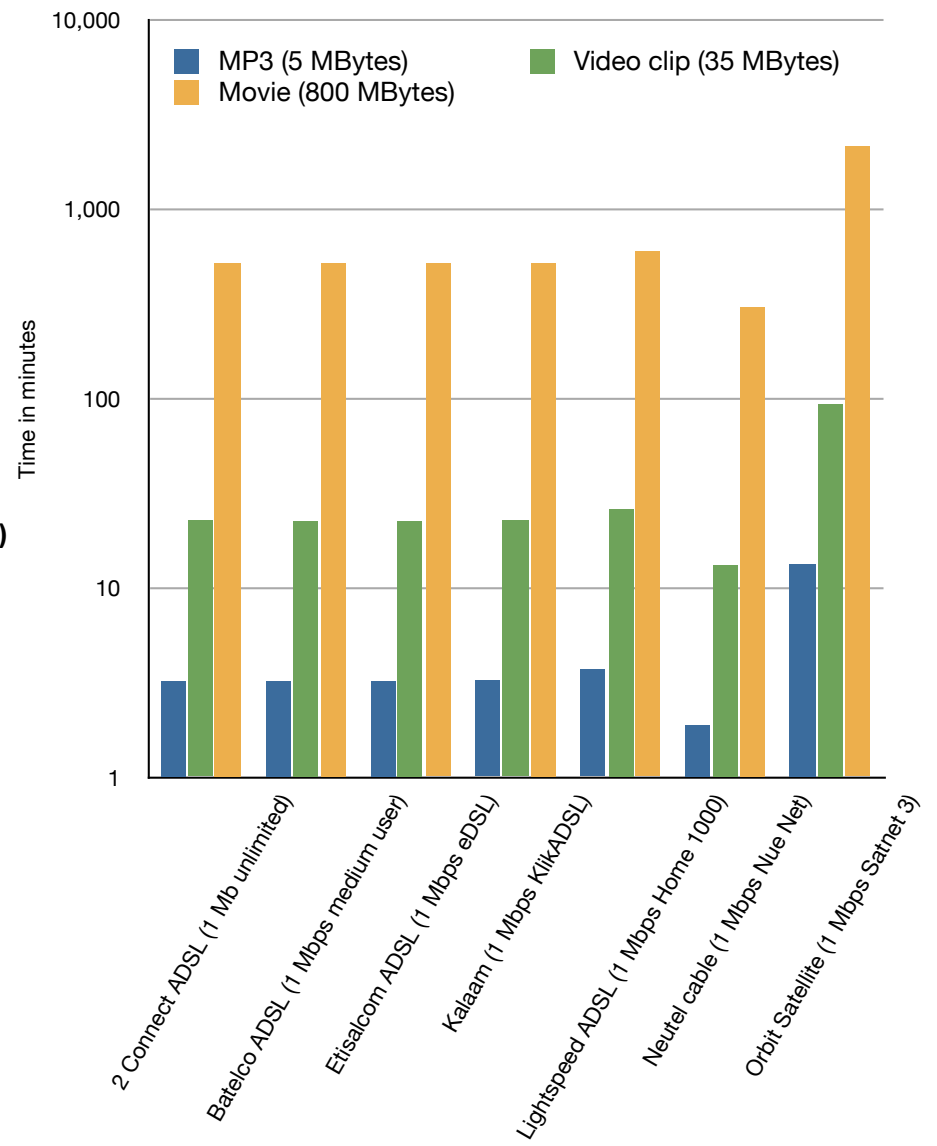
Chart 9 - HTTP Download Speed (average) (Cached) (1 Mbps services)

Legend:
- 2 Connect ADSL (1 Mb unlimited)
- Batelco ADSL (1 Mbps medium user)
- Etisalcom ADSL (1 Mbps eDSL)
- Kalaam (1 Mbps KlikADSL)
- Lightspeed ADSL (1 Mbps Home 1000)
- Neutel cable (1 Mbps Nue Net)
- Orbit Satellite (1 Mbps Satnet 3)
- 1 Mbps ADSL Industry Average
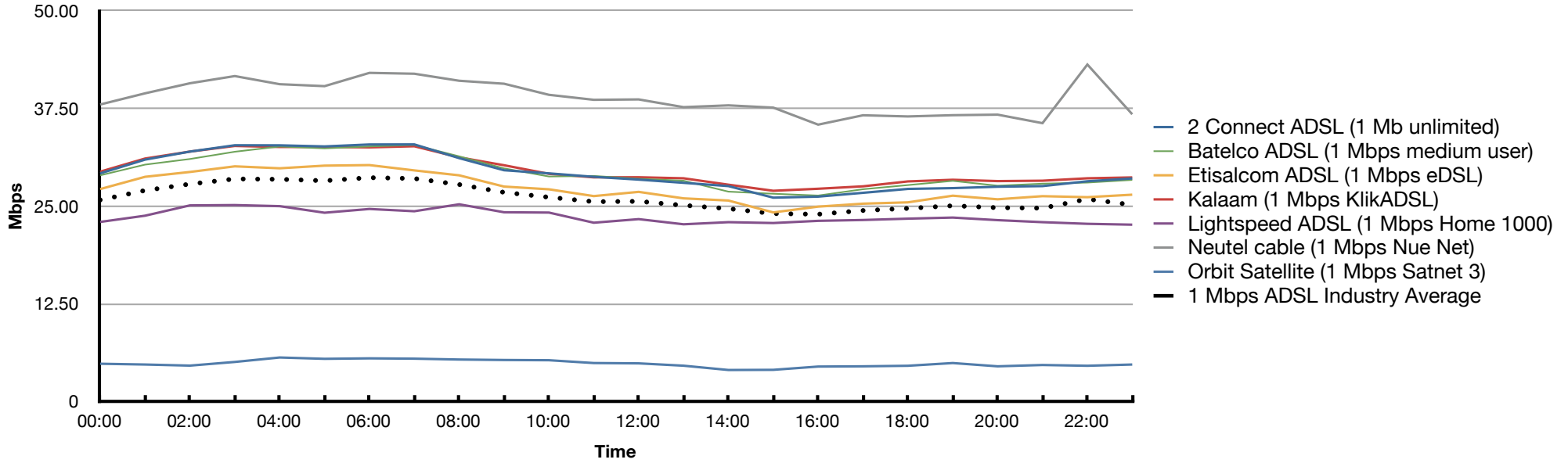
Chart 10 - HTTP Download Speed (Average) (Cached) (2 Mbps WiMax services)

Legend:
- Mena WiMax (2 Mbps Boost Mena Home)
- Zain WiMax (2 Mbps Zain@Home)
- 2 Mbps WiMax Industry Average

Table 5 - HTTP Download Speed (average) (Cached)
01 April 2010 - 30 june 2010 between 00:00:00 and 24:00:00

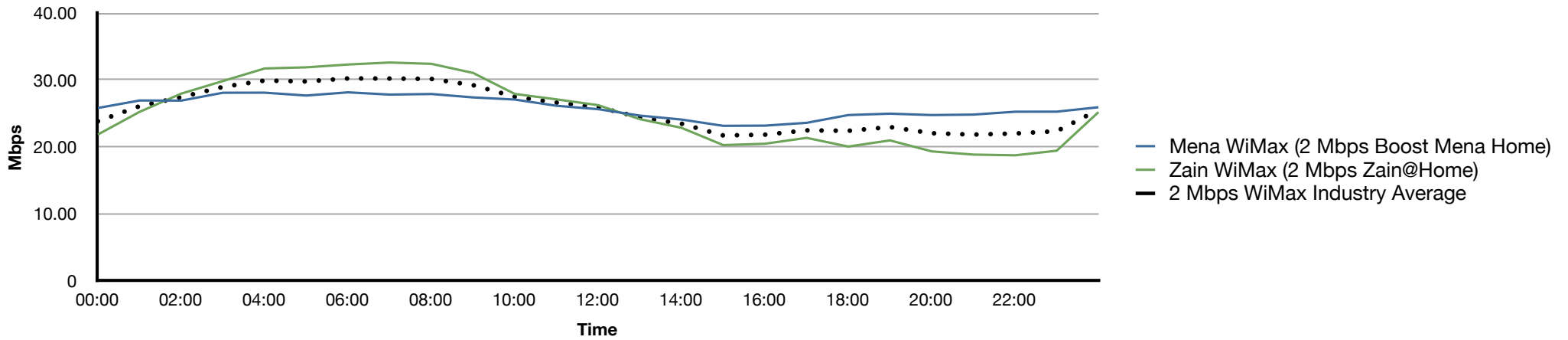|	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24 Hour average
2 Connect ADSL (1 Mb unlimited)	29.17	30.93	31.96	32.77	32.76	32.62	32.87	32.88	31.12	29.57	29.17	28.73	28.37	27.96	27.54	26.06	26.19	26.68	27.18	27.28	27.46	27.54	28.16	28.52	29.31
Batelco ADSL (1 Mbps medium user)	28.92	30.29	31.01	31.94	32.61	32.37	32.62	32.81	31.35	29.81	28.77	28.84	28.48	28.23	26.83	26.56	26.33	27.14	27.67	28.21	27.59	27.85	27.99	28.33	29.27
Etisalcom ADSL (1 Mbps eDSL)	27.16	28.73	29.35	30.07	29.82	30.16	30.23	29.55	28.92	27.48	27.13	26.26	26.80	25.97	25.69	24.17	24.91	25.29	25.46	26.31	25.85	26.25	26.12	26.44	27.26
Kalaam (1 Mbps KlikADSL)	29.39	31.07	31.96	32.68	32.55	32.55	32.50	32.64	31.22	30.21	29.11	28.66	28.67	28.54	27.72	26.94	27.20	27.51	28.14	28.35	28.18	28.23	28.54	28.65	29.63
Lightspeed ADSL (1 Mbps Home 1000)	22.95	23.75	25.07	25.11	24.97	24.13	24.61	24.32	25.21	24.19	24.15	22.85	23.31	22.65	22.92	22.81	23.09	23.20	23.37	23.51	23.18	22.92	22.71	22.60	23.65
Neutel cable (1 Mbps Nue Net)	37.99	39.42	40.71	41.63	40.59	40.34	42.04	41.93	41.03	40.65	39.23	38.59	38.64	37.65	37.88	37.59	35.41	36.61	36.46	36.62	36.69	35.60	43.11	36.74	38.88
Orbit Satellite (1 Mbps Satnet 3)	4.79	4.69	4.55	5.02	5.59	5.42	5.48	5.44	5.33	5.27	5.24	4.88	4.84	4.54	3.99	4.01	4.43	4.46	4.53	4.88	4.46	4.63	4.53	4.69	4.82
Mena WiMax (2 Mbps Boost Mena Hom	25.81	26.93	26.91	28.09	28.10	27.67	28.15	27.81	27.90	27.39	27.07	26.14	25.63	24.67	24.08	23.14	23.17	23.59	24.75	24.96	24.75	24.82	25.25	25.26	25.92
Zain WiMax (2 Mbps Zain@Home)	21.84	25.23	27.96	29.84	31.72	31.89	32.31	32.61	32.41	31.05	27.91	27.10	26.23	24.14	22.84	20.26	20.46	21.34	20.04	20.96	19.32	18.84	18.73	19.42	25.19
1 Mbps ADSL Industry Average	25.77	26.98	27.80	28.46	28.41	28.23	28.62	28.51	27.74	26.74	26.11	25.54	25.59	25.08	24.65	24.02	23.94	24.41	24.69	25.02	24.77	24.72	25.88	25.14	26.12
2 Mbps WiMax Industry Average	23.83	26.08	27.44	28.97	29.91	29.78	30.23	30.21	30.16	29.22	27.49	26.62	25.93	24.41	23.46	21.70	21.82	22.47	22.40	22.96	22.04	21.83	21.99	22.34	25.55

HTTP Measurements (Download Speed - Cache)

The HTTP (HyperText Transfer Protocol) test makes a request to a specified URL (Uniform Resource Locator) and records the time taken and the amount of data downloaded, from which the speed of the download is derived. Depending on the configuration of the test, test probe is also able to download the embedded content (e.g. images on a web page) in any HTML (HyperText Markup Language) that results from the HTTP request.

Any additional content downloaded is reflected in the captured timings and size of data downloaded. Additionally, the HTTP test can be configured to run in one of two modes of operation: cached and non-cached. When the test downloads from the specified URL in "cached[6]" mode, the speed of the download could be impacted by any caching mechanisms implemented by the network provider.

Chart 11 - HTTP Download Speed (average) (non cached 1 Mbps services)

Legend for Chart 11:
- 2 Connect ADSL (1 Mb unlimited)
- Batelco ADSL (1 Mbps medium user)
- Etisalcom ADSL (1 Mbps eDSL)
- Kalaam (1 Mbps KlikADSL)
- Lightspeed ADSL (1 Mbps Home 1000)
- Neutel cable (1 Mbps Nue Net)
- Orbit Satellite (1 Mbps Satnet 3)
- 1 Mbps ADSL Industry Average
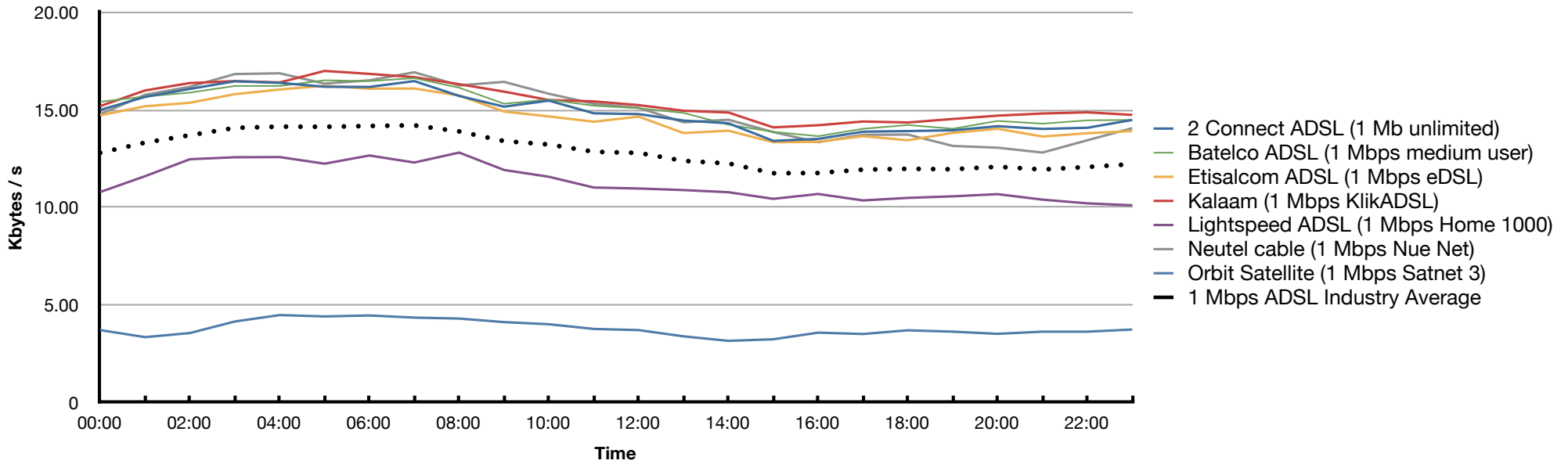
Chart 12 - HTTP Download Speed (Average) (Non cached 2 Mbps WiMax services)

Legend for Chart 12:
- Mena WiMax (2 Mbps Boost Mena Home)
- Zain WiMax (2 Mbps Zain@Home)
- 2 Mbps WiMax Industry Average
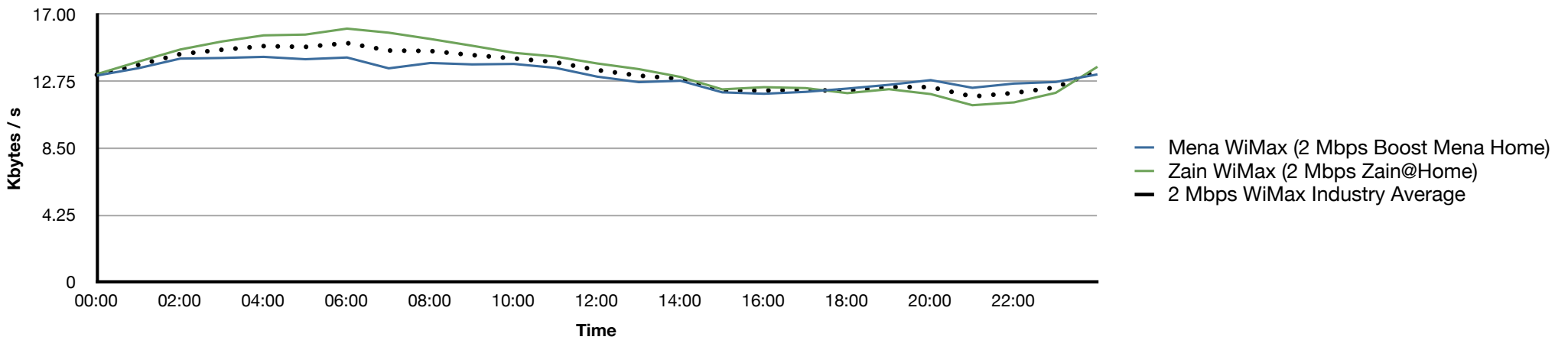
Table 6 - HTTP Download Speed (average) (Non Cached)
01 April 2010 - 30 june 2010 between 00:00:00 and 24:00:00

	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24 Hour average
2 Connect ADSL (1 Mb unlimited)	14.99	15.66	16.07	16.46	16.38	16.18	16.17	16.47	15.71	15.16	15.47	14.82	14.78	14.45	14.31	13.41	13.51	13.88	13.91	13.95	14.16	14.02	14.08	14.48	14.94
Batelco ADSL (1 Mbps medium user)	15.41	15.68	15.88	16.22	16.22	16.51	16.47	16.62	16.13	15.31	15.52	15.21	15.08	14.84	14.24	13.87	13.65	14.03	14.22	14.03	14.43	14.29	14.46	14.48	15.12
Etisalcom ADSL (1 Mbps eDSL)	14.72	15.18	15.36	15.80	16.04	16.23	16.08	16.09	15.73	14.91	14.66	14.39	14.65	13.81	13.93	13.34	13.36	13.65	13.44	13.82	14.03	13.63	13.80	13.91	14.61
Kalaam (1 Mbps KlikADSL)	15.19	15.99	16.37	16.47	16.40	16.99	16.84	16.67	16.31	15.93	15.50	15.43	15.24	14.95	14.86	14.10	14.21	14.40	14.35	14.53	14.70	14.81	14.87	14.74	15.41
Lightspeed ADSL (1 Mbps Home 1000)	10.79	11.60	12.47	12.57	12.58	12.24	12.66	12.30	12.81	11.92	11.57	11.02	10.97	10.89	10.78	10.44	10.69	10.36	10.49	10.57	10.68	10.40	10.21	10.11	11.30
Neutel cable (1 Mbps Nue Net)	14.77	15.77	16.18	16.83	16.87	16.34	16.51	16.92	16.25	16.43	15.82	15.31	15.10	14.36	14.49	13.86	13.34	13.72	13.73	13.15	13.06	12.81	13.44	14.06	14.96
Orbit Satellite (1 Mbps Satnet 3)	3.72	3.36	3.57	4.16	4.49	4.42	4.47	4.36	4.31	4.13	4.02	3.78	3.72	3.40	3.17	3.25	3.59	3.52	3.71	3.64	3.53	3.64	3.64	3.75	3.81
Mena WiMax (2 Mbps Boost Mena Home)	13.12	13.59	14.20	14.24	14.31	14.16	14.27	13.58	13.92	13.83	13.86	13.61	13.05	12.70	12.79	12.05	11.96	12.08	12.29	12.53	12.83	12.34	12.61	12.71	13.19
Zain WiMax (2 Mbps Zain@Home)	13.21	14.01	14.78	15.29	15.68	15.73	16.11	15.85	15.45	15.02	14.57	14.33	13.89	13.53	13.03	12.24	12.38	12.32	12.00	12.25	11.94	11.23	11.41	12.02	13.68
1 Mbps ADSL Industry Average	12.80	13.32	13.70	14.07	14.14	14.13	14.17	14.20	13.89	13.40	13.22	12.85	12.79	12.39	12.25	11.75	11.76	11.94	11.98	11.96	12.08	11.94	12.07	12.22	12.88
2 Mbps WiMax Industry Average	13.17	13.80	14.49	14.77	15.00	14.95	15.19	14.72	14.69	14.43	14.22	13.97	13.47	13.12	12.91	12.15	12.17	12.20	12.15	12.39	12.39	11.79	12.01	12.37	13.44

HTTP Measurements (Download Speed - Non Cache)

The HTTP (HyperText Transfer Protocol) test makes a request to a specified URL (Uniform Resource Locator) and records the time taken and the amount of data downloaded, from which the speed of the download is derived. Depending on the configuration of the test, test probe is also able to download the embedded content (e.g. images on a web page) in any HTML (HyperText Markup Language) that results from the HTTP request.

Any additional content downloaded is reflected in the captured timings and size of data downloaded. Additionally, the HTTP test can be configured to run in one of two modes of operation: cached and non-cached. When the test downloads from the specified URL in ""non-cached" mode a random query parameter is appended to the end of the URL, which will result in the request bypassing any caches present in the network, and the request will be serviced by the web server specified in the URL as opposed to any cache.

Chart 13 - DNS Time (1 Mbps services)

Milliseconds

- 2 Connect ADSL (1 Mb unlimited)
- Batelco ADSL (1 Mbps medium user)
- Etisalcom ADSL (1 Mbps eDSL)
- Kalaam (1 Mbps KlikADSL)
- Lightspeed ADSL (1 Mbps Home 1000)
- Neutel cable (1 Mbps Nue Net)
- Orbit Satellite (1 Mbps Satnet 3)
- 1 Mbps ADSL Industry Average
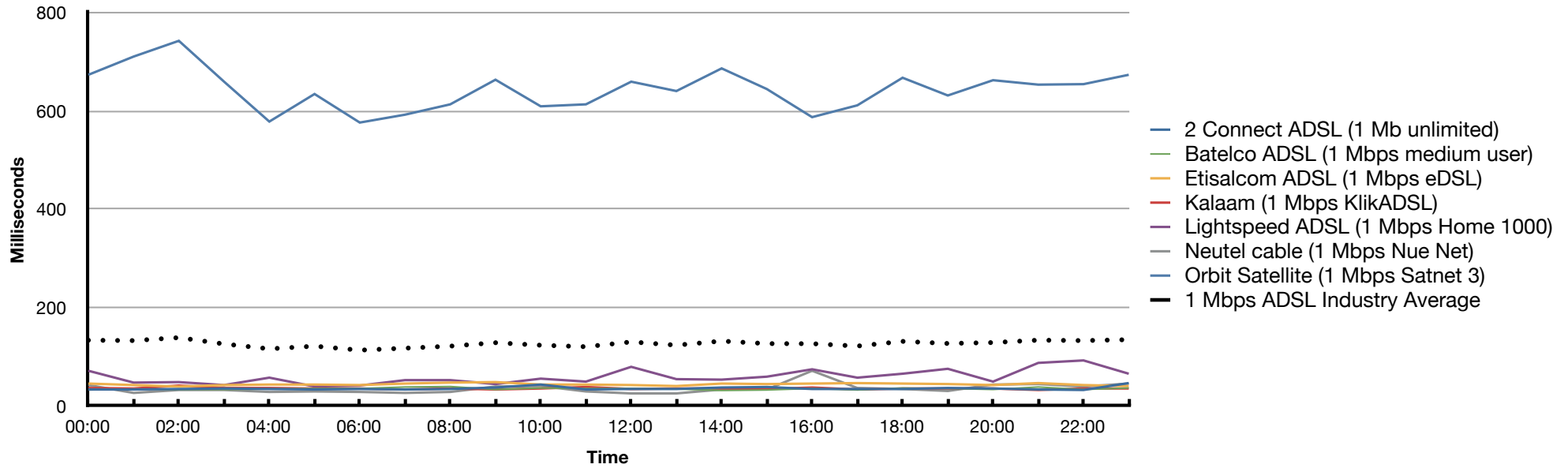
Time

Chart 14 - DNS Time (2 Mbps WiMax services)

Milliseconds

- Mena WiMax (2 Mbps Boost Mena Home)
- Zain WiMax (2 Mbps Zain@Home)
- 2 Mbps WiMax Industry Average
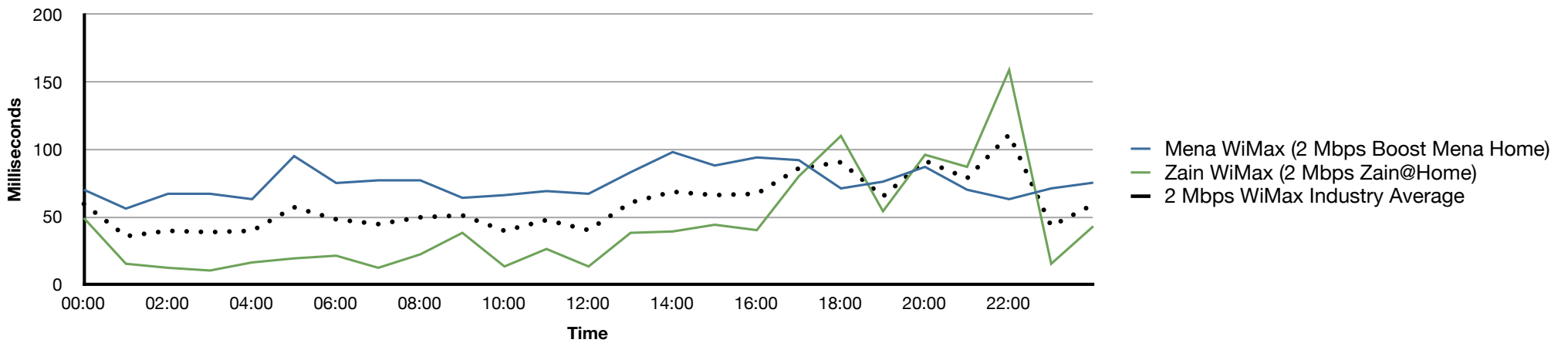
Time

Table 7 - DNS Time
01 April 2010 - 30 june 2010 between 00:00:00 and 24:00:00

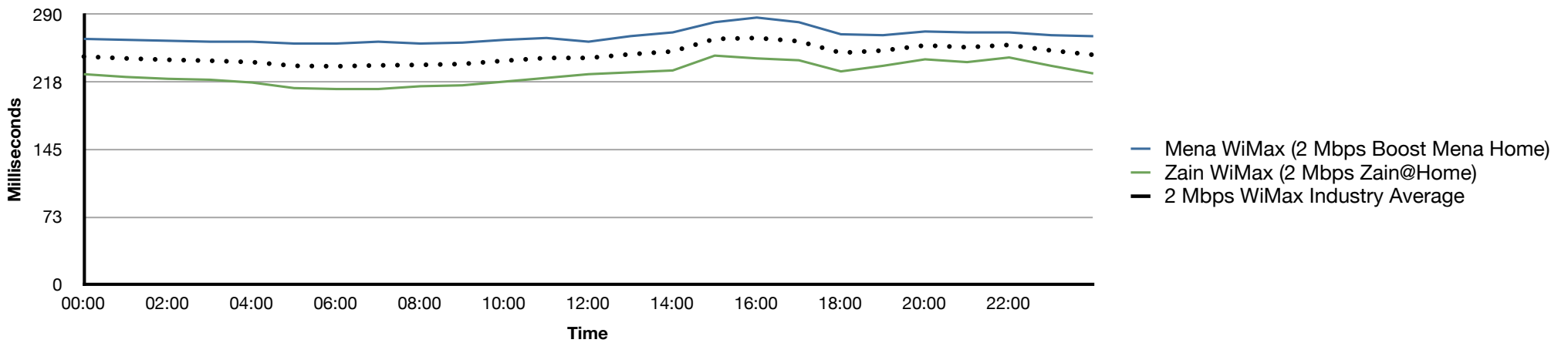|	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24 Hour average
2 Connect ADSL (1 Mb unlimited)	34	34	35	36	35	34	35	34	35	38	44	34	35	35	38	39	35	35	35	37	36	34	33	47	36
Batelco ADSL (1 Mbps medium user)	33	35	34	34	35	36	36	39	40	34	37	36	36	35	32	33	36	33	37	36	34	39	34	37	35
Etisalcom ADSL (1 Mbps eDSL)	46	43	40	43	44	44	43	46	48	49	44	44	43	41	46	45	46	47	46	45	43	47	43	41	44
Kalaam (1 Mbps KlikADSL)	37	36	42	37	37	36	36	34	36	34	36	39	35	36	36	35	38	34	36	36	36	33	36	36	36
Lightspeed ADSL (1 Mbps Home 1000)	72	48	49	43	58	40	42	53	53	45	56	50	80	55	54	60	75	58	66	76	50	88	93	66	60
Neutel cable (1 Mbps Nue Net)	43	27	33	33	29	30	29	27	29	40	41	30	26	26	34	34	72	37	35	31	44	45	40	46	36
Orbit Satellite (1 Mbps Satnet 3)	673	710	742	659	578	634	576	592	613	663	609	613	659	640	686	644	587	611	667	631	662	653	654	673	643
Mena WiMax (2 Mbps Boost Mena Home)	70	56	67	67	63	95	75	77	77	64	66	69	67	83	98	88	94	92	71	76	87	70	63	71	75
Zain WiMax (2 Mbps Zain@Home)	49	15	12	10	16	19	21	12	22	38	13	26	13	38	39	44	40	80	110	54	96	87	159	15	43
1 Mbps ADSL Industry Average	134	133	139	126	117	122	114	118	122	129	124	121	131	124	132	127	127	122	132	127	129	134	133	135	127
2 Mbps WiMax Industry Average	60	36	40	39	40	57	48	45	50	51	40	48	40	61	69	66	67	86	91	65	92	79	111	43	59

DNS Time (Domain Name System)

The DNS test records the time taken (in milliseconds) to resolve a fully qualified domain name to a corresponding IP address. The DNS servers used for the query are the DNS servers (primary and secondary) dynamically assigned by the service provider when the network connection is initiated. Alternatively a specific DNS server can be configured for use during DNS tests. The test probe disables the Windows DNS Client Service responsible for caching the results of DNS requests so that the DNS query is performed on the DNS servers, and not returned from any local cache.

Ping Time (1 Mbps services)

Legend:
- 2 Connect ADSL (1 Mb unlimited)
- Batelco ADSL (1 Mbps medium user)
- Etisalcom ADSL (1 Mbps eDSL)
- Kalaam (1 Mbps KlikADSL)
- Lightspeed ADSL (1 Mbps Home 1000)
- Neutel cable (1 Mbps Nue Net)
- Orbit Satellite (1 Mbps Satnet 3)
- 1 Mbps ADSL Industry Average

Ping Time (2 Mbps WiMax services)

Legend:
- Mena WiMax (2 Mbps Boost Mena Home)
- Zain WiMax (2 Mbps Zain@Home)
- 2 Mbps WiMax Industry Average
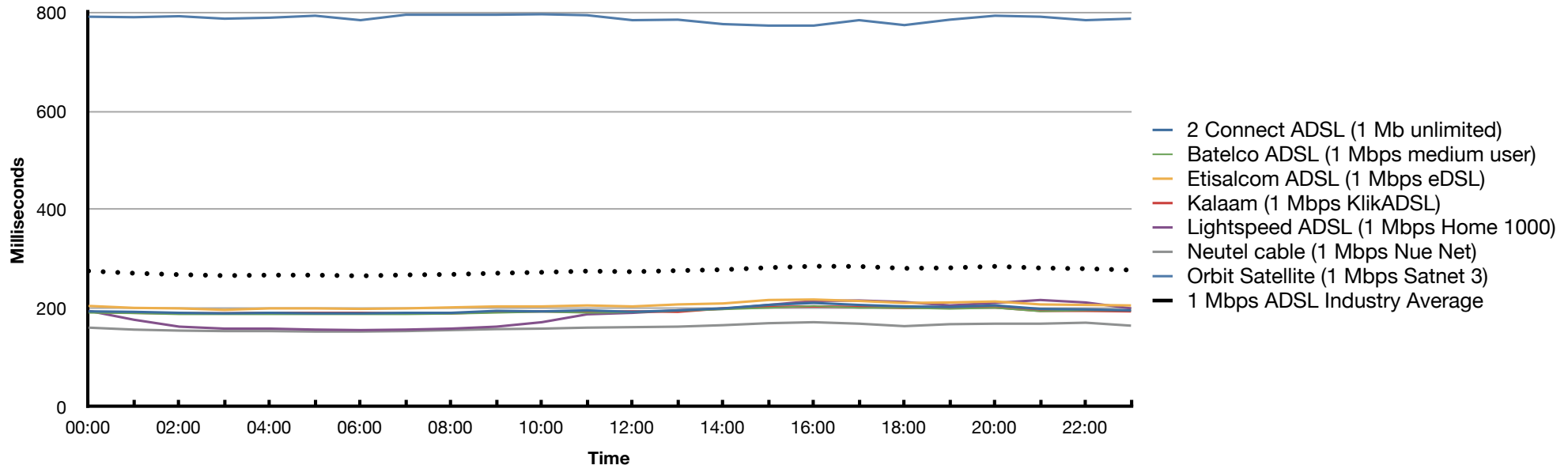
TRA Bahrain Broadband Quality of Service Analysis Report

Time 8 - Ping Time
01 April 2010 - 30 june 2010 between 00:00:00 and 24:00:00

	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24 Hour average
2 Connect ADSL (1 Mb unlimited)	194	193	191	190	191	190	190	191	191	195	194	196	193	196	200	207	211	207	204	203	206	199	198	196	197
Batelco ADSL (1 Mbps medium user)	191	190	188	188	188	188	188	188	189	191	193	191	192	195	198	201	205	201	201	199	201	194	196	196	194
Etisalcom ADSL (1 Mbps eDSL)	205	201	200	197	200	200	199	200	202	204	204	206	204	208	210	217	218	215	211	212	214	208	207	206	206
Kalaam (1 Mbps KlikADSL)	193	191	190	190	191	191	191	190	190	193	194	193	194	193	200	203	204	203	201	202	202	195	195	194	195
Lightspeed ADSL (1 Mbps Home 1000)	195	177	163	159	159	157	156	157	159	163	172	188	191	196	199	207	215	216	213	206	211	217	212	200	187
Neutel cable (1 Mbps Nue Net)	161	157	155	154	154	153	153	154	156	158	159	161	162	163	166	170	172	169	164	168	169	169	171	165	162
Orbit Satellite (1 Mbps Satnet 3)	791	790	792	787	789	793	784	795	795	795	796	794	784	785	776	773	773	784	774	785	793	791	784	787	787
Mena WiMax (2 Mbps Boost Mena Home)	264	263	262	261	261	259	259	261	259	260	263	265	261	267	271	282	287	282	269	268	272	271	271	268	267
Zain WiMax (2 Mbps Zain@Home)	226	223	221	220	217	211	210	210	213	214	218	222	226	228	230	246	243	241	229	235	242	239	244	235	227
1 Mbps ADSL Industry Average	276	271	268	266	267	267	266	268	269	271	273	276	274	277	278	283	285	285	281	282	285	282	280	278	275
2 Mbps WiMax Industry Average	245	243	242	241	239	235	235	236	236	237	241	244	244	248	251	264	265	262	249	252	257	255	258	252	247

Ping Time (Latency)

The Ping test measures network latency by sending an ICMP (Internet Control Message Protocol) echo request to the specified server. The time recorded by test probe is the total round trip time (in milliseconds) from the request to the echo response being received from the server.
The measurements reported are the average time for tests to servers located in Bahrain, Europe and the USA.