هيئة تنظيم الاتصالات
Telecommunications Regulatory Authority

Fixed Broadband Analysis Report
01 January 2012 – 31 March 2012 between 00:00:00 and 24:00:00 Bahrain

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Public Document

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Introduction

Broadband, defined as a technology that enables high speed transfer of data, is inextricably linked to the emergence of the Internet. Investment in and adoption of broadband increased exponentially around the world since the middle of the 1990s. Broadband benefit the economy of a country in different ways, direct contribution to the Gross Domestic Products (GDP), productivity gains and specific impact on the economy with the development of eCommerce.

Broadband is part of the Kingdom of Bahrain 2030 vision and it is the duty of TRA to ensure the necessary regulatory environment is in place that will pave the way to the future state of the art infrastructure and services in a healthy competitive environment for the general benefit and citizen and consumers

Whilst ISPs do provide the basic level of information required to allow customers to make decisions relating to price, expected download speed and download threshold, they do not make available information relating to the download, upload and browsing speeds experienced on average by consumers.

Via this report TRA aim at providing consumers with data relating to the actual quality of service achieved by each of the monitored ISP Services to allow consumers to make informed decisions with respect to understanding what is likely to be provided by each ISP on the specific measured packages. It is not feasible for the TRA to monitor all the available packages from all ISPs and therefore the choice has been made to focus on the 2 Mbps packages for aDSL, Fiber and WiMax Services from the following ISPs:

aDSL:	2Connect, Batelco, Etisalcom, Kalaam, Lightspeed,
Fiber:	NueTel
WiMax:	Menatelecom, Zain

Beside the difference in access technologies between aDSL, Fiber and WiMax, other important elements such as network load and dimensioning, network capacity towards the global internet and ISPs internal engineering rules based on specific commercial objectives have all an impact on end user experience.

ISPs are continuously working at optimizing their respective networks, results between two specific measurement period are subject to change however after several consecutive measurements quarters TRA is confident that industry trends have established.

Measurements Methods Overview

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.

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 from test probes that have been deployed on each of the broadband connections under this test program . The tests involve requests being sent towards a standard specified list of public websites as well as dedicated servers located in the Kingdom of Bahrain, USA , Asia and Europe.

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

Diagram 1 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

Noticeable events this Quarter

TCP download speed performance remained stable with some services performance flat throughout the day whereas other services performance did fluctuate between busy hours and non busy hours.

Average **TCP download performance increased for the third quarter reaching 1.50 Mbps** (from 1.45 Mbps previously).

TCP upload speed increased dramatically for aDSL packages resulting in industry average reaching 0.58 Mbps from 0.42 Mbps previous quarter. Results are equally spread around the average.

Some ISPs did improve HTTP download speed compared to previous quarter, overall industry average remained stable.

Some volatility appeared on some ISPs' DNS performance during busy hours (after 17:00) but overall performance remained within 50 milliseconds average.

Ping performance did vary with time of the day suggesting some services performance fluctuation during busy hours.

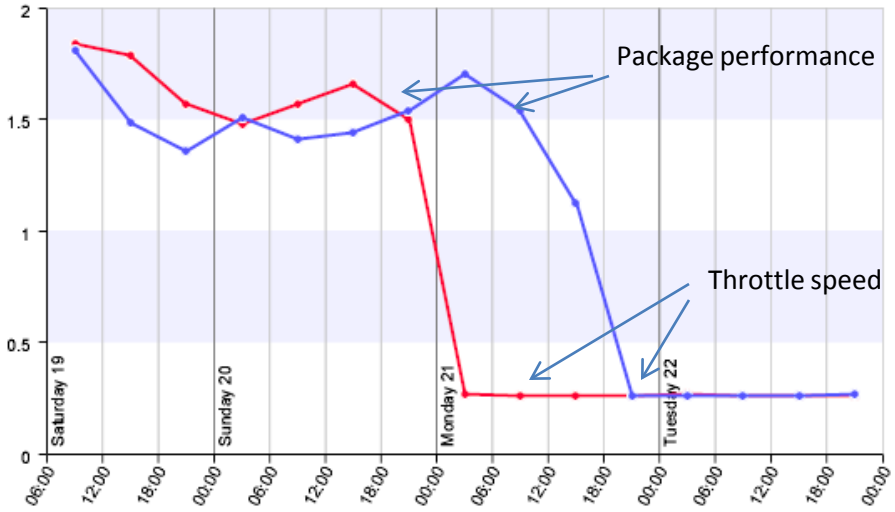
Highlight on Fair Usage Policy

Most Broadband packages in the Kingdom are delivered with FUP or download threshold levels, this means a fixed number of data packets, measured in Bytes (MB or GB), that can be downloaded as part of a specific data package. When the threshold is met, ISPs throttle down connection speed until the start of the next billing month. Consumer can choose to pay extra at published price to keep package performance.

The diagram illustrate FUP mechanism at work for two individual 2Mbps broadband packages being throttle at 256Kbps.

Fair Usage Policy when triggered can have a significant impact of the average performance of a service for the month.

In the example shown FUP was triggered on the 21st of the month, this represent 30% of the time.



For consumer, the presence (or absence) of Fair Usage Policy is an important element to take into account in the choice of a Broadband package. When using the service, knowing FUP consumption allow consumer to better manage download allocation and plan for upgrade to higher threshold level, if necessary, to maintain a continuous performance level throughout the month.

RESULTS

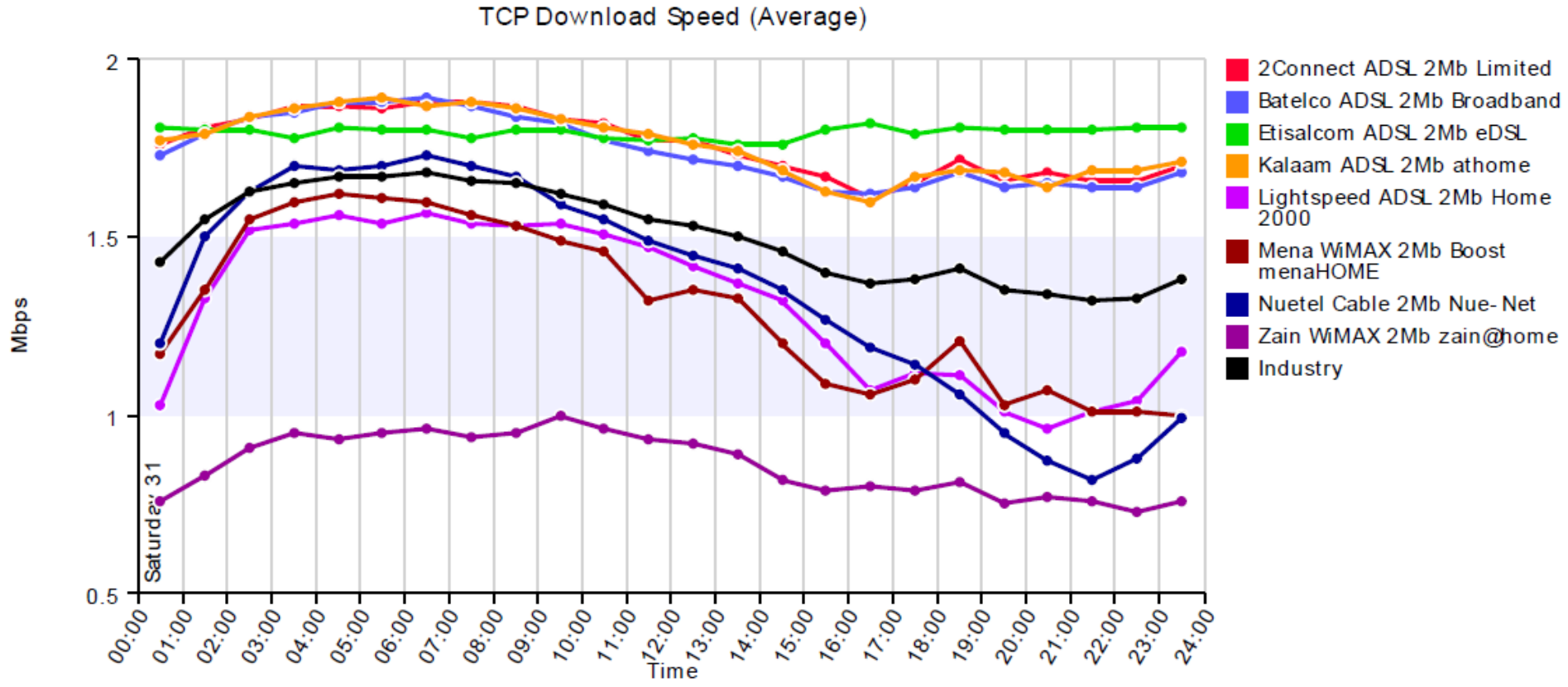
The following pages present the result of measurements taken every hour for each audited service during the period of Q1 2012, from 00:00:00 on the 1 January 2012 to 24:00:00 on the 31 March 2012.

For each ISP, one set of measurements is taken each hour, 24 hours a day. In this report, results for a given hour are then averaged to determine the average QoS in that hour over the three month period. i.e. all results recorded between 8:00 and 9:00 for an ISP are averaged and reported as one observation on the graph that provide the average performance of this specific time period over a three month period.

This method has the advantage that it can show trends over an audited period as well as show variations during a 24h period.

TCP Download Speed (Average) Line Chart (Peer view)

01 Jan 2012 - 31 Mar 2012, between 00:00:00 and 24:00:00 Asia/Bahrain



TCP Download Speed (Average) Line Chart Values (Peer view)

01 Jan 2012 - 31 Mar 2012, between 00:00:00 and 24:00:00 Asia/Bahrain

	00:00, 31 Dec	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
2Connect ADSL 2Mb Limited	1.76	1.81	1.83	1.87	1.87	1.86	1.88	1.88	1.87	1.83	1.82	1.77	1.77	1.73	1.70	1.67	1.61	1.65	1.72	1.66	1.68	1.66	1.66	1.70
Batelco ADSL 2Mb Broadband	1.73	1.79	1.84	1.85	1.88	1.88	1.89	1.87	1.84	1.82	1.77	1.74	1.72	1.70	1.67	1.63	1.62	1.64	1.68	1.64	1.65	1.64	1.64	1.68
Etisalcom ADSL 2Mb eDSL	1.81	1.80	1.80	1.78	1.81	1.80	1.80	1.78	1.80	1.80	1.78	1.77	1.78	1.76	1.76	1.80	1.82	1.79	1.81	1.80	1.80	1.80	1.81	1.81
Kalaam ADSL 2Mb athome	1.77	1.79	1.84	1.86	1.88	1.89	1.87	1.88	1.86	1.83	1.81	1.79	1.76	1.74	1.69	1.63	1.60	1.67	1.69	1.68	1.64	1.69	1.69	1.71
Lightspeed ADSL 2Mb Home 2000	1.03	1.33	1.52	1.54	1.56	1.54	1.57	1.54	1.53	1.54	1.51	1.47	1.42	1.37	1.32	1.20	1.07	1.12	1.11	1.01	0.96	1.01	1.04	1.18
Mena WiMAX 2Mb Boost menaHOME	1.17	1.35	1.55	1.60	1.62	1.61	1.60	1.56	1.53	1.49	1.46	1.32	1.35	1.33	1.20	1.09	1.06	1.10	1.21	1.03	1.07	1.01	1.01	1.00
Nuetel Cable 2Mb Nue-Net	1.20	1.50	1.63	1.70	1.69	1.70	1.73	1.70	1.67	1.59	1.55	1.49	1.45	1.41	1.35	1.27	1.19	1.14	1.06	0.95	0.87	0.82	0.88	0.99
Zain WiMAX 2Mb zain@home	0.76	0.83	0.91	0.95	0.93	0.95	0.96	0.94	0.95	1.00	0.96	0.93	0.92	0.89	0.82	0.79	0.80	0.79	0.81	0.75	0.77	0.76	0.73	0.76

TCP download measurements (Mbit/s)

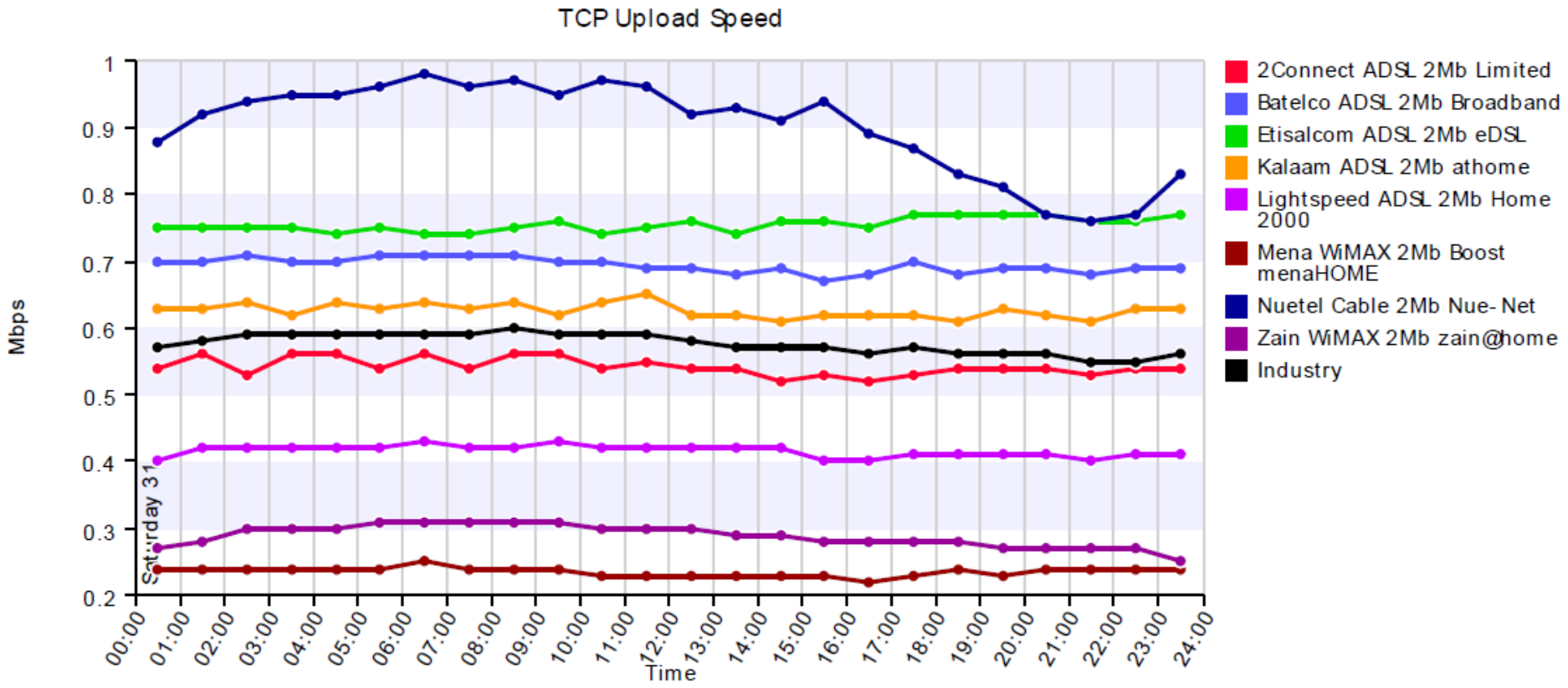
TCP (Transfer Control Protocol) throughput tests measuring download speeds are conducted at a raw socket level (a socket that allows access to the underlying transport provider (ISP) that is supported by protocols such as IPv4 and IPv6) in order to test the full capacity of the connection. The probe 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.

The higher is the download speed the better is the performance.

TCP Upload Speed (Average) Line Chart (Peer view)

01 Jan 2012 - 31 Mar 2012, between 00:00:00 and 24:00:00 Asia/Bahrain



TCP Upload Speed (Average) Line Chart Values (Peer view)

01 Jan 2012 - 31 Mar 2012, between 00:00:00 and 24:00:00 Asia/Bahrain

	00:00, 31 Dec	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
2Connect ADSL 2Mb Limited	0.54	0.56	0.53	0.56	0.56	0.54	0.56	0.54	0.56	0.56	0.54	0.55	0.54	0.54	0.52	0.53	0.52	0.53	0.54	0.54	0.54	0.53	0.54	0.54
Batelco ADSL 2Mb Broadband	0.70	0.70	0.71	0.70	0.70	0.71	0.71	0.71	0.71	0.70	0.70	0.69	0.69	0.68	0.69	0.67	0.68	0.70	0.68	0.69	0.69	0.68	0.69	0.69
Etisalcom ADSL 2Mb eDSL	0.75	0.75	0.75	0.75	0.74	0.75	0.74	0.74	0.75	0.76	0.74	0.75	0.76	0.74	0.76	0.76	0.75	0.77	0.77	0.77	0.77	0.76	0.76	0.77
Kalaam ADSL 2Mb athome	0.63	0.63	0.64	0.62	0.64	0.63	0.64	0.63	0.64	0.62	0.64	0.65	0.62	0.62	0.61	0.62	0.62	0.62	0.61	0.63	0.62	0.61	0.63	0.63
Lightspeed ADSL 2Mb Home 2000	0.40	0.42	0.42	0.42	0.42	0.42	0.43	0.42	0.42	0.43	0.42	0.42	0.42	0.42	0.42	0.40	0.40	0.41	0.41	0.41	0.41	0.40	0.41	0.41
Mena WiMAX 2Mb Boost menaHOME	0.24	0.24	0.24	0.24	0.24	0.24	0.25	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.23	0.23	0.22	0.23	0.24	0.23	0.24	0.24	0.24	0.24
Nuetel Cable 2Mb Nue-Net	0.88	0.92	0.94	0.95	0.95	0.96	0.98	0.96	0.97	0.95	0.97	0.96	0.92	0.93	0.91	0.94	0.89	0.87	0.83	0.81	0.77	0.76	0.77	0.83
Zain WiMAX 2Mb zain@home	0.27	0.28	0.30	0.30	0.30	0.31	0.31	0.31	0.31	0.31	0.30	0.30	0.30	0.29	0.29	0.28	0.28	0.28	0.28	0.27	0.27	0.27	0.27	0.25

TCP upload measurements (Mbits/s)

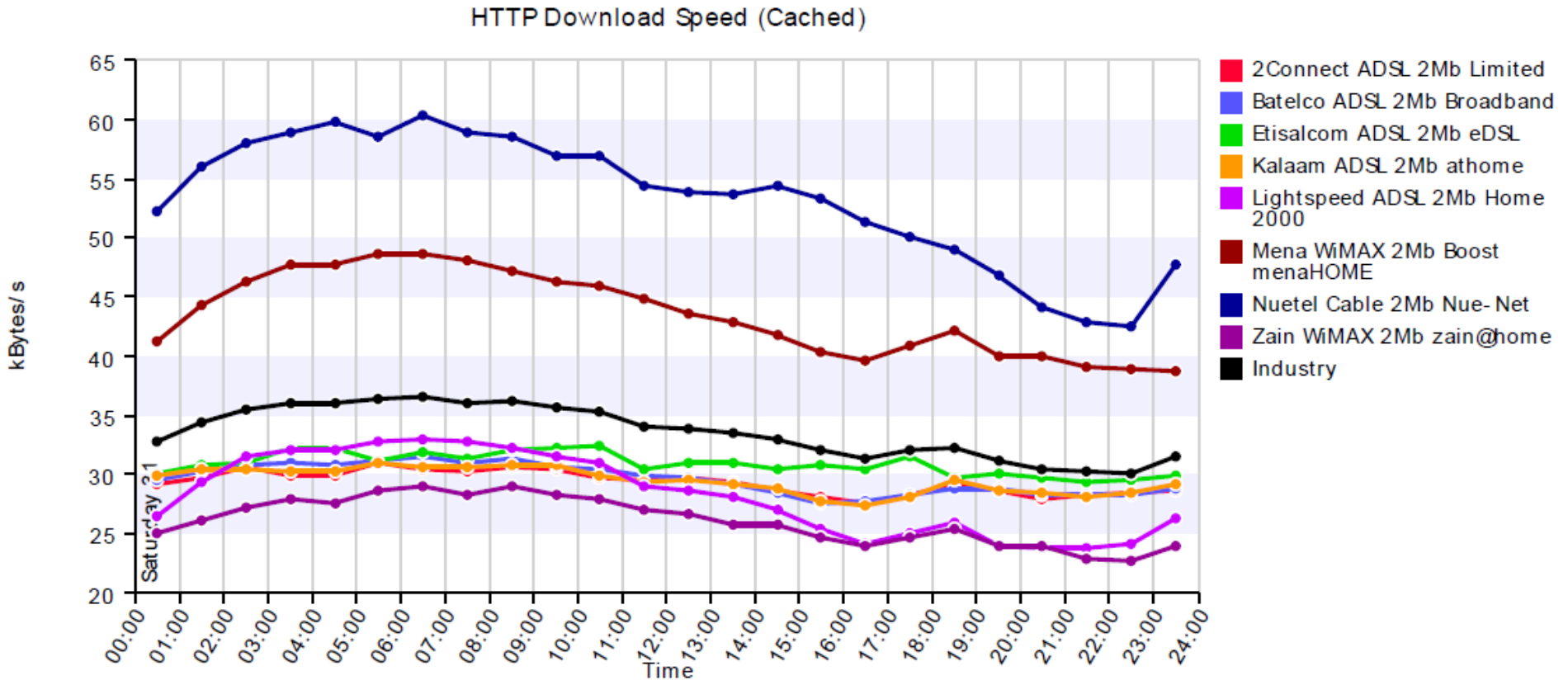
TCP (Transfer Control Protocol) throughput tests measuring upload speeds are conducted at a raw socket level (a socket that allows access to the underlying transport provider (ISP) that is supported by protocols such as IPv4 and IPv6) in order to test the full capacity of the connection. The probe is 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 minimizes 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.

The higher is the upload speed the better is the performance.

HTTP Download Speed (Cached) Line Chart (Peer view)

01 Jan 2012 - 31 Mar 2012, between 00:00:00 and 24:00:00 Asia/Bahrain



HTTP Download Speed (Cached) Line Chart Values (Peer view)

01 Jan 2012 - 31 Mar 2012, between 00:00:00 and 24:00:00 Asia/Bahrain

	00:00, 31 Dec	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
2Connect ADSL 2Mb Limited	29.25	29.77	30.53	29.90	29.84	30.96	30.44	30.24	30.61	30.35	29.74	29.53	29.72	29.41	28.68	28.03	27.61	28.26	29.21	28.61	27.95	28.29	28.40	28.70
Batelco ADSL 2Mb Broadband	29.61	30.32	30.81	30.94	30.78	31.21	31.55	30.94	31.32	30.65	30.38	29.85	29.67	29.10	28.53	27.48	27.75	28.27	28.90	28.76	28.35	28.24	28.36	28.84
Etisalcom ADSL 2Mb eDSL	30.16	30.75	30.91	32.20	32.17	31.22	31.82	31.39	32.13	32.25	32.46	30.52	30.90	30.92	30.48	30.82	30.42	31.56	29.66	30.15	29.68	29.40	29.50	29.99
Kalaam ADSL 2Mb athome	29.98	30.43	30.52	30.30	30.17	30.95	30.63	30.57	30.74	30.82	29.98	29.39	29.46	29.26	28.87	27.75	27.46	28.17	29.55	28.56	28.38	28.17	28.38	29.19
Lightspeed ADSL 2Mb Home 2000	26.48	29.29	31.53	32.00	32.10	32.83	32.89	32.75	32.18	31.46	31.00	29.02	28.59	28.18	26.97	25.47	24.12	25.05	25.93	24.03	23.70	23.77	24.11	26.37
Mena WiMAX 2Mb Boost menaHOME	41.29	44.27	46.34	47.70	47.72	48.69	48.66	48.06	47.19	46.20	45.98	44.84	43.66	42.93	41.83	40.42	39.61	40.87	42.20	40.06	39.99	39.15	38.85	38.79
Nuetel Cable 2Mb Nue-Net	52.18	56.03	58.05	58.81	59.83	58.54	60.35	58.92	58.58	56.85	56.89	54.37	53.85	53.57	54.32	53.29	51.28	50.14	49.06	46.83	44.03	42.92	42.53	47.73
Zain WiMAX 2Mb zain@home	25.04	26.14	27.24	27.87	27.49	28.65	28.91	28.29	28.95	28.22	27.94	26.96	26.63	25.83	25.70	24.61	23.96	24.73	25.38	24.03	23.94	22.85	22.75	23.97

HTTP Measurements (Download Speed - Cache) (Kbytes/s)

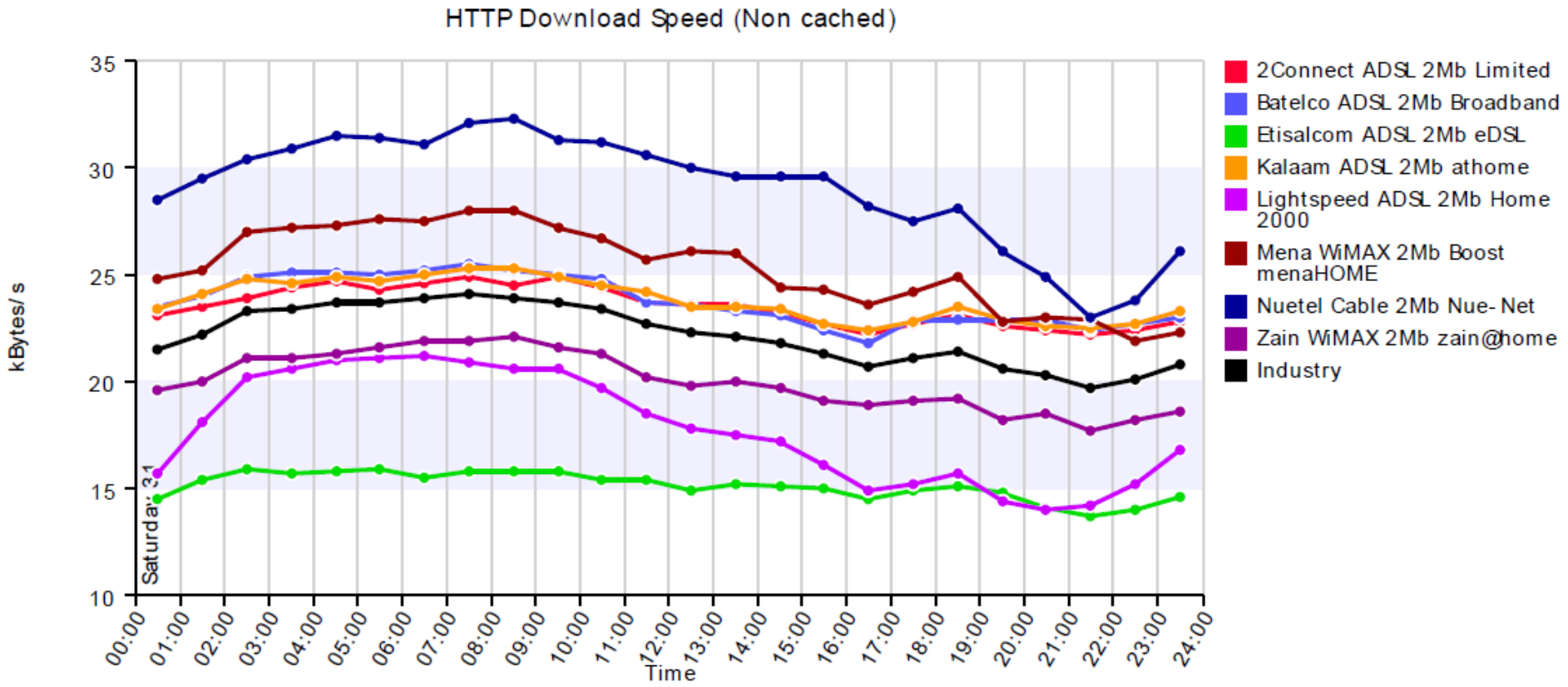
The HTTP (HyperText Transfer Protocol) test makes a request to a specified URL (Uniform Resource Locator) and records the time taken and the amount of data downloaded, from which the speed of the download is derived. Depending on the configuration of the test, test probe is also able to download the 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” mode, the speed of the download could be impacted by any caching mechanisms implemented by the network provider.

The higher is the download speed the better is the performance.

HTTP Download Speed (Non cached) Line Chart (Peer view)

01 Jan 2012 - 31 Mar 2012, between 00:00:00 and 24:00:00 Asia/Bahrain



HTTP Download Speed (Non cached) Line Chart Values (Peer view)

01 Jan 2012 - 31 Mar 2012, between 00:00:00 and 24:00:00 Asia/Bahrain

	00:00, 31 Dec	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
2Connect ADSL 2Mb Limited	23.06	23.50	23.87	24.40	24.67	24.26	24.59	24.90	24.45	24.87	24.44	23.74	23.56	23.59	23.18	22.70	22.18	22.74	23.15	22.63	22.36	22.23	22.44	22.84
Batelco ADSL 2Mb Broadband	23.52	23.99	24.94	25.07	25.12	25.00	25.21	25.51	25.15	25.01	24.78	23.72	23.58	23.28	23.14	22.39	21.82	22.90	22.93	22.87	22.89	22.44	22.71	23.03
Etisalcom ADSL 2Mb eDSL	14.52	15.37	15.88	15.67	15.75	15.94	15.48	15.77	15.76	15.84	15.38	15.38	14.93	15.17	15.08	15.04	14.52	14.90	15.09	14.80	14.14	13.65	14.03	14.57
Kalaam ADSL 2Mb athome	23.38	24.06	24.84	24.58	24.90	24.67	24.98	25.26	25.25	24.90	24.50	24.19	23.51	23.47	23.36	22.69	22.35	22.77	23.51	22.93	22.63	22.52	22.68	23.29
Lightspeed ADSL 2Mb Home 2000	15.74	18.12	20.21	20.61	20.96	21.14	21.19	20.94	20.65	20.56	19.74	18.49	17.84	17.52	17.23	16.15	14.93	15.18	15.74	14.40	13.96	14.24	15.18	16.75
Mena WiMAX 2Mb Boost menaHOME	24.77	25.17	27.01	27.22	27.26	27.63	27.49	28.01	27.99	27.19	26.67	25.68	26.15	25.95	24.37	24.32	23.55	24.16	24.94	22.75	23.00	22.89	21.86	22.26
Nuetel Cable 2Mb Nue-Net	28.46	29.52	30.36	30.85	31.54	31.39	31.11	32.14	32.29	31.31	31.16	30.57	29.96	29.65	29.62	29.59	28.19	27.49	28.05	26.13	24.88	22.98	23.81	26.07
Zain WiMAX 2Mb zain@home	19.56	19.97	21.09	21.06	21.29	21.56	21.89	21.90	22.13	21.57	21.29	20.23	19.83	19.99	19.67	19.10	18.86	19.13	19.16	18.17	18.53	17.70	18.16	18.63

HTTP Measurements (Download Speed - Non Cache) (Kbytes/s)

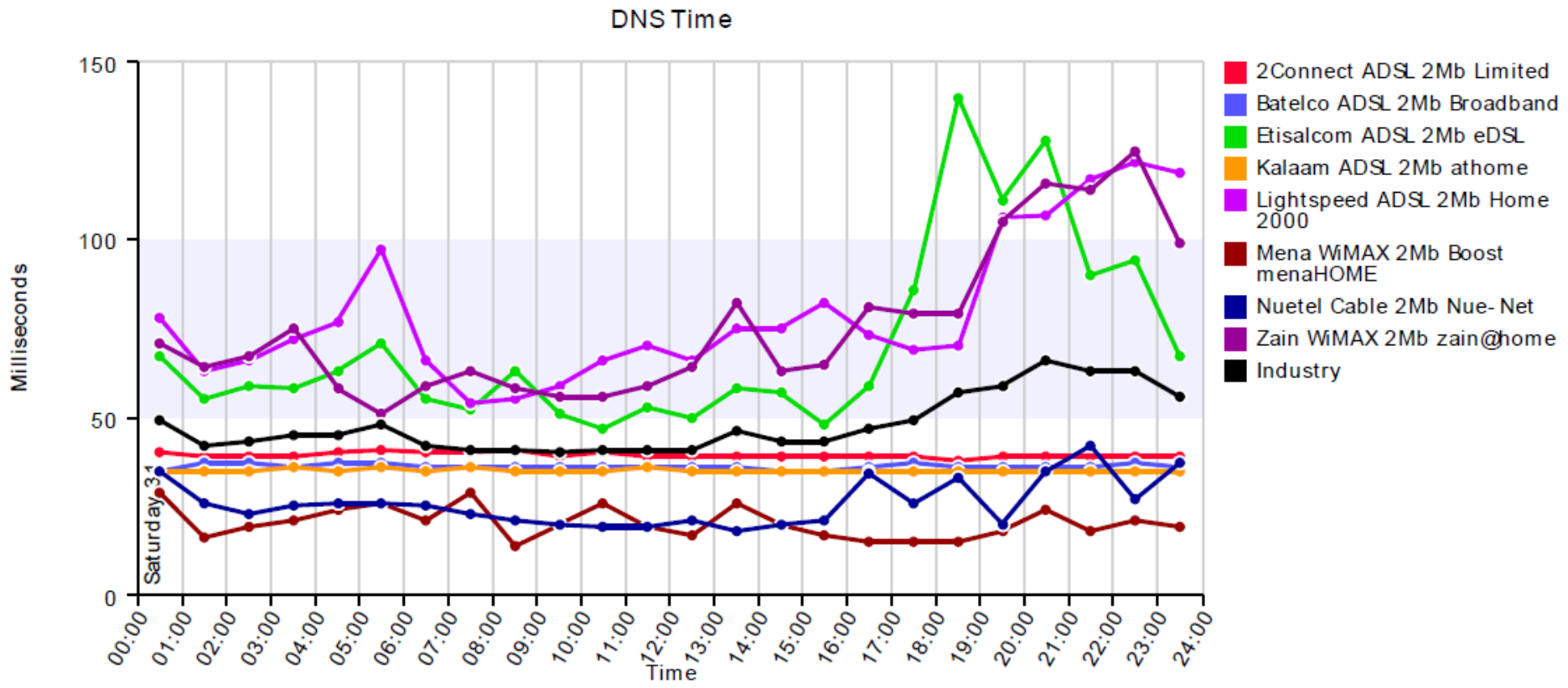
The HTTP (HyperText Transfer Protocol) test makes a request to a specified URL (Uniform Resource Locator) and records the time taken and the amount of data downloaded, from which the speed of the download is derived. Depending on the configuration of the test, test probe is also able to download the 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.

The higher is the download speed the better is the performance.

DNS Time Line Chart (Peer view)

01 Jan 2012 - 31 Mar 2012, between 00:00:00 and 24:00:00 Asia/Bahrain



DNS Time Line Chart Values (Peer view)

01 Jan 2012 - 31 Mar 2012, between 00:00:00 and 24:00:00 Asia/Bahrain

	00:00, 31 Dec	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
2Connect ADSL 2Mb Limited	40	39	39	39	40	41	40	40	41	39	40	39	39	39	39	39	39	39	38	39	39	39	39	39
Batelco ADSL 2Mb Broadband	35	37	37	36	37	37	36	36	36	36	36	36	36	36	35	35	36	37	36	36	36	36	37	36
Etisalcom ADSL 2Mb eDSL	67	55	59	58	63	71	55	52	63	51	47	53	50	58	57	48	59	86	140	111	128	90	94	67
Kalaam ADSL 2Mb athome	35	35	35	36	35	36	35	36	35	35	35	36	35	35	35	35	35	35	35	35	35	35	35	35
Lightspeed ADSL 2Mb Home 2000	78	63	66	72	77	97	66	54	55	59	66	70	66	75	75	82	73	69	70	106	107	117	122	119
Mena WiMAX 2Mb Boost menaHOME	29	16	19	21	24	26	21	29	14	20	26	19	17	26	20	17	15	15	15	18	24	18	21	19
Nuetel Cable 2Mb Nue-Net	35	26	23	25	26	26	25	23	21	20	19	19	21	18	20	21	34	26	33	20	35	42	27	37
Zain WiMAX 2Mb zain@home	71	64	67	75	58	51	59	63	58	56	56	59	64	82	63	65	81	79	79	105	116	114	125	99

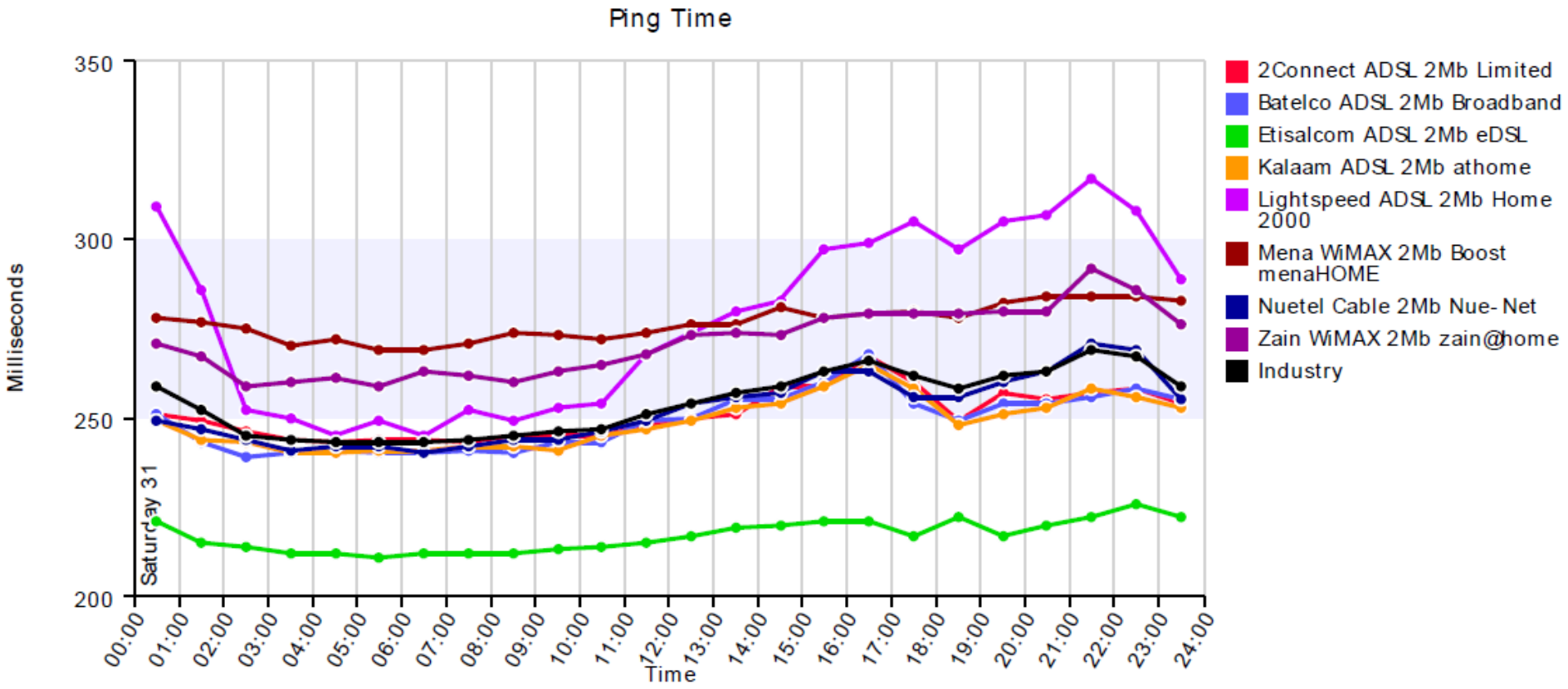
DNS Time (Domain Name System) (Milliseconds)

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.

The shorter the DNS resolution time is the better is the performance.

Ping Time Line Chart (Peer view)

01 Jan 2012 - 31 Mar 2012, between 00:00:00 and 24:00:00 Asia/Bahrain



Ping Time Line Chart Values (Peer view)

01 Jan 2012 - 31 Mar 2012, between 00:00:00 and 24:00:00 Asia/Bahrain

	00:00, 31 Dec	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
2Connect ADSL 2Mb Limited	251	249	246	244	243	244	244	243	245	245	245	248	250	251	259	259	267	260	249	257	255	257	258	254
Batelco ADSL 2Mb Broadband	251	243	239	240	241	240	240	241	240	243	243	249	250	255	255	260	268	254	249	254	254	256	258	255
Etisalcom ADSL 2Mb eDSL	221	215	214	212	212	211	212	212	212	213	214	215	217	219	220	221	221	217	222	217	220	222	226	222
Kalaam ADSL 2Mb athome	249	244	243	240	240	241	241	242	242	241	245	247	249	253	254	259	265	258	248	251	253	258	256	253
Lightspeed ADSL 2Mb Home 2000	309	286	252	250	245	249	245	252	249	253	254	268	274	280	283	297	299	305	297	305	307	317	308	289
Mena WiMAX 2Mb Boost menaHOME	278	277	275	270	272	269	269	271	274	273	272	274	276	276	281	278	279	280	278	282	284	284	284	283
Nuetel Cable 2Mb Nue-Net	249	247	244	241	242	242	240	242	244	244	246	249	254	256	257	263	263	256	256	260	263	271	269	255
Zain WiMAX 2Mb zain@home	271	267	259	260	261	259	263	262	260	263	265	268	273	274	273	278	279	279	279	280	280	292	286	276

Ping Time (Latency) (Milliseconds)

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.

The shorter the Latency is the better is the performance.

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