هيئة تنظيم الاتصالات
Telecommunications Regulatory Authority

Fixed Broadband Analysis Report
01 October 2012 – 31 December 2012 between 00:00:00 and 24:00:00 Bahrain

Published 07 January 2012

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 of 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 performance 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 quarterly 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 residential 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 the contractor.

Diagram 1 provides a overview of the system that has been implemented. For the sake of simplicity only three of the eight ISPs connected to the platform and only one of the Epitiro Ltd endpoints have been illustrated.

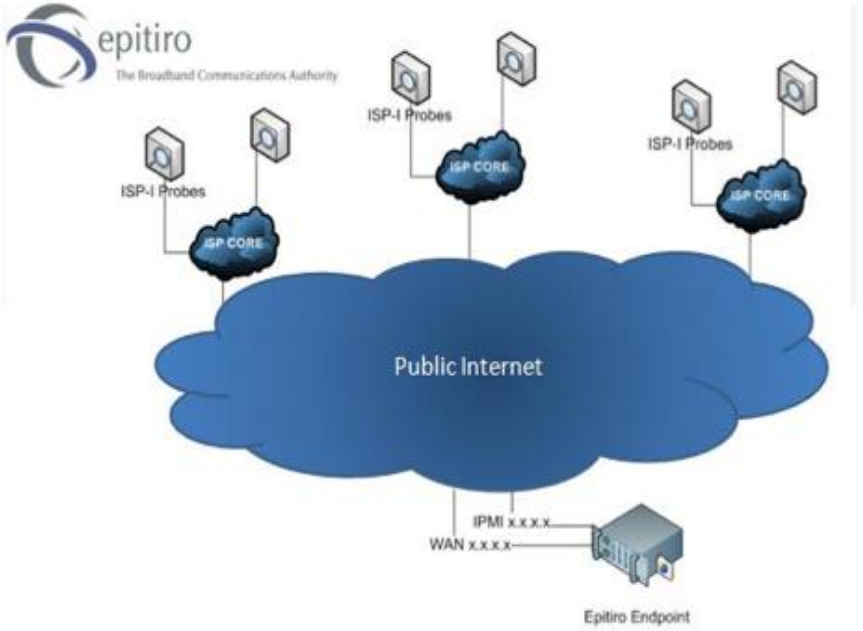


Diagram 1 - Broadband Quality of Service test platform overview

Noticeable events this Quarter

Average TCP download performance slightly increased to 1.64 Mbps compared to last quarter 1.56 Mbps.

Average TCP upload speed remained stable compared to last quarter at 0.65 Mbps.

Average HTTP performance over the quarter reached 39.46 kBytes/s for cache and 24.95 kBytes/s for non cache.

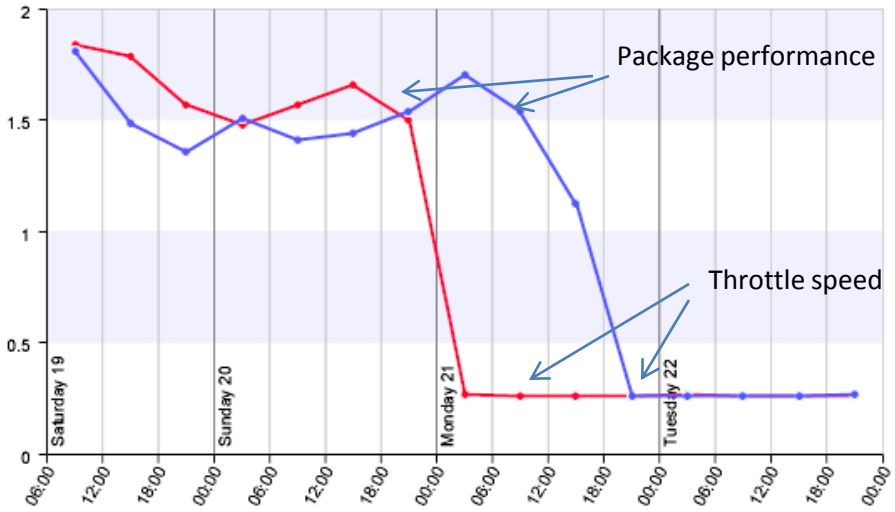
Average Domain Name Server resolution reduced to 47 milliseconds compared to 56 milliseconds last quarter.

Network latency (ping) performance has stabilized compared to last quarter.

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

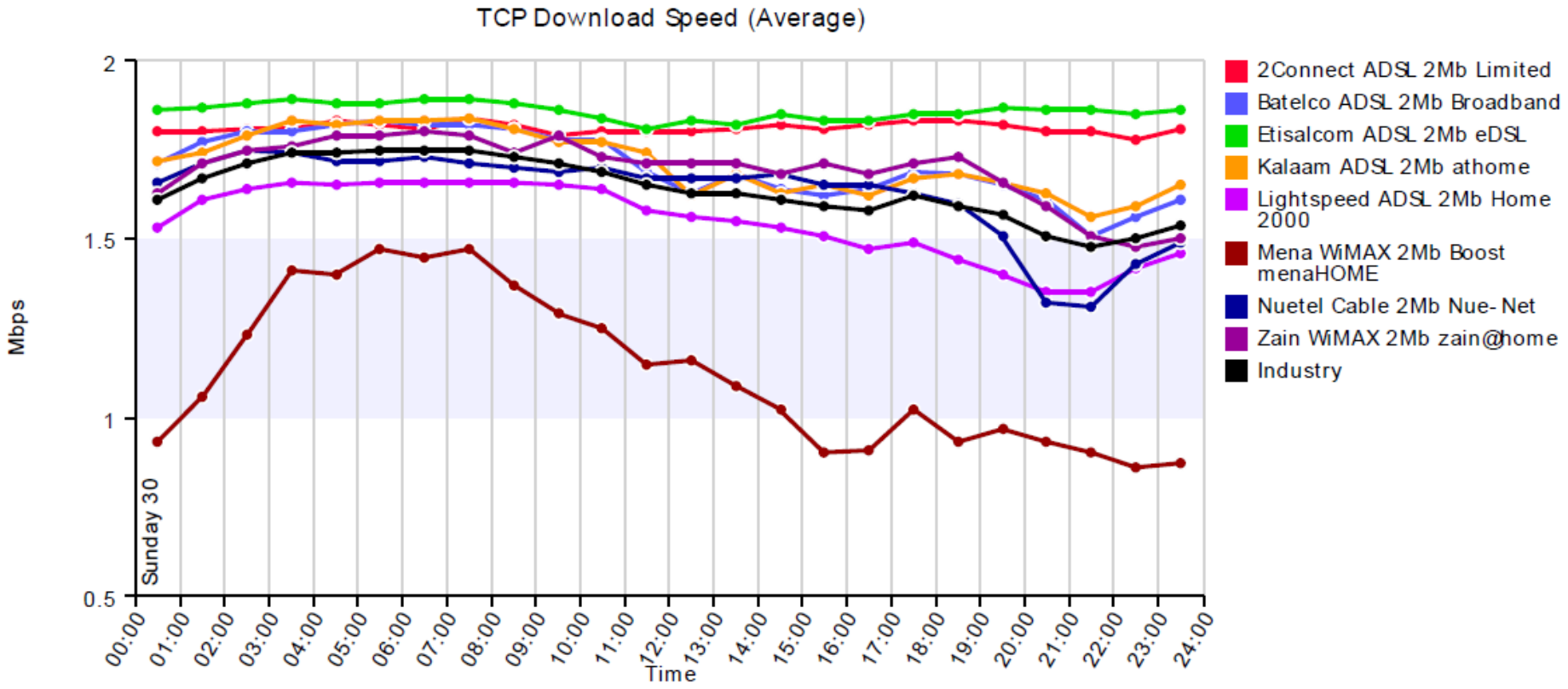
The following pages present the result of measurements taken every hour for each audited service during the period of Q4 2012, from 00:00:00 on the 1 October 2012 to 24:00:00 on the 31 December 2012.

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 Oct 2012 - 31 Dec 2012, between 00:00:00 and 24:00:00 Asia/Bahrain



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

01 Oct 2012 - 31 Dec 2012, between 00:00:00 and 24:00:00 Asia/Bahrain

	00:00, 30 Sep	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	1.80	1.80	1.81	1.81	1.83	1.82	1.81	1.84	1.82	1.79	1.80	1.80	1.80	1.81	1.82	1.81	1.82	1.83	1.83	1.82	1.80	1.80	1.78	1.81
Batelco ADSL 2Mb Broadband	1.71	1.77	1.80	1.80	1.82	1.83	1.82	1.82	1.81	1.78	1.78	1.69	1.63	1.68	1.64	1.62	1.64	1.69	1.68	1.65	1.61	1.51	1.56	1.61
Etisalcom ADSL 2Mb eDSL	1.86	1.87	1.88	1.89	1.88	1.88	1.89	1.89	1.88	1.86	1.84	1.81	1.83	1.82	1.85	1.83	1.83	1.85	1.85	1.87	1.86	1.86	1.85	1.86
Kalaam ADSL 2Mb athome	1.72	1.74	1.79	1.83	1.82	1.83	1.83	1.84	1.81	1.77	1.77	1.74	1.62	1.68	1.63	1.65	1.62	1.67	1.68	1.66	1.63	1.56	1.59	1.65
Lightspeed ADSL 2Mb Home 2000	1.53	1.61	1.64	1.66	1.65	1.66	1.66	1.66	1.66	1.65	1.64	1.58	1.56	1.55	1.53	1.51	1.47	1.49	1.44	1.40	1.35	1.35	1.42	1.46
Mena WiMAX 2Mb Boost menaHOME	0.93	1.06	1.23	1.41	1.40	1.47	1.45	1.47	1.37	1.29	1.25	1.15	1.16	1.09	1.02	0.90	0.91	1.02	0.93	0.97	0.93	0.90	0.86	0.87
Nuetel Cable 2Mb Nue-Net	1.66	1.71	1.75	1.74	1.72	1.72	1.73	1.71	1.70	1.69	1.70	1.67	1.67	1.67	1.68	1.65	1.65	1.63	1.60	1.51	1.32	1.31	1.43	1.49
Zain WiMAX 2Mb zain@home	1.63	1.71	1.75	1.76	1.79	1.79	1.80	1.79	1.74	1.79	1.73	1.71	1.71	1.71	1.68	1.71	1.68	1.71	1.73	1.66	1.59	1.51	1.48	1.50

TCP download measurements (Mbit/s)

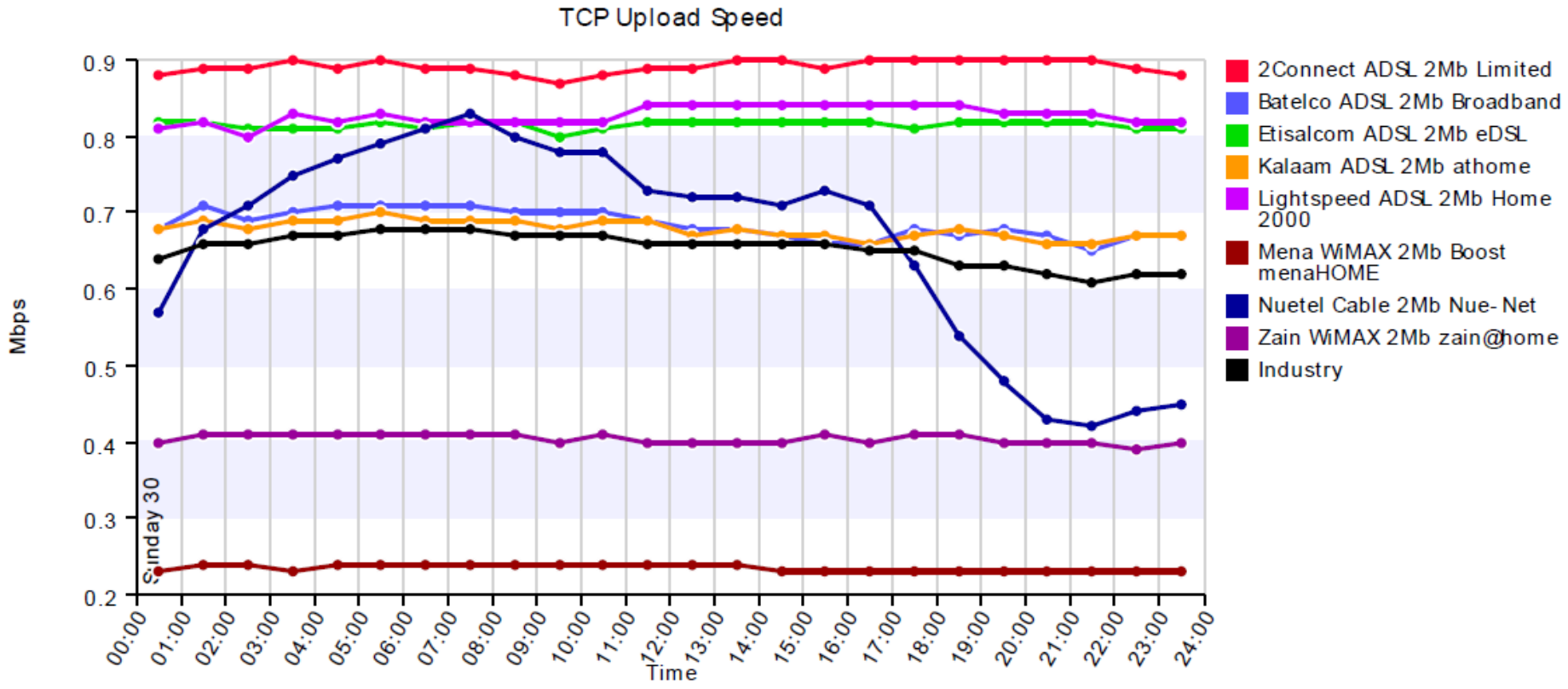
TCP (Transfer Control Protocol) throughput tests measuring download speeds are conducted at a raw socket level (a socket that allows access to the underlying transport provider (ISP) that is supported by protocols such as IPv4 and IPv6) in order to test the full capacity of the connection. The probe 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 Oct 2012 - 31 Dec 2012, between 00:00:00 and 24:00:00 Asia/Bahrain



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

01 Oct 2012 - 31 Dec 2012, between 00:00:00 and 24:00:00 Asia/Bahrain

	00:00, 30 Sep	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	0.88	0.89	0.89	0.90	0.89	0.90	0.89	0.89	0.88	0.87	0.88	0.89	0.89	0.90	0.90	0.89	0.90	0.90	0.90	0.90	0.90	0.90	0.89	0.88
Batelco ADSL 2Mb Broadband	0.68	0.71	0.69	0.70	0.71	0.71	0.71	0.71	0.70	0.70	0.70	0.69	0.68	0.68	0.67	0.66	0.66	0.68	0.67	0.68	0.67	0.65	0.67	0.67
Etisalcom ADSL 2Mb eDSL	0.82	0.82	0.81	0.81	0.81	0.82	0.81	0.82	0.82	0.80	0.81	0.82	0.82	0.82	0.82	0.82	0.82	0.81	0.82	0.82	0.82	0.82	0.81	0.81
Kalaam ADSL 2Mb athome	0.68	0.69	0.68	0.69	0.69	0.70	0.69	0.69	0.69	0.68	0.69	0.69	0.67	0.68	0.67	0.67	0.66	0.67	0.68	0.67	0.66	0.66	0.67	0.67
Lightspeed ADSL 2Mb Home 2000	0.81	0.82	0.80	0.83	0.82	0.83	0.82	0.82	0.82	0.82	0.82	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.83	0.83	0.83	0.82	0.82
Mena WiMAX 2Mb Boost menaHOME	0.23	0.24	0.24	0.23	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Nuetel Cable 2Mb Nue-Net	0.57	0.68	0.71	0.75	0.77	0.79	0.81	0.83	0.80	0.78	0.78	0.73	0.72	0.72	0.71	0.73	0.71	0.63	0.54	0.48	0.43	0.42	0.44	0.45
Zain WiMAX 2Mb zain@home	0.40	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.40	0.41	0.40	0.40	0.40	0.40	0.41	0.40	0.41	0.41	0.40	0.40	0.40	0.39	0.40

TCP upload measurements (Mbits/s)

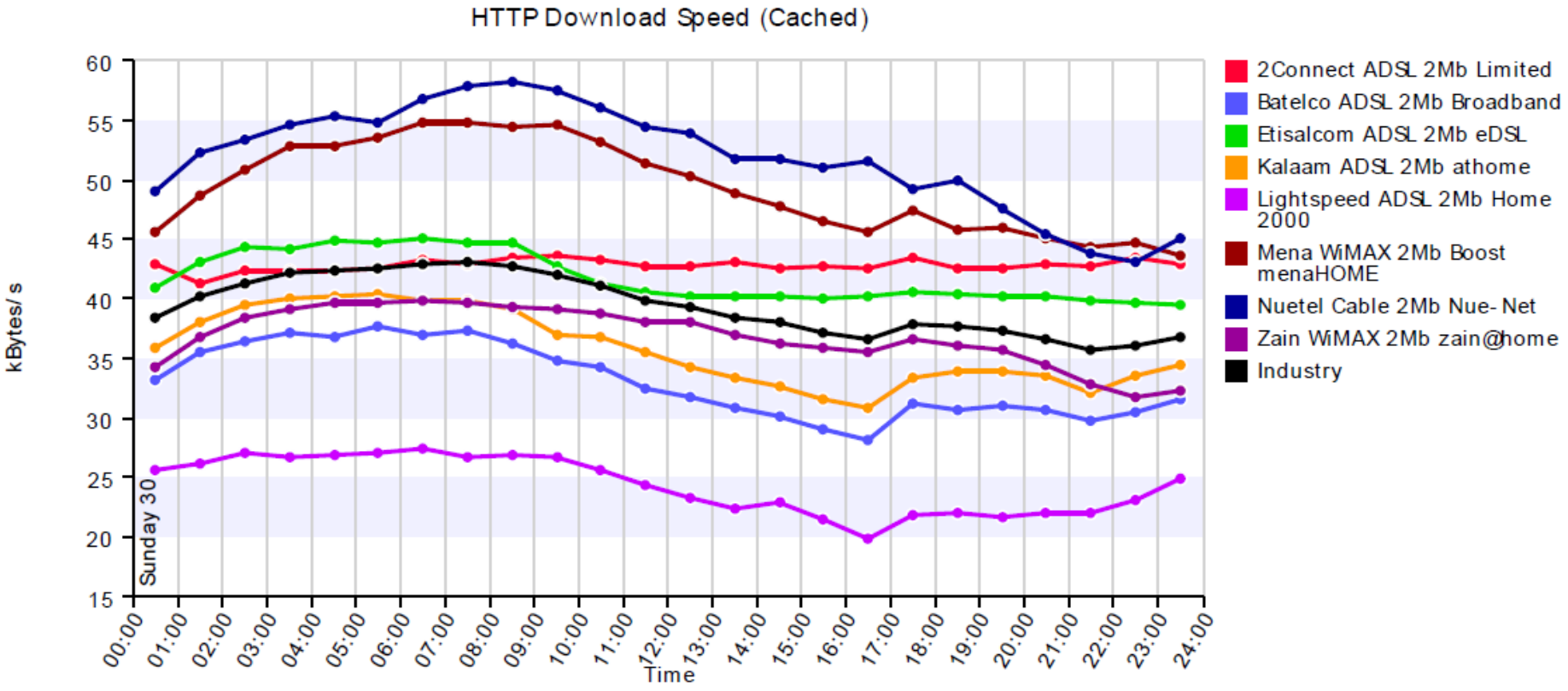
TCP (Transfer Control Protocol) throughput tests measuring upload speeds are conducted at a raw socket level (a socket that allows access to the underlying transport provider (ISP) that is supported by protocols such as IPv4 and IPv6) in order to test the full capacity of the connection. The probe is 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 Oct 2012 - 31 Dec 2012, between 00:00:00 and 24:00:00 Asia/Bahrain



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

01 Oct 2012 - 31 Dec 2012, between 00:00:00 and 24:00:00 Asia/Bahrain

	00:00, 30 Sep	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	42.91	41.36	42.38	42.41	42.37	42.59	43.20	42.94	43.43	43.57	43.29	42.68	42.80	43.06	42.54	42.79	42.55	43.35	42.47	42.45	42.98	42.79	43.48	42.93
Batelco ADSL 2Mb Broadband	33.26	35.48	36.35	37.17	36.87	37.68	37.02	37.31	36.19	34.81	34.29	32.51	31.75	30.90	30.16	29.05	28.21	31.24	30.67	30.94	30.68	29.76	30.39	31.50
Etisalcom ADSL 2Mb eDSL	40.93	43.15	44.26	44.12	44.84	44.66	45.02	44.64	44.65	42.78	41.23	40.59	40.27	40.17	40.20	40.03	40.12	40.57	40.43	40.22	40.19	39.87	39.68	39.56
Kalaam ADSL 2Mb athome	35.82	38.11	39.44	40.07	40.24	40.32	39.76	39.84	39.06	37.03	36.75	35.50	34.25	33.41	32.60	31.57	30.79	33.32	33.86	33.86	33.48	32.12	33.51	34.43
Lightspeed ADSL 2Mb Home 2000	25.61	26.11	27.05	26.68	26.81	27.08	27.35	26.79	26.92	26.69	25.63	24.27	23.25	22.45	22.93	21.41	19.90	21.84	22.04	21.71	22.00	22.06	23.10	24.93
Mena WiMAX 2Mb Boost menaHOME	45.62	48.70	50.82	52.82	52.83	53.51	54.84	54.86	54.48	54.62	53.15	51.40	50.34	48.84	47.76	46.42	45.67	47.47	45.85	45.94	45.12	44.30	44.65	43.66
Nuetel Cable 2Mb Nue-Net	48.96	52.23	53.37	54.65	55.24	54.86	56.82	57.88	58.22	57.48	56.06	54.46	53.81	51.79	51.73	51.00	51.46	49.16	49.90	47.59	45.37	43.81	43.02	45.12
Zain WiMAX 2Mb zain@home	34.28	36.80	38.35	39.09	39.59	39.69	39.82	39.72	39.33	39.20	38.68	37.97	37.99	36.96	36.17	35.90	35.49	36.69	36.08	35.72	34.38	32.88	31.69	32.33

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

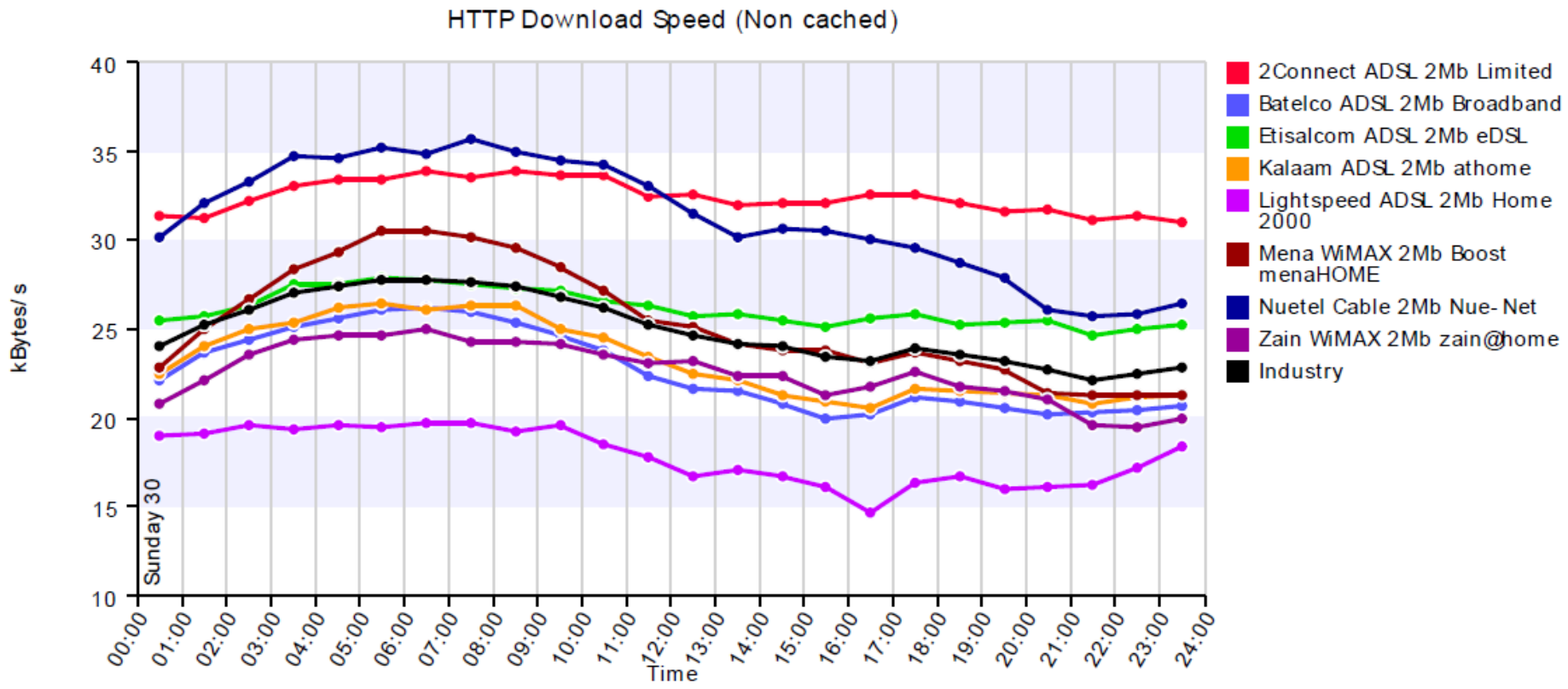
The HTTP (HyperText Transfer Protocol) test makes a request to a specified URL (Uniform Resource Locator) and records the time taken and the amount of data downloaded, from which the speed of the download is derived. Depending on the configuration of the test, test probe is also able to download the 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 Oct 2012 - 31 Dec 2012, between 00:00:00 and 24:00:00 Asia/Bahrain



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

01 Oct 2012 - 31 Dec 2012, between 00:00:00 and 24:00:00 Asia/Bahrain

	00:00, 30 Sep	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	31.38	31.25	32.20	33.04	33.44	33.45	33.87	33.53	33.90	33.61	33.62	32.48	32.55	32.01	32.06	32.07	32.61	32.53	32.10	31.64	31.76	31.17	31.30	30.95
Batelco ADSL 2Mb Broadband	22.08	23.67	24.35	25.06	25.61	26.07	26.15	25.91	25.35	24.61	23.75	22.31	21.66	21.49	20.84	19.91	20.15	21.13	20.86	20.54	20.25	20.27	20.38	20.72
Etisalcom ADSL 2Mb eDSL	25.45	25.74	26.26	27.46	27.53	27.84	27.75	27.46	27.24	27.16	26.51	26.30	25.67	25.86	25.45	25.14	25.58	25.88	25.27	25.38	25.44	24.63	24.99	25.27
Kalaam ADSL 2Mb athome	22.47	24.07	25.01	25.32	26.17	26.47	26.08	26.33	26.27	25.05	24.46	23.49	22.51	22.16	21.26	20.94	20.60	21.59	21.57	21.35	21.24	20.82	21.16	21.28
Lightspeed ADSL 2Mb Home 2000	18.99	19.13	19.61	19.36	19.63	19.51	19.68	19.71	19.27	19.58	18.54	17.79	16.72	17.12	16.70	16.13	14.71	16.40	16.72	15.96	16.07	16.22	17.17	18.42
Mena WiMAX 2Mb Boost menaHOME	22.83	25.05	26.66	28.38	29.33	30.49	30.55	30.18	29.51	28.46	27.18	25.46	25.11	24.21	23.78	23.81	23.03	23.65	23.17	22.77	21.43	21.31	21.29	21.29
Nuetel Cable 2Mb Nue-Net	30.20	32.02	33.31	34.67	34.59	35.18	34.88	35.71	34.94	34.47	34.21	33.02	31.52	30.20	30.61	30.52	30.01	29.53	28.70	27.91	26.11	25.74	25.85	26.46
Zain WiMAX 2Mb zain@home	20.77	22.08	23.57	24.37	24.68	24.69	25.01	24.23	24.26	24.13	23.51	23.11	23.23	22.38	22.39	21.30	21.73	22.58	21.77	21.50	21.06	19.63	19.51	19.93

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

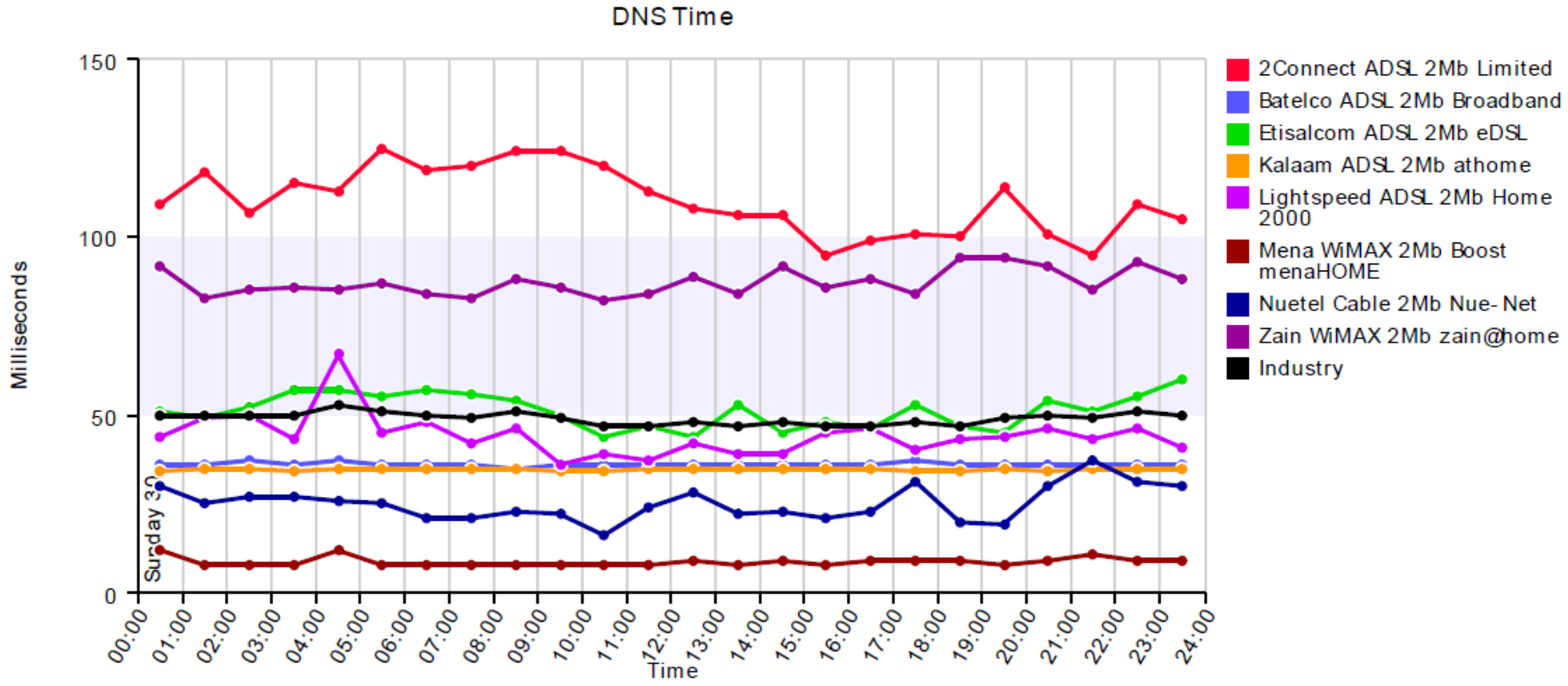
The HTTP (HyperText Transfer Protocol) test makes a request to a specified URL (Uniform Resource Locator) and records the time taken and the amount of data downloaded, from which the speed of the download is derived. Depending on the configuration of the test, test probe is also able to download the 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 Oct 2012 - 31 Dec 2012, between 00:00:00 and 24:00:00 Asia/Bahrain



DNS Time Line Chart Values (Peer view)

01 Oct 2012 - 31 Dec 2012, between 00:00:00 and 24:00:00 Asia/Bahrain

	00:00, 30 Sep	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	109	118	107	115	113	125	119	120	124	124	120	113	108	106	106	95	99	101	100	114	101	95	109	105
Batelco ADSL 2Mb Broadband	36	36	37	36	37	36	36	36	35	36	36	36	36	36	36	36	36	37	36	36	36	36	36	36
Etisalcom ADSL 2Mb eDSL	51	49	52	57	57	55	57	56	54	50	44	47	44	53	45	48	46	53	47	45	54	51	55	60
Kalaam ADSL 2Mb athome	34	35	35	34	35	35	35	35	35	34	34	35	35	35	35	35	35	34	34	35	34	35	35	35
Lightspeed ADSL 2Mb Home 2000	44	49	50	43	67	45	48	42	46	36	39	37	42	39	39	45	46	40	43	44	46	43	46	41
Mena WiMAX 2Mb Boost menaHOME	12	8	8	8	12	8	8	8	8	8	8	8	9	8	9	8	9	9	9	8	9	11	9	9
Nuetel Cable 2Mb Nue-Net	30	25	27	27	26	25	21	21	23	22	16	24	28	22	23	21	23	31	20	19	30	37	31	30
Zain WiMAX 2Mb zain@home	92	83	85	86	85	87	84	83	88	86	82	84	89	84	92	86	88	84	94	94	92	85	93	88

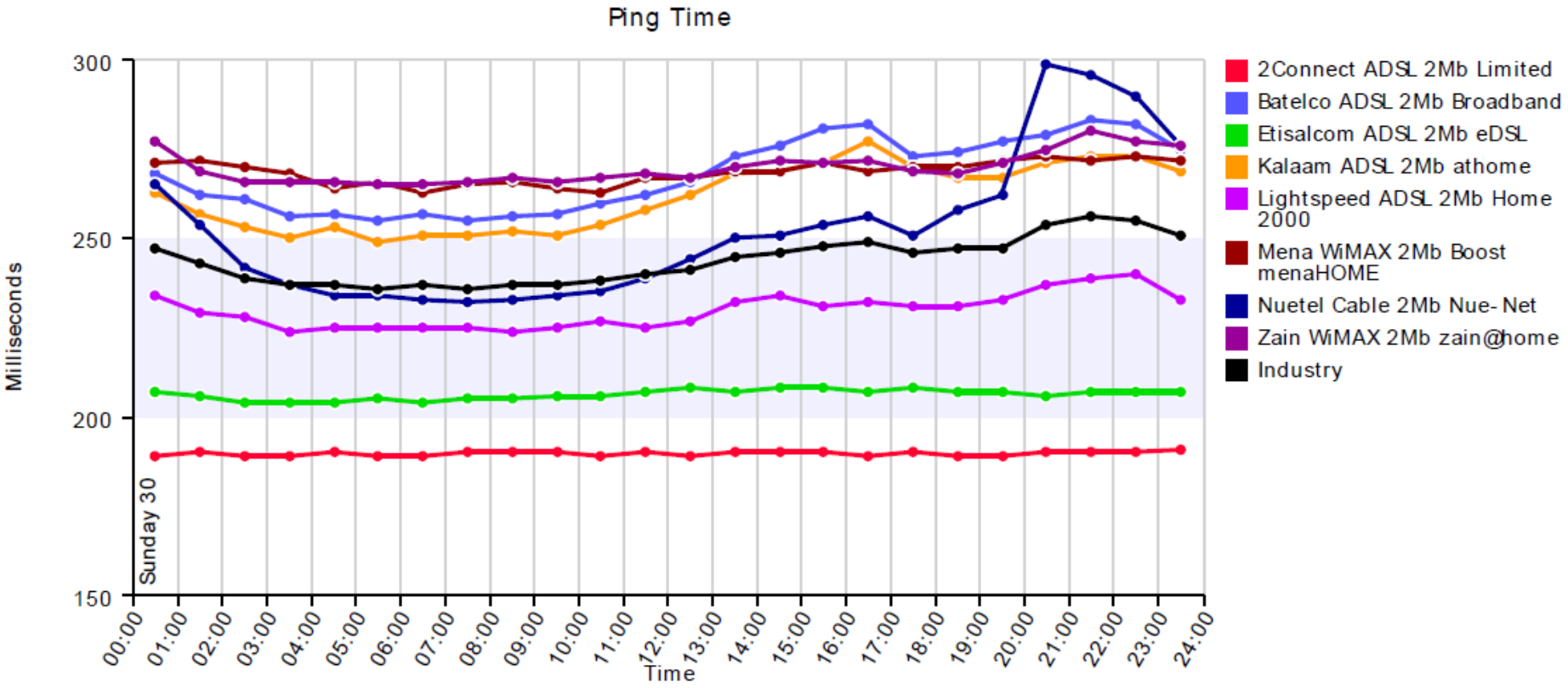
DNS Time (Domain Name System) (Milliseconds)

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 Oct 2012 - 31 Dec 2012, between 00:00:00 and 24:00:00 Asia/Bahrain



Ping Time Line Chart Values (Peer view)

01 Oct 2012 - 31 Dec 2012, between 00:00:00 and 24:00:00 Asia/Bahrain

	00:00, 30 Sep	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	189	190	189	189	190	189	189	190	190	190	189	190	189	190	190	190	189	190	189	189	190	190	190	191
Batelco ADSL 2Mb Broadband	268	262	261	256	257	255	257	255	256	257	260	262	266	273	276	281	282	273	274	277	279	283	282	275
Etisalcom ADSL 2Mb eDSL	207	206	204	204	204	205	204	205	205	206	206	207	208	207	208	208	207	208	207	207	206	207	207	207
Kalaam ADSL 2Mb athome	263	257	253	250	253	249	251	251	252	251	254	258	262	268	269	271	277	270	267	267	271	273	273	269
Lightspeed ADSL 2Mb Home 2000	234	229	228	224	225	225	225	225	224	225	227	225	227	232	234	231	232	231	231	233	237	239	240	233
Mena WiMAX 2Mb Boost menaHOME	271	272	270	268	264	266	263	265	266	264	263	267	267	269	269	271	269	270	270	272	273	272	273	272
Nuetel Cable 2Mb Nue-Net	265	254	242	237	234	234	233	232	233	234	235	239	244	250	251	254	256	251	258	262	299	296	290	276
Zain WiMAX 2Mb zain@home	277	269	266	266	266	265	265	266	267	266	267	268	267	270	272	271	272	269	268	271	275	280	277	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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