هيئة تنظيم الاتصالات
Telecommunications Regulatory Authority

Fixed Broadband Analysis Report

01 January 2013 – 31 March 2013 between 00:00:00 and 24:00:00 Bahrain

Published 07 April 2013

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.

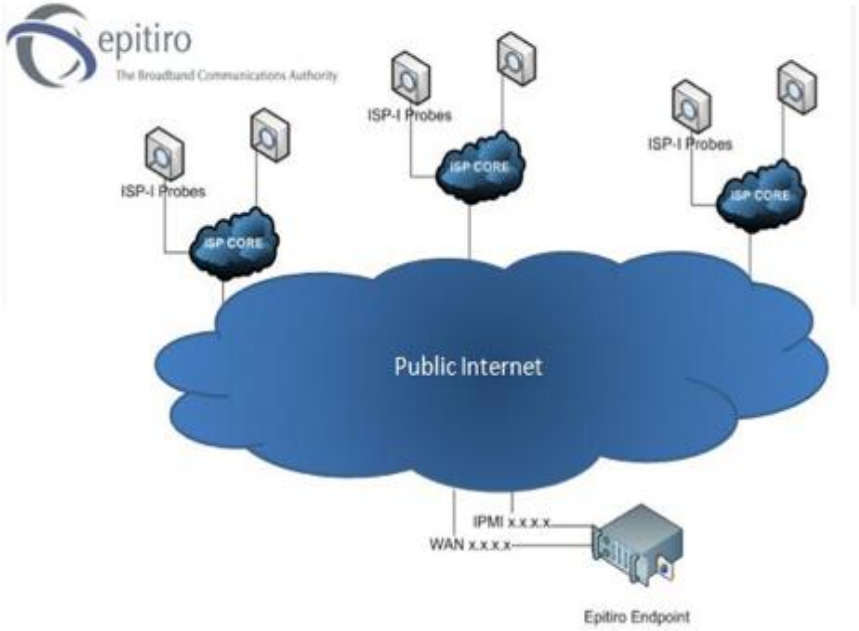


Diagram 1 - Broadband Quality of Service test platform overview

Noticeable events this Quarter

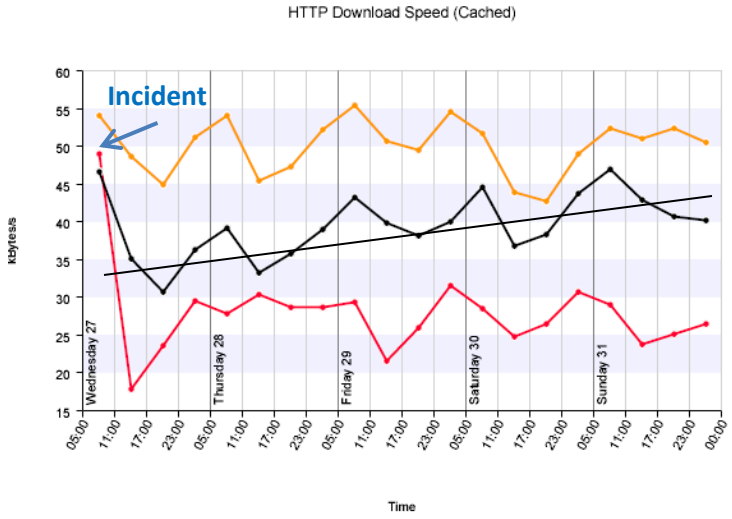
On Thursday 27 Mach 2013 at 10:20 a failure occurred near Egypt coast on the South East Asia-Middle East-West Europe 4 (SMW4) submarine cable system linking South East Asia to Europe via the Indian Sub-Continent and Middle East. This submarine cable support a significant proportion of the Internet flow between the GCC Region, including the Kingdom of Bahrain, with Europe & the USA.

Alternate submarine cable routes are available however due to the existence of other submarine cable outages (transparent to end user QoS experience) either longer routes than the existing had to be used, or congestion occurred. The adverse effect on end users was amplified due to this pre-existing conditions.

The diagram illustrate various levels of impact experienced by end users on one of the metrics monitored, web page download.

Depending of each specific ISP IP transit routing arrangements and network load, QoS experienced since the incident might be very different.

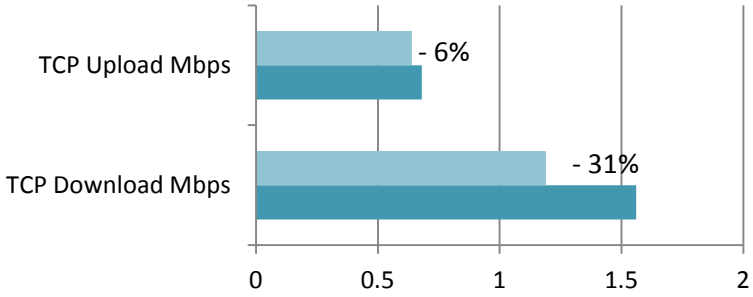
Also the situation is slowly improving, as shown in the industry linear curve, quality of service should be fully back to normal after the two first weeks of April 2013 following repair of the cables.

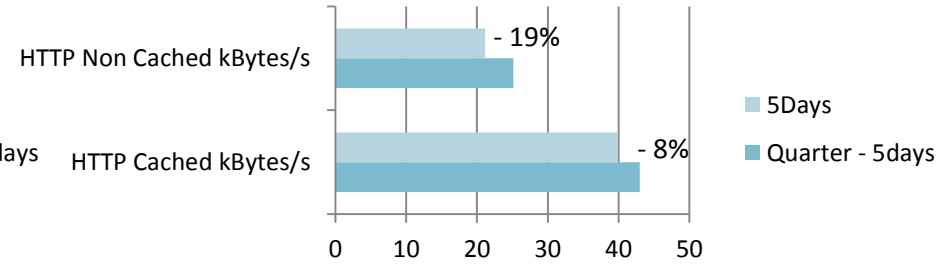


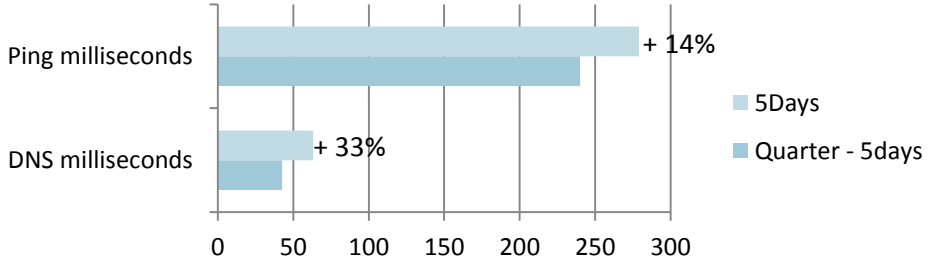
HTTP observed service performance evolution since the incident

Noticeable events this Quarter

The following graphs provides a comparison of observed Industry average performance on measured KPIs over the quarter before the incident (quarter minus 5 days) and since the incident over the 5 days period from 27 March to 31 March.







In terms of statistical representativeness, the quarterly report is based on 4,320 samples for each ISP of which about 216 have been made since the SMW4 cable was disrupted, at the very end period of the Quarter. This represent only 5% of the total number of samples and explain the fact observed average figures in the report are only marginally degraded.

To note in addition to this cable incident the Distributed Denial of Service (DDOS) attach targeting Spamhaus in Europe since middle of March that might have impacted quality of Internet services in Bahrain over the period, when accessing content hosted in Europe and the USA, however no direct link can be established.

RESULTS

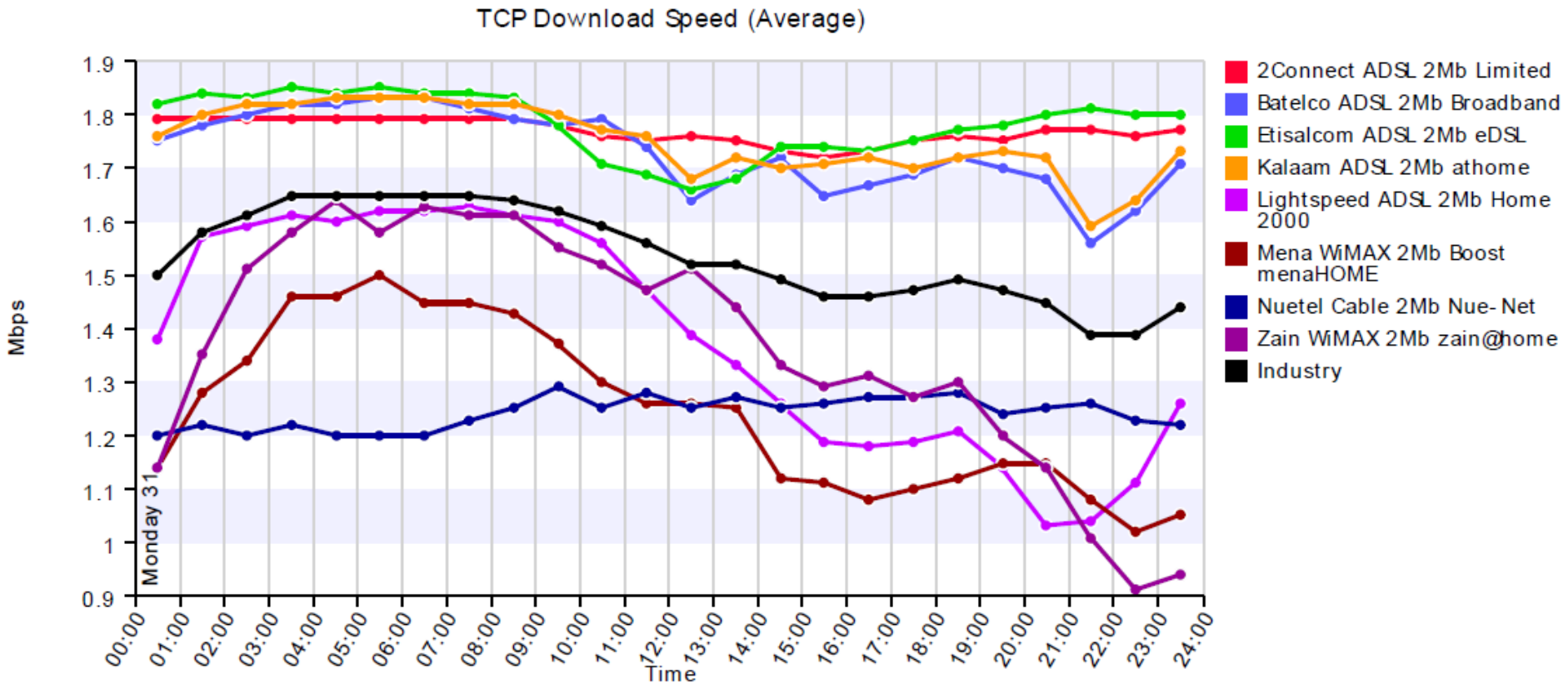
The following pages present the result of measurements taken every hour for each audited service during the period of Q1 2013, from 00:00:00 on the 1 January 2013 to 24:00:00 on the 31 March 2013.

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 2013 - 31 Mar 2013, between 00:00:00 and 24:00:00 Asia/Bahrain



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

01 Jan 2013 - 31 Mar 2013, 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	1.79	1.79	1.79	1.79	1.79	1.79	1.79	1.79	1.79	1.78	1.76	1.75	1.76	1.75	1.73	1.72	1.73	1.75	1.76	1.75	1.77	1.77	1.76	1.77
Batelco ADSL 2Mb Broadband	1.75	1.78	1.80	1.82	1.82	1.83	1.83	1.81	1.79	1.78	1.79	1.74	1.64	1.69	1.72	1.65	1.67	1.69	1.72	1.70	1.68	1.56	1.62	1.71
Etisalcom ADSL 2Mb eDSL	1.82	1.84	1.83	1.85	1.84	1.85	1.84	1.84	1.83	1.78	1.71	1.69	1.66	1.68	1.74	1.74	1.73	1.75	1.77	1.78	1.80	1.81	1.80	1.80
Kalaam ADSL 2Mb athome	1.76	1.80	1.82	1.82	1.83	1.83	1.83	1.82	1.82	1.80	1.77	1.76	1.68	1.72	1.70	1.71	1.72	1.70	1.72	1.73	1.72	1.59	1.64	1.73
Lightspeed ADSL 2Mb Home 2000	1.38	1.57	1.59	1.61	1.60	1.62	1.62	1.63	1.61	1.60	1.56	1.47	1.39	1.33	1.26	1.19	1.18	1.19	1.21	1.14	1.03	1.04	1.11	1.26
Mena WiMAX 2Mb Boost menaHOME	1.14	1.28	1.34	1.46	1.46	1.50	1.45	1.45	1.43	1.37	1.30	1.26	1.26	1.25	1.12	1.11	1.08	1.10	1.12	1.15	1.15	1.08	1.02	1.05
Nuetel Cable 2Mb Nue-Net	1.20	1.22	1.20	1.22	1.20	1.20	1.20	1.23	1.25	1.29	1.25	1.28	1.25	1.27	1.25	1.26	1.27	1.27	1.28	1.24	1.25	1.26	1.23	1.22
Zain WiMAX 2Mb zain@home	1.14	1.35	1.51	1.58	1.64	1.58	1.63	1.61	1.61	1.55	1.52	1.47	1.51	1.44	1.33	1.29	1.31	1.27	1.30	1.20	1.14	1.01	0.91	0.94

TCP download measurements (Mbit/s)

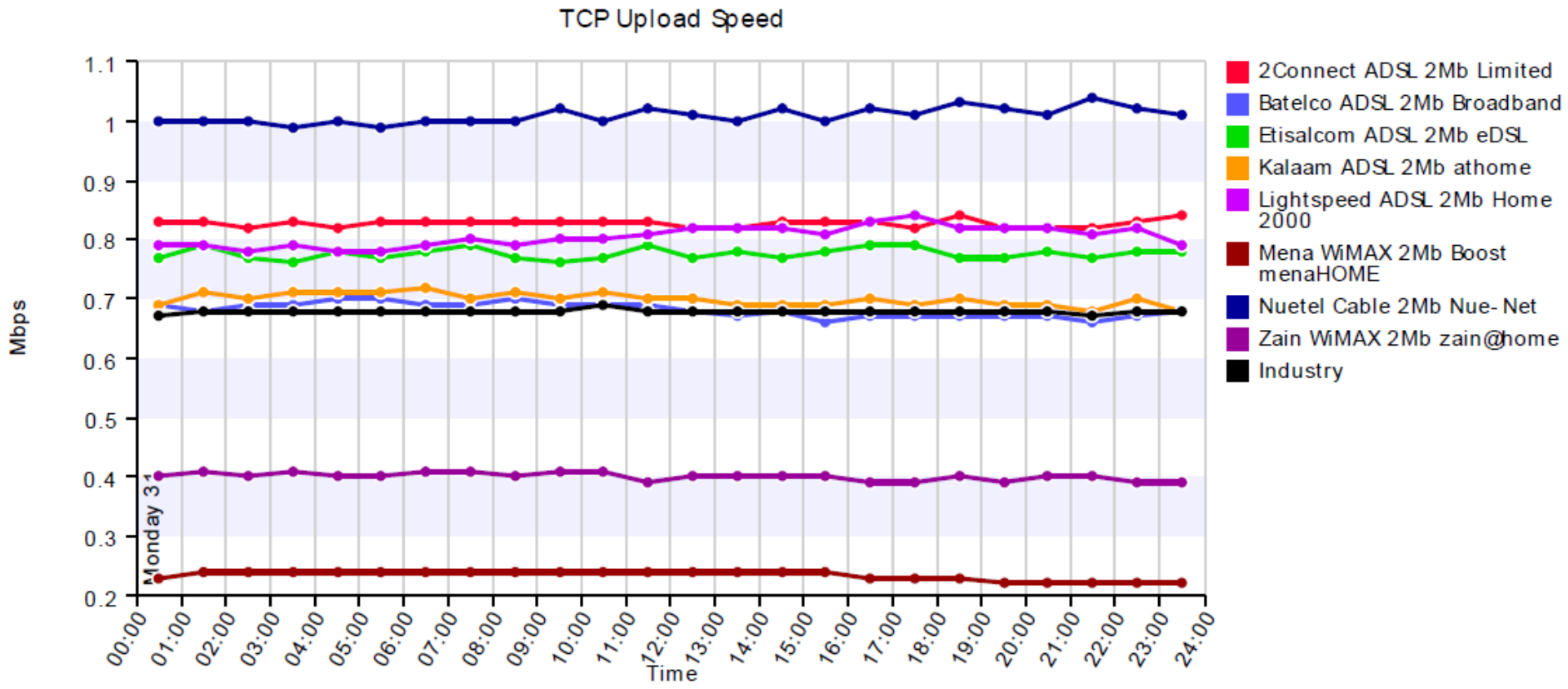
TCP (Transfer Control Protocol) throughput tests measuring download speeds are conducted at a raw socket level (a socket that allows access to the underlying transport provider (ISP) that is supported by protocols such as IPv4 and IPv6) in order to test the full capacity of the connection. The probe 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 2013 - 31 Mar 2013, between 00:00:00 and 24:00:00 Asia/Bahrain



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

01 Jan 2013 - 31 Mar 2013, 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	0.83	0.83	0.82	0.83	0.82	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.82	0.82	0.83	0.83	0.83	0.82	0.84	0.82	0.82	0.82	0.83	0.84
Batelco ADSL 2Mb Broadband	0.69	0.68	0.69	0.69	0.70	0.70	0.69	0.69	0.70	0.69	0.69	0.69	0.68	0.67	0.68	0.66	0.67	0.67	0.67	0.67	0.67	0.66	0.67	0.68
Etisalcom ADSL 2Mb eDSL	0.77	0.79	0.77	0.76	0.78	0.77	0.78	0.79	0.77	0.76	0.77	0.79	0.77	0.78	0.77	0.78	0.79	0.79	0.77	0.77	0.78	0.77	0.78	0.78
Kalaam ADSL 2Mb athome	0.69	0.71	0.70	0.71	0.71	0.71	0.72	0.70	0.71	0.70	0.71	0.70	0.70	0.69	0.69	0.69	0.70	0.69	0.70	0.69	0.69	0.68	0.70	0.68
Lightspeed ADSL 2Mb Home 2000	0.79	0.79	0.78	0.79	0.78	0.78	0.79	0.80	0.79	0.80	0.80	0.81	0.82	0.82	0.82	0.81	0.83	0.84	0.82	0.82	0.82	0.81	0.82	0.79
Mena WiMAX 2Mb Boost menaHOME	0.23	0.24	0.24	0.24	0.24	0.24	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	0.22	0.22	0.22	0.22	0.22
Nuetel Cable 2Mb Nue-Net	1.00	1.00	1.00	0.99	1.00	0.99	1.00	1.00	1.00	1.02	1.00	1.02	1.01	1.00	1.02	1.00	1.02	1.01	1.03	1.02	1.01	1.04	1.02	1.01
Zain WiMAX 2Mb zain@home	0.40	0.41	0.40	0.41	0.40	0.40	0.41	0.41	0.40	0.41	0.41	0.39	0.40	0.40	0.40	0.40	0.39	0.39	0.40	0.39	0.40	0.40	0.39	0.39

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.

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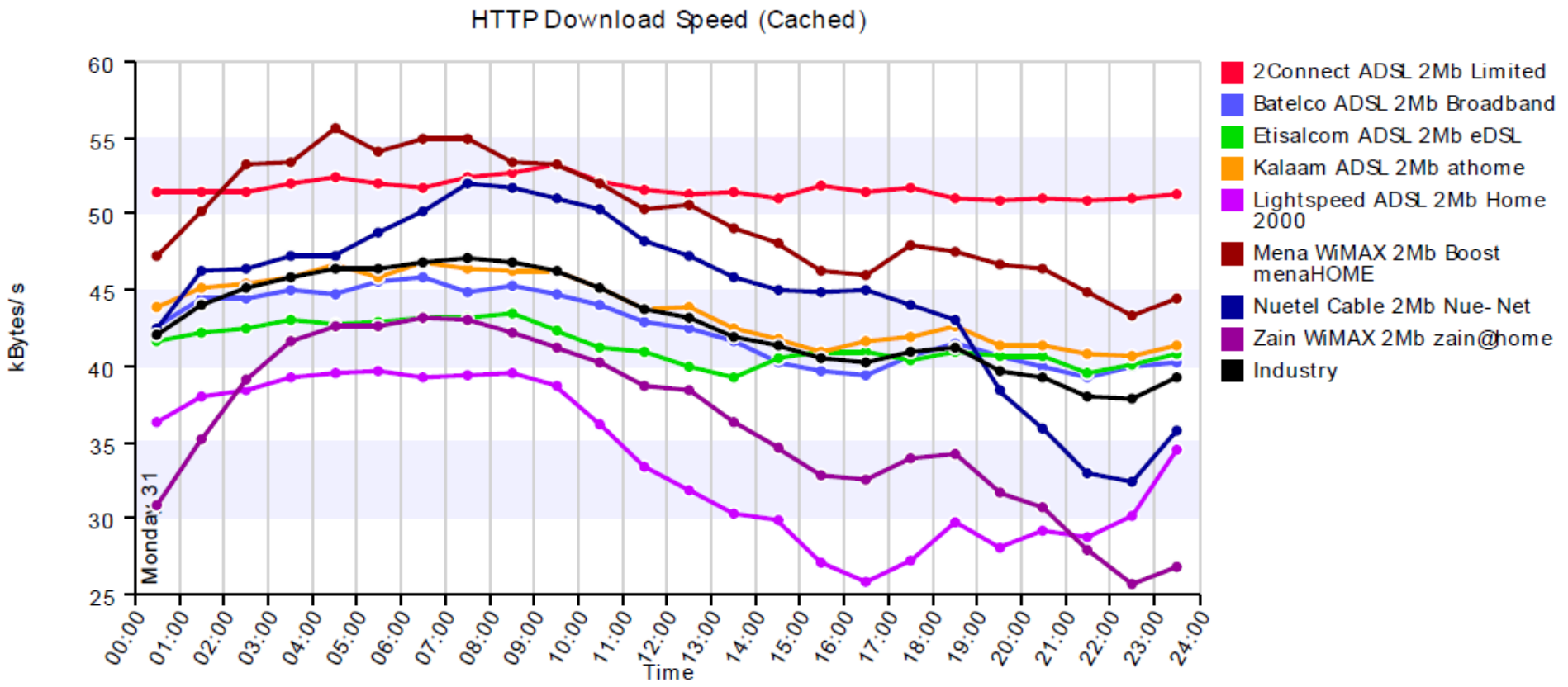
The higher is the upload speed the better is the performance.

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

01 Jan 2013 - 31 Mar 2013, between 00:00:00 and 24:00:00 Asia/Bahrain



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

01 Jan 2013 - 31 Mar 2013, 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	51.52	51.48	51.49	51.95	52.38	51.95	51.76	52.45	52.74	53.24	52.18	51.66	51.25	51.39	50.98	51.88	51.45	51.73	51.06	50.94	51.07	50.87	51.01	51.28
Batelco ADSL 2Mb Broadband	42.59	44.39	44.46	44.95	44.79	45.55	45.88	44.83	45.23	44.80	44.07	42.86	42.54	41.72	40.25	39.69	39.44	40.63	41.58	40.69	40.05	39.34	40.05	40.29
Etisalcom ADSL 2Mb eDSL	41.61	42.19	42.46	43.10	42.80	42.88	43.18	43.25	43.47	42.34	41.23	41.01	39.96	39.21	40.54	40.98	41.02	40.40	40.89	40.63	40.63	39.52	40.10	40.78
Kalaam ADSL 2Mb athome	43.90	45.18	45.49	45.79	46.63	45.83	46.83	46.47	46.28	46.32	45.20	43.75	43.84	42.48	41.81	41.02	41.62	41.98	42.58	41.31	41.39	40.82	40.68	41.33
Lightspeed ADSL 2Mb Home 2000	36.37	38.06	38.41	39.25	39.58	39.65	39.29	39.45	39.57	38.69	36.14	33.34	31.89	30.36	29.95	27.05	25.81	27.29	29.78	28.08	29.17	28.84	30.17	34.47
Mena WiMAX 2Mb Boost menaHOME	47.25	50.15	53.29	53.42	55.59	54.09	54.89	55.02	53.36	53.30	51.96	50.27	50.58	49.08	48.13	46.24	46.05	47.96	47.52	46.63	46.36	44.85	43.40	44.43
Nuetel Cable 2Mb Nue-Net	42.44	46.24	46.35	47.27	47.28	48.79	50.13	52.08	51.72	51.05	50.33	48.30	47.30	45.82	45.02	44.94	45.03	44.09	43.12	38.38	35.88	32.94	32.37	35.78
Zain WiMAX 2Mb zain@home	30.90	35.25	39.13	41.73	42.67	42.65	43.26	43.04	42.26	41.30	40.32	38.74	38.48	36.31	34.59	32.89	32.56	34.00	34.30	31.76	30.77	27.98	25.70	26.87

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

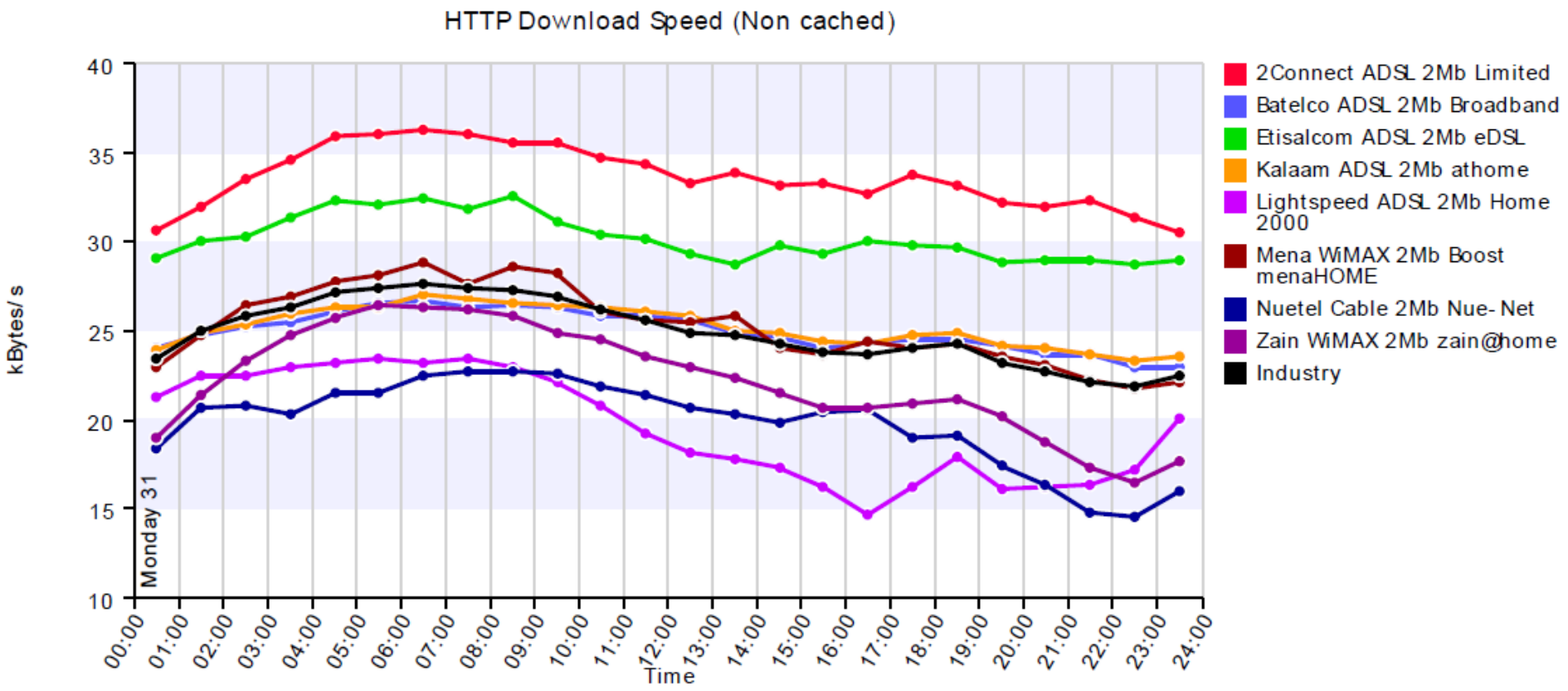
The HTTP (HyperText Transfer Protocol) test makes a request to a specified URL (Uniform Resource Locator) and records the time taken and the amount of data downloaded, from which the speed of the download is derived. Depending on the configuration of the test, test probe is also able to download the 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 2013 - 31 Mar 2013, between 00:00:00 and 24:00:00 Asia/Bahrain



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

01 Jan 2013 - 31 Mar 2013, 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	30.61	31.97	33.48	34.57	35.91	36.06	36.25	36.09	35.52	35.55	34.70	34.37	33.26	33.89	33.10	33.31	32.73	33.79	33.17	32.25	31.93	32.31	31.38	30.48
Batelco ADSL 2Mb Broadband	24.01	24.77	25.21	25.45	26.04	26.59	26.69	26.36	26.41	26.27	25.86	25.79	25.54	24.86	24.62	24.03	24.23	24.56	24.54	24.11	23.63	23.66	23.00	23.01
Etisalcom ADSL 2Mb eDSL	29.04	30.01	30.24	31.34	32.37	32.13	32.47	31.88	32.50	31.15	30.41	30.14	29.26	28.74	29.76	29.33	29.98	29.77	29.70	28.89	28.99	28.94	28.75	28.98
Kalaam ADSL 2Mb athome	23.91	24.92	25.31	25.91	26.28	26.32	27.02	26.82	26.61	26.39	26.31	26.04	25.81	25.01	24.85	24.35	24.28	24.81	24.91	24.12	24.01	23.71	23.31	23.50
Lightspeed ADSL 2Mb Home 2000	21.23	22.43	22.51	23.01	23.22	23.39	23.14	23.43	22.93	22.16	20.75	19.29	18.16	17.83	17.29	16.27	14.73	16.29	17.94	16.09	16.18	16.32	17.15	20.05
Mena WiMAX 2Mb Boost menaHOME	22.94	24.79	26.47	26.90	27.74	28.08	28.80	27.63	28.60	28.18	26.13	25.65	25.46	25.78	24.09	23.64	24.42	24.07	24.32	23.50	23.12	22.20	21.75	22.09
Nuetel Cable 2Mb Nue-Net	18.44	20.66	20.76	20.35	21.46	21.53	22.46	22.77	22.70	22.57	21.88	21.42	20.73	20.33	19.80	20.40	20.50	19.03	19.11	17.45	16.38	14.75	14.58	15.95
Zain WiMAX 2Mb zain@home	19.05	21.35	23.31	24.74	25.68	26.49	26.30	26.18	25.86	24.92	24.49	23.54	22.97	22.31	21.55	20.68	20.72	20.92	21.13	20.19	18.77	17.38	16.48	17.66

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

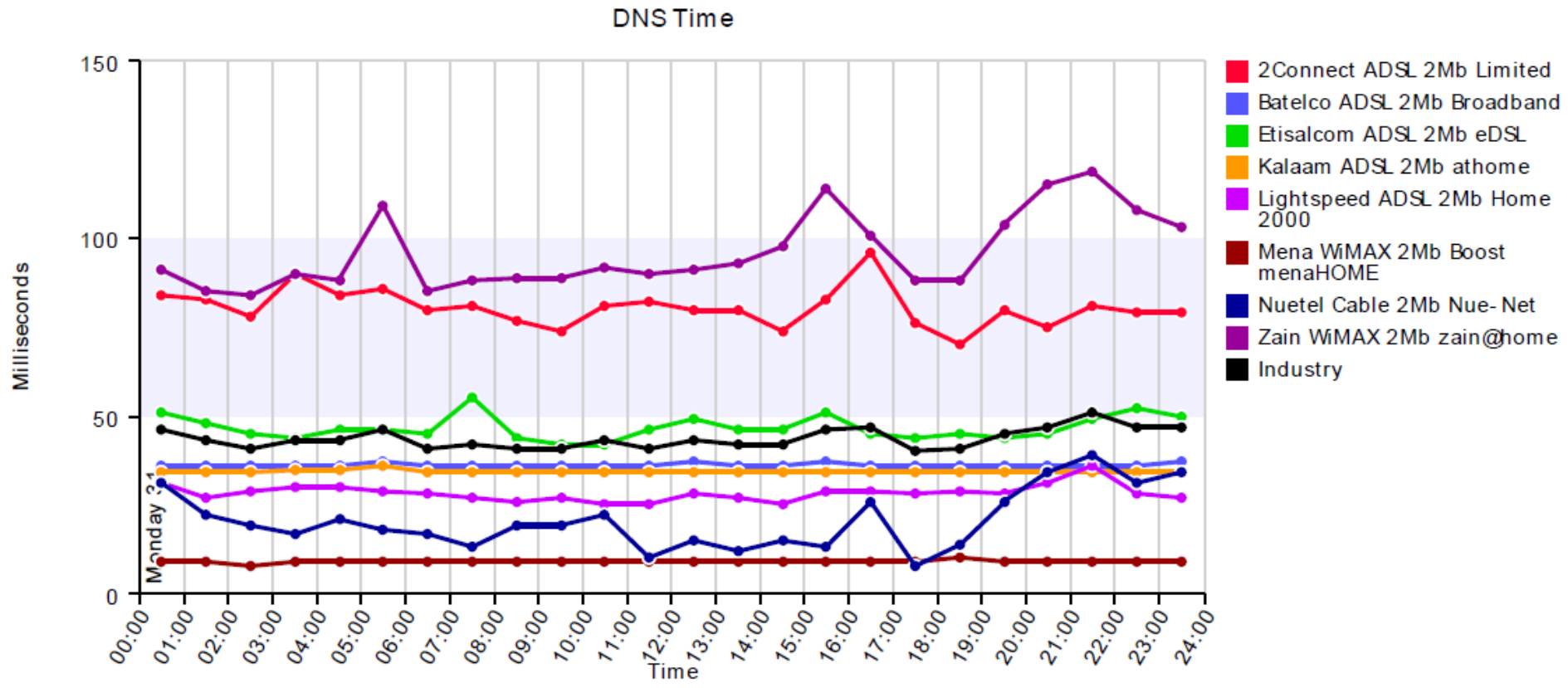
The HTTP (HyperText Transfer Protocol) test makes a request to a specified URL (Uniform Resource Locator) and records the time taken and the amount of data downloaded, from which the speed of the download is derived. Depending on the configuration of the test, test probe is also able to download the 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 2013 - 31 Mar 2013, between 00:00:00 and 24:00:00 Asia/Bahrain



DNS Time Line Chart Values (Peer view)

01 Jan 2013 - 31 Mar 2013, 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	84	83	78	90	84	86	80	81	77	74	81	82	80	80	74	83	96	76	70	80	75	81	79	79
Batelco ADSL 2Mb Broadband	36	36	36	36	36	37	36	36	36	36	36	36	37	36	36	37	36	36	36	36	36	36	36	37
Etisalcom ADSL 2Mb eDSL	51	48	45	44	46	46	45	55	44	42	42	46	49	46	46	51	45	44	45	44	45	49	52	50
Kalaam ADSL 2Mb athome	34	34	34	35	35	36	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34
Lightspeed ADSL 2Mb Home 2000	31	27	29	30	30	29	28	27	26	27	25	25	28	27	25	29	29	28	29	28	31	36	28	27
Mena WiMAX 2Mb Boost menaHOME	9	9	8	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	10	9	9	9	9	9
Nuetel Cable 2Mb Nue-Net	31	22	19	17	21	18	17	13	19	19	22	10	15	12	15	13	26	8	14	26	34	39	31	34
Zain WiMAX 2Mb zain@home	91	85	84	90	88	109	85	88	89	89	92	90	91	93	98	114	101	88	88	104	115	119	108	103

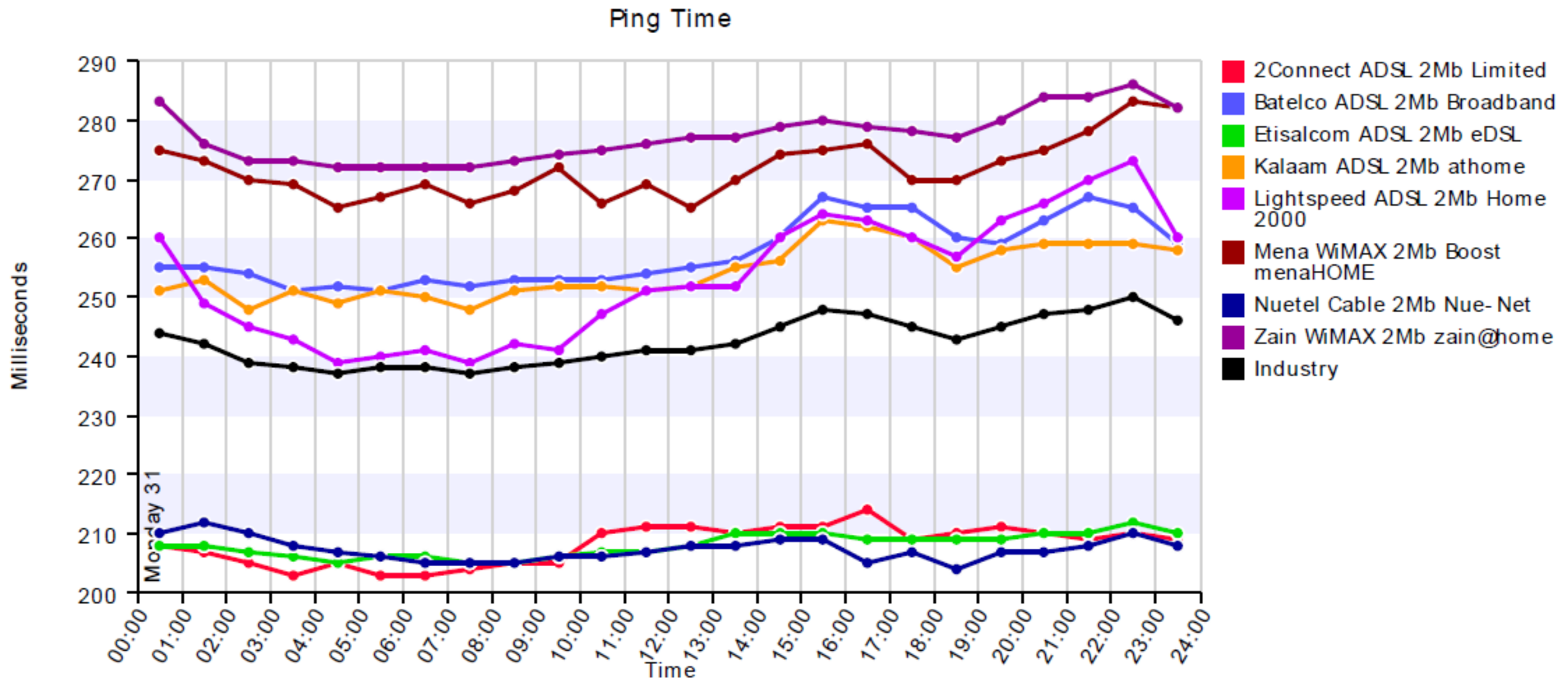
DNS Time (Domain Name System) (Milliseconds)

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 2013 - 31 Mar 2013, between 00:00:00 and 24:00:00 Asia/Bahrain



Ping Time Line Chart Values (Peer view)

01 Jan 2013 - 31 Mar 2013, 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	208	207	205	203	205	203	203	204	205	205	210	211	211	210	211	211	214	209	210	211	210	209	210	209
Batelco ADSL 2Mb Broadband	255	255	254	251	252	251	253	252	253	253	253	254	255	256	260	267	265	265	260	259	263	267	265	259
Etisalcom ADSL 2Mb eDSL	208	208	207	206	205	206	206	205	205	206	207	207	208	210	210	210	209	209	209	209	210	210	212	210
Kalaam ADSL 2Mb athome	251	253	248	251	249	251	250	248	251	252	252	251	252	255	256	263	262	260	255	258	259	259	259	258
Lightspeed ADSL 2Mb Home 2000	260	249	245	243	239	240	241	239	242	241	247	251	252	252	260	264	263	260	257	263	266	270	273	260
Mena WiMAX 2Mb Boost menaHOME	275	273	270	269	265	267	269	266	268	272	266	269	265	270	274	275	276	270	270	273	275	278	283	282
Nuetel Cable 2Mb Nue-Net	210	212	210	208	207	206	205	205	205	206	206	207	208	208	209	209	205	207	204	207	207	208	210	208
Zain WiMAX 2Mb zain@home	283	276	273	273	272	272	272	272	273	274	275	276	277	277	279	280	279	278	277	280	284	284	286	282

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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