

Comparison of AT-Tester with Other Popular Testers for Quality of Service Experience (QoSE) of an Internet Connection¹

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1. Introduction

Internet service providers (ISPs) offer various broadband packages to their subscribers. They typically specify the minimum, maximum or range of bandwidths that the subscriber could obtain on the last-mile link. The ISP may also use Quality of Service (QoS) techniques to ensure a minimum service level, say 256 kb/s on the broadband link [QoS09]. In practice, the achieved bandwidth may differ significantly from the advertised bandwidth as subscribers are more interested in the overall quality of their service experience (QoSE) when using Internet services such as browsing, VOIP, streaming video, etc. This includes the end-to-end path through the Internet to a distant server, in addition to the last-mile. QoSE is the actual measure of the user's experience with an operator in terms of delivered quality with or without reference to what is being promised. This is measured quantitatively and not subjective [QoSE09].

The TeNeT Group of IIT-Madras and LIRNEasia, Colombo have developed the *AshokaTissa* (AT) Tester Methodology by which a subscriber can measure his/her quality of service experience. A freely downloadable tool is available (currently for Windows) by which the subscriber can run the tests and generate a report on the QoSE of his/her broadband connection. The results are stored on a server from which the average performance of all subscribers of each ISP are publicly available.

While there are a large number of free broadband speed testers available, there are practically no critical evaluations of them. There are reviews of individual testers (see e.g. [Fisher]). One of the few reports on multiple testers merely only gives a terse description of each of 6 test tools [Mitchell].

In this document, we review some of the popular tools that are available for testing the performance of a subscriber's Internet connection. In the next section, we review the test methodology and the factors that influence the QoSE. In Section 3, we give a detailed evaluation of the more popular testers and the AT-Tester. This is followed by a summary table and our conclusions in Section 4. The Appendix lists the features and our rating of all the other testers that we have surveyed. Note that we only review tools that are free to use.

2. Experimental Methodology

2.1 Metrics

Different applications make different demands on the Internet connection. For example, browsing a photo gallery requires high download speed while a networked game requires low round trip delay. Hence, the AT Tester Methodology [AT08] defines a comprehensive set of 6 performance metrics that should be measured in each experiment. Note that these metrics are similar to the metrics defined by ITU-T [ITUT02] and the IETF [IETF09] for operator-centric QoS. The 6 metrics are briefly described below.

Download speed (kbps)	The maximum rate at which data can be received from the Internet. This is measured by downloading a large file over about 1 minute, in order to average out temporary fluctuations in speed. It is an indicator of the basic browsing experience.
Upload speed (kbps)	This metric defines the speed at which the subscriber can send data to the Internet. It plays a significant role in responsiveness of real-time applications like VOIP.
Round trip time or RTT (millisec)	Time taken for a packet to reach the destination and return. This is significant in systems that require two-way interactive communication such as online commerce and gaming.
Jitter (millisec)	Jitter is the variation of end-to-end delay from one packet to the next within the same packet stream/connection/flow. Jitter is more relevant for real-time traffic like VOIP.
Packet-Loss (%)	The fraction of packets which do not reach the destination. This can result in noticeable performance degradation with streaming traffic such as video where retransmission is not done.
Availability (%)	This measures the number of times we are able to access the Broadband services. If T attempts are made to connect to the Internet, and if F attempts fail, then Availability = $(1-F/T) \times 100\%$

These 6 metrics help the subscriber to estimate the quality of experience with various applications in a qualitative manner. This is done using Table 1 below.

Table 1: Relevance of Metrics to Various Internet Services

Service	Speed		Delay		Loss
	Down	Up	RTT	Jitter	
Browse (text)	++	-	++	-	-
Browse (media)	+++	-	++	+	+
Download file	+++	-	-	-	-
Transactions	-	-	++	+	-
Streaming media	+++	-	++	++	++
VOIP	+	+	+++	+++	+++
Games	+	+	+++	++	++

Legend: +++ highly relevant, ++ very relevant, + relevant, - not relevant

2.2 Factors Affecting the Measurements

There are many factors that can influence the Quality of Service Experience perceived by the subscriber. These include:

- a) The theoretical maximum data transfer rate of the subscriber's Internet connection (last mile)

- b) The nature of the last-mile medium (copper, optical fibre, wireless or satellite)
- c) Sharing of the last mile by any other users
- d) The number of links and number of ISPs between the source and the destination, and the congestion on these links
- e) The number of other requests being handled by the remote server.
- f) The presence of interference in the last mile due to lightning, electrical noise, loose connections, etc.
- g) Subscriber's computer configuration and other applications running on it
- h) Time of day and day of week (peak business time, national holiday, etc).

Many of the factors vary dynamically. For example, a backbone link serving a business area may be heavily congested at 10 a.m. but may have almost zero traffic at 2 a.m. Likewise, a short thunderstorm may cause severe degradation of performance for a few minutes. Hence, it is clear that *a single measurement is meaningless*. Any experiment must be repeated at different times of day, different days of the week, with different servers (some nearby, some distant), etc. Only with such a systematic experiment can the subscriber get a true picture of the quality of the Internet connection.

To account for the effects of these factors, the experiments should be by each subscriber as follows:

Type of day: Week day, week end, holiday (local/national)

Time of the day: Peak/non-peak business hours, peak/non-peak residential hours

Location of server

- ISP Level Test – to/from a server in the subscriber's ISP
- Country Level Test – to/from a server in the subscriber's country but hosted by a different ISP
- Global Level Test – to/from a server outside the subscriber's country.

In all cases, the server chosen should be a widely-used one so that it is representative and is likely to have high-bandwidth network connections.

3. AT-Tester and Other Popular Testers

We now describe the AT-Tester and 3 other popular testers. Each tool is described under the following headings:

1. **Description:** This describes the tool and its salient features.
2. **Performance Metrics:** The metrics that are quantified by the tool.
3. **Drawbacks:** The various important drawbacks of the tool.
4. **Rating:** A good tool must satisfy two requirements:

- a. *Technical merit*: it must use a sound methodology to measure a comprehensive set of QoSE metrics. The test results must be analysed to produce meaningful summaries.
- b. *Convenience*:
Use: the tool must be easy for a non-technical subscriber to use
Results: must be presented in a form that such the person can easily understand.

For each of these parameters, we rate the tool as *Poor, Marginal, Average, Good* or *Excellent*

3.1 AT-Tester **(<http://www.broadbandasia.info>)**

Description

The client software referred to as the AT-Tester is pre-installed in the user PC for measuring the QoSE metrics periodically. Results can be viewed locally and uploaded to the www.broadbandasia.info server. The tool is written in VBScript. The tests are done using ping, download of files from selected servers, and upload of files to the www.broadbandasia.info server.

The AT-Tester allows the subscriber to test against 3 different servers: global, national and ISP. Widely-used servers are selected for each country and ISP. This allows the subscriber to assess the QoSE for services hosted in different parts of the Internet cloud.

- ISP Level Test – to/from a server in the subscriber’s ISP
- Country Level Test – to/from a server in the subscriber’s country but hosted by a different ISP
- Global Level Test – to/from a server outside the subscriber’s country.

Salient features of the AT-Tester:

- The client application supports registration, scheduling of tests, manual running of tests, viewing and uploading of results (see Figure 1).
- During registration, the subscriber selects his/her location, ISP and tariff package
- Tests can be run manually, or can be run by the scheduler at selected times
- Results are stored on the PC and can be viewed locally.



Figure 1: AT-Tester main window, scheduler, local results (clockwise from top-left)

- The results are uploaded manually to the www.broadbandasia.info server. There they are aggregated with other results for the same ISP and location, and the aggregate results are publicly viewable (see Figure 2).
- Results for different service providers can be compared.
- It tests the throughput to three servers, namely (a) the local ISP (b) another server within the same country and (c) a global server outside the country (this is located in Germany for the US and in the US for all other countries)
- Care is taken to ensure that there is no other network traffic on the subscriber's link during the tests.
- Both the test methodology and the source code for the AT-Tester are open.

Performance Measures

The *AshokaTissa* methodology includes all the 6 key metrics described, viz. download speed, upload speed, RTT (latency), jitter, packet loss and availability. See the figure below for a sample report of the aggregate statistics for one ISP. The times of the tests cover peak/non-peak business and peak/non-peak residential use.

Drawbacks

- Total time taken for each test is about 5 minutes. The complete test suite consists of 6 tests day on at least 2 days.
- At the time of registration, if the subscriber's ISP is not in the configured list, s/he has to wait for it to be configured by the www.broadbandasia.info admin and only then can tests be run
- The user interface could be better, e.g. results are presented only in tabular form



Figure 2: AT Tester aggregate global server results for an ISP at various times of day

Rating

Table 2: AT-Tester Rating

<i>Measure</i>	<i>Score</i>	<i>Comments</i>
Technical merit	Excellent	Covers all metrics, multiple well-defined servers, meaningful aggregation of statistics, sound experimental methods
Convenience	Use: Average Results: Good	Results are useful to a technically savvy person, not so easily used by a non-technical person. Tedious registration process.

3.2 Speedtest.net

(<http://www.speedtest.net/>)

Description

Speedtest.net is provided by Ookla (www.ookla.com), a company that is focused on web-based network diagnostic applications. Ookla provides network speed testing applications for an annual license fee ranging from \$400-\$2,000. The services of the speedtest.net website, reviewed here, are provided free.

Salient features of Speedtest.net:

- This tool allows you to check the performance of their connection to and from hundreds of locations around the world.
- The tool is browser-based, there is no application to be installed on the PC
- The tester is implemented in Adobe Flash which must be installed in the browser. Flash is freely available for all PC browsers, and is installed in most browsers.
- The tests are done against a server which is selected from a large list. There are about 100 servers each in N. America and Europe, and about 100 in the rest of the world. Servers are available in all continents. There are 2 servers in India (Mumbai and Delhi) and one in Sri Lanka (Colombo).
-

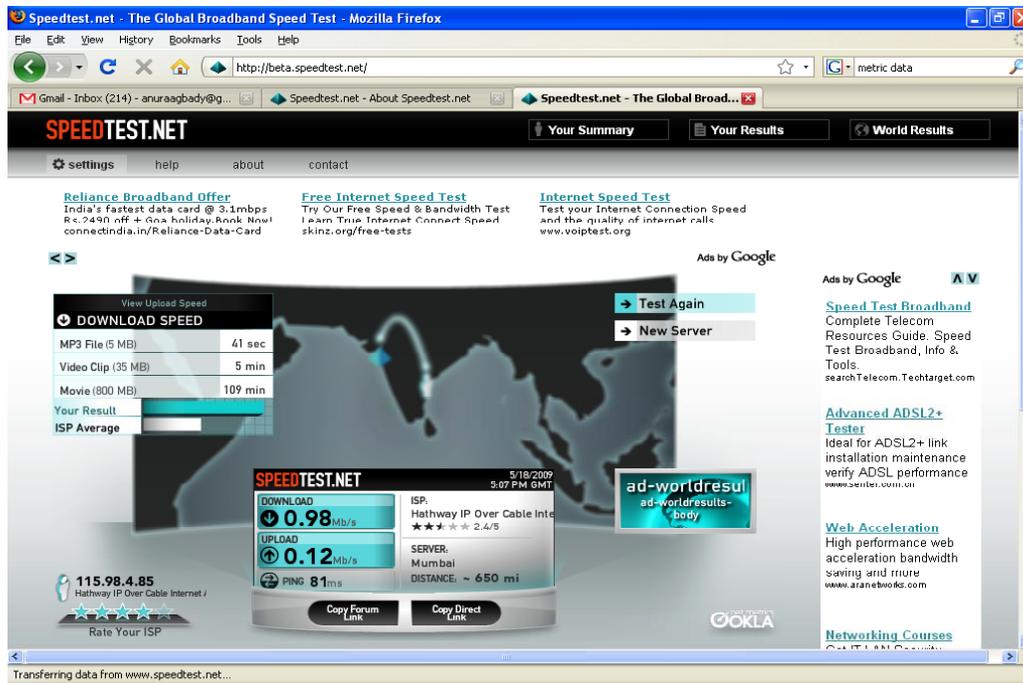


Figure 3: Speedtest.net: test results for top ISPs in India

- It is very user friendly. It also shows the ISP name, IP address and the physical distance between your system and the selected server. Results are shown in an attractive graphical form (see Figure 3).
- World results can be viewed and compared easily on basis of download and upload speed. It also shows the top 10 results (Only the best test scores are used for the ranking) of the world/continent/country/city.
- The subscriber can see a summary of his/her Internet speed, including past results, and compare with the ISP's average, and with other ISPs nationally (see Figure 4) and around the world (see **Error! Reference source not found.**)
- It allows the subscriber to upload results and rate the ISP
- Total time taken for the test is less than one minute
- Speedtest.net also allows individuals and organizations to register their servers in the list of available servers. This requires some configuration of the server.
- Speedtest.net can also be used from an iPhone

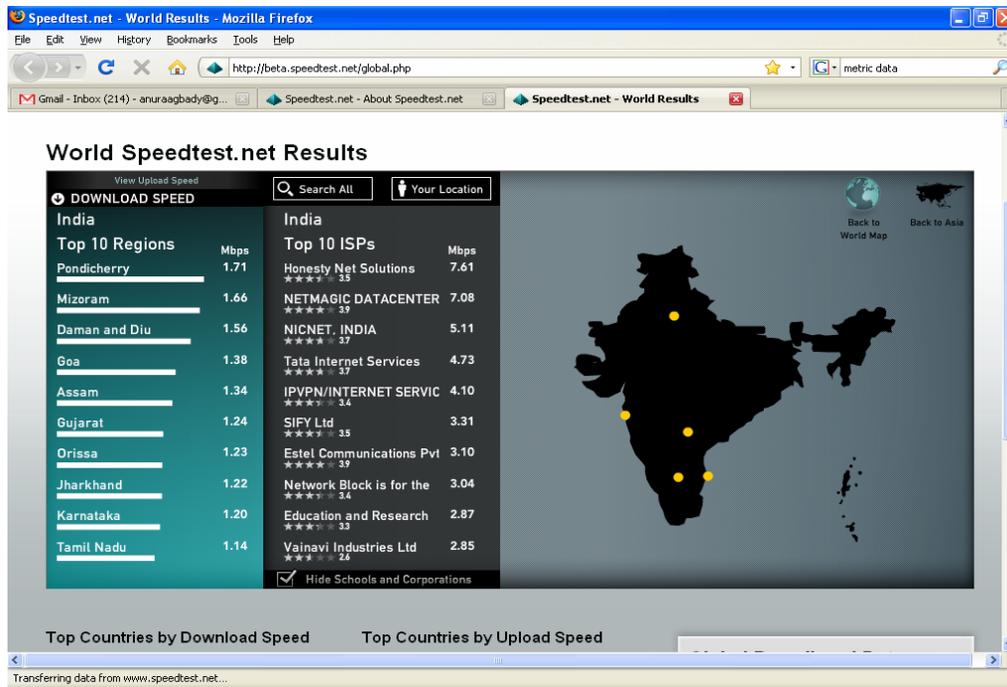


Figure 4: Speedtest.net: Top ISPs in India

Performance Measures

Speedtest.net performs three measurements, viz. download speed, upload speed and round trip time (RTT) out of the 6 metrics defined above. (Note: the commercial versions of the tester also measure jitter and packet loss.)

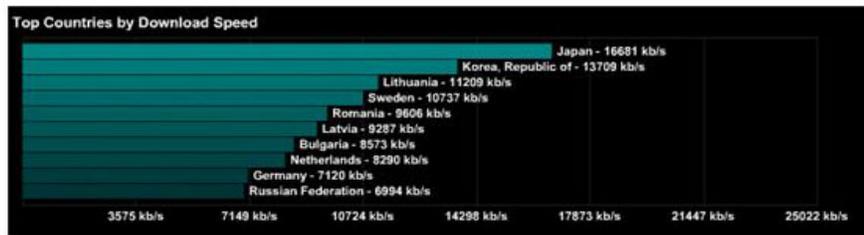
Drawbacks

- Only three parameters Download Speed, Upload Speed and Latency are considered for generating the result whereas other parameters like Jitter, availability and packet loss are not considered
- Results are averaged over different times of day and different days. Hence they can be misleading if one ISP is tested at peak time and another at off-peak time.
- Results are averaged across the large number of servers chosen by each subscriber.



As you can see, my connection is quite slow compared to the Shanghai average, China average, Asia average, and global average.

Let's see how other continents and countries fare.



How fast is your Internet connection?

Figure 5 Speedtest.net: Summary of world-wide results

Rating

Table 3: Speedtest.net Rating

Measure	Score	Comments
Technical merit	Average	Covers 3 metrics, many servers around the world; aggregation of statistics misleading
Convenience	Use: Excellent Results: Average	Effective graphics. Results are easily understood by a lay person, but could be misleading. Large database of test results.

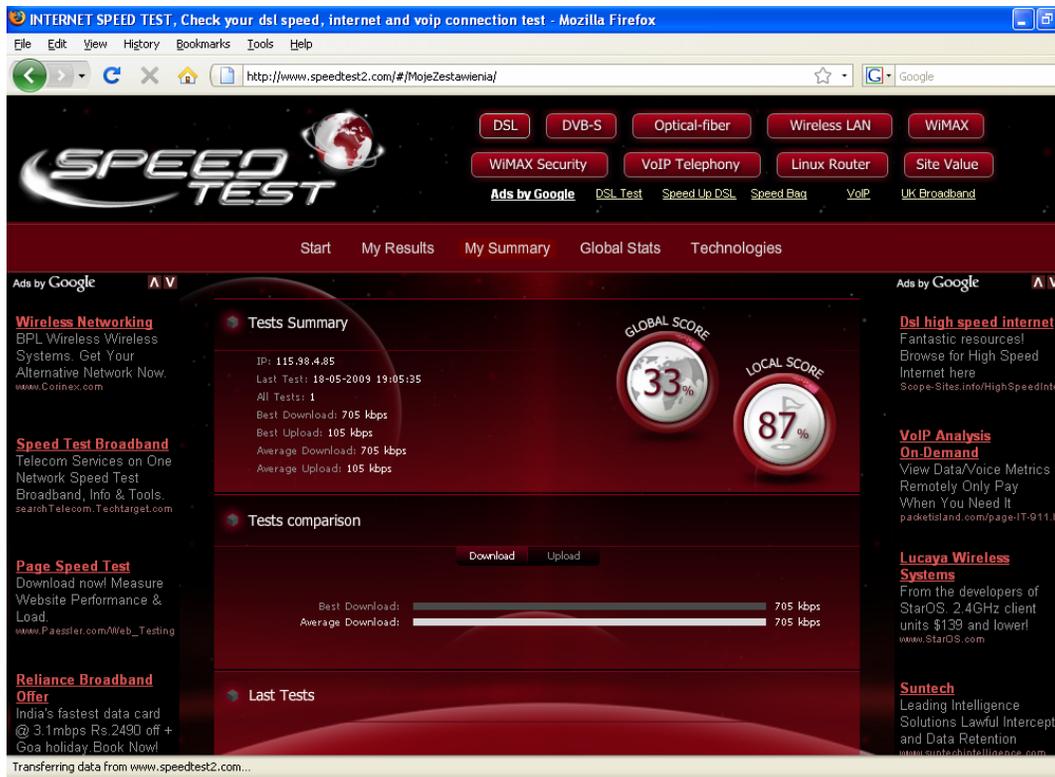


Figure 6: Speedtest2: Summary of test results

3.3 Speedtest2.com (http://www.speedtest2.com)

Description

Note: this tester is quite distinct from Speedtest.net, though it appears to have been inspired by it (user interface, metrics and Flash implementation).

- Very user friendly with a good GUI, the ISP name and location are automatically determined (see Figure 6)
- The tool is browser based
- No registration is needed, the subscriber selects a server and the test is run immediately
- Total time taken is less than one minute
- It allows the subscriber to upload results and rate the ISP
- Global summaries can be displayed
- An individual or organization can register their server to be used. This requires about 100 MB of disk space and PHP support.

Performance Measures

Speedtest2.com performs three key measurements used to determine the overall quality and performance of Internet connection, which are download Speed, Upload Speed and Ping (Latency).

Drawbacks

- Only three parameters Download Speed, Upload Speed and Latency are considered for generating the result whereas parameters like Jitter, availability and packet loss are not considered
- Results are averaged over different times of day and different days. Hence they can be misleading if one ISP is tested at peak time and another at off-peak time.
- Results are averaged across the large number of servers chosen by each subscriber.
- The number of servers (10) is small compared to Speedtest.net: there are 5 servers in Poland, 3 in the rest of Europe, 1 in the US and 1 in Kolkata, India.

Rating

Table 4: Speedtest2.com Rating

<i>Measure</i>	<i>Rating</i>	<i>Comments</i>
Technical merit	Average	Covers 3 metrics, limited servers around the world; aggregation of statistics misleading
Convenience	Use: Good Results: Average	Effective use of graphics. Results are easily understood and used by a lay person, but could be misleading

3.4 Internetfrog

(<http://www.internetfrog.com/mypc/speedtest/>)

Description

- The Internet Frog has many tools for webmasters, domain owners, network administrators, and website developers.
- The tool is browser based.
- The measured speed is compared with a speed guide (see Figure 7)
- The time for downloading a file (1MB, 10MB or 100 MB) from the Internet is estimated, to help the subscriber understand the speed results
- It also shows the Quality of Service in percentage, which is not seen in other tools.
- Total time taken is less than one minute

Performance Measures

It provides information regarding download and upload speeds, RTT, max pause (longest gap between successive packets) and “Quality of Service” (a percentage measure of the consistent download capacity).

Drawbacks

- Jitter, availability and packet loss are not considered
- A single pre-determined server is used
- The tester uses a Java applet and hence will not run on browsers that do not have the correct version of Java installed.

Rating

Table 5: Internetfrog Rating

Measure	Score	Comments
Technical merit	Marginal	Covers 3 metrics, many servers around the world
Convenience	Use: Good Results: Marginal	Results are easily understood and used by a lay person, but aggregation is misleading

4. Comparative Evaluation

We now compare the above 4 broadband testers. A good tool must satisfy two requirements, technical merit and convenience (see Section 3).

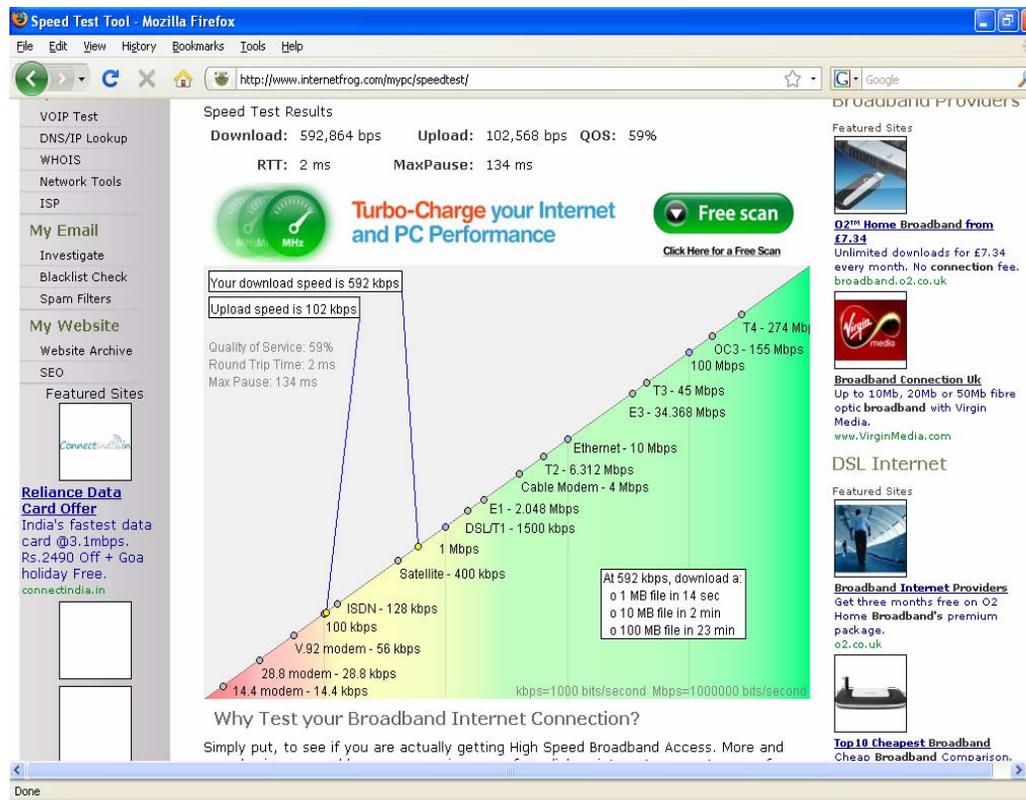


Figure 7: Internetfrog.com: Test results

Technical Merit

ISPs advertise only the bandwidth of a broadband service and most of the testers concentrate only on this metric. However, subscribers use the Internet for a diversity of uses, each making different demands on the network. In this regard, the AT-Tester is superior to the other testers.

As discussed earlier, *a single experiment is meaningless* given the number of factors that could affect the experiment. Again, the AT-Tester scores much above the other testers in the rigour of its experimental methodology. All the other testers take single tests done by uncoordinated users and average them to yield a single *figure of merit*. The AT-Tester gets each user to repeat the tests at least 12 times as carefully chosen times and days with each of 3 different servers. The results are averaged across multiple users only when other factors are the same. This produces a set of numbers that define the QoSE of each ISP. The detailed performance is also available at a click of a button.

A single figure of merit may seem attractive but is often meaningless. Suppose that a user in Delhi is considering a 6 Mb/s ADSL service. The “fact” that Tata Internet Services achieves 4.73 Mb/s vs. 3.31 Mb/s for SIFY (from the Speedtest.net website) may give a false picture. It may be that the SIFY tests were done at peak business hours with high congestion while the Tata tests were done during the early morning with light load. Likewise, the Tata testers may have had high-speed packages, while the SIFY testers could have had lower speed packages. The AT-Tester which gives time of day, type of day, ISP, package, and region allows the user to do an apples to apples comparison.

Table 6 compares the technical merit of the 4 testers. We consider several issues. First is the number of metrics. As discussed in Section 2.1, a comprehensive set consists of 6 metrics. Next is the experimental method. Does the tester attempt to compensate for uncontrolled factors such as line quality, thunderstorms, etc? The third issue is repetition of the test from the same location to account for daily and weekly variations. Next, we examine the servers used for the testing. Another issue is the degree of openness, which enabled the public to understand and criticize the methodology. Next, we consider the issue of the analysis. Is this done to produce meaningful and useable summaries? Finally, based on these issues, we give our overall rating on a scale of 1-5.

Table 6: Comparison of Technical Merit of 4 Testers

Issue	AT-Tester	Speedtest.net	Speedtest2.com	Internetfrog
Metrics	6 (download and upload speed, RTT, jitter, packet loss, availability)	3 (download and upload speed, RTT)	3 (download and upload speed, RTT)	3 (download and upload speed, RTT)
Experimental method	Tests done with large files, ping	File size and ping repetitions not	File size and ping repetitions not	Large file size used. Ping repetitions not

Issue	AT-Tester	Speedtest.net	Speedtest2.com	Internetfrog
	repeated 100 times, other network activity stopped	known. Browser may generate spurious network traffic.	known. Browser may generate spurious network traffic.	known. Browser may generate spurious network traffic.
Repetitions	Each test is repeated at 6 times of day, and on 2 days (weekday and weekend)	Depends on the subscriber, typically only one test is done	Depends on the subscriber, typically only one test is done	Depends on the subscriber, typically only one test is done
Servers	Carefully chosen servers, per ISP, each country and global. ISPs and countries added on demand.	About 300 servers in N. America, Europe and ROW. Most countries covered.	Only 10 servers (5 of which are in Poland)	Many servers around the world
Analysis	Uploaded data is manually scanned for any obvious inconsistencies. Data is averaged in a meaningful way: for the same time of day, type of day, ISP, country, etc. to produce detailed summaries.	Averaging is done across all subscribers to produce a single figure of merit for one ISP or one country. No distinction is made for time of day, type of day, etc.	Averaging is done across all subscribers to produce a single figure of merit for one ISP or one country. No distinction is made for time of day, type of day, etc.	Averaging is done across all subscribers to produce a single figure of merit for one ISP or one country. No distinction is made for time of day, type of day, etc.
Openness	Methodology and source code are fully public. Public seminars are conducted to disseminate and discuss results. Results are shared with ISPs.	Metrics and some details of the methodology are described on the website.	Metrics and some details of the methodology are described on the website.	Metrics and some details of the methodology are described on the website.
Rating	Excellent	Average	Marginal	Marginal

Convenience

In convenience, all the testers except AT-Tester run entirely within the browser. There is no need for registration. The tester automatically determines the subscriber's ISP name and location. Extensive use of graphics enhances convenience and appeal. The user can run a test in about 1 minute. With the AT-Tester, one test takes about 5 minutes and the complete suite of tests requires 2 days.

In the presentation of the results, again all the testers except AT-Tester present a single number. This is easy to use but as discussed above can be very misleading. The AT-Tester summaries contain more detailed information that avoid misleading data but require more effort on the part of the user.

The use of a browser has a downside. The browser may have tabs open that use the network in the background, eg. for periodic refresh of content. This will affect the accuracy of the readings. The AT-Tester runs stand-alone and cautions the user to stop all network activity.

Automatic determination of ISP information is a convenience that is not always useful. For example, the IP addresses for BSNL (a large nationwide ISP in India) are sometimes listed as “NIB (National Internet Backbone)” and sometimes as BSNL. The automatic algorithm thus mistakes BSNL as two ISPs. Most users who see a report for NIB will not know that this in fact is a part of BSNL.

Finally, developed by an academic group, TeNeT of IIT-Madras, and LinneAsia, an NGO, the AT-Tester screens are completely devoted to test information. In contrast, all the other testers include ads that distract the user and may consume bandwidth!

Summary

In summary, the AT-Tester is the best tester for broadband QoSE in technical merit compared to all other testers surveyed (above and see the Appendix below). AT-Tester lacks in ease of use, and could be enhanced by better use of graphics and perhaps a browser version.

We note that results of a few technically rigorous studies of broadband performance have been published by academic groups (e.g. [Dischinger07]). However, these are not readable by the general public, the test tools are not freely available, and the results only cover the US and Europe. The AT-Tester makes technically rigorous measurements available to the general public, with a focus on South Asia.

Appendix: Other Test Tools

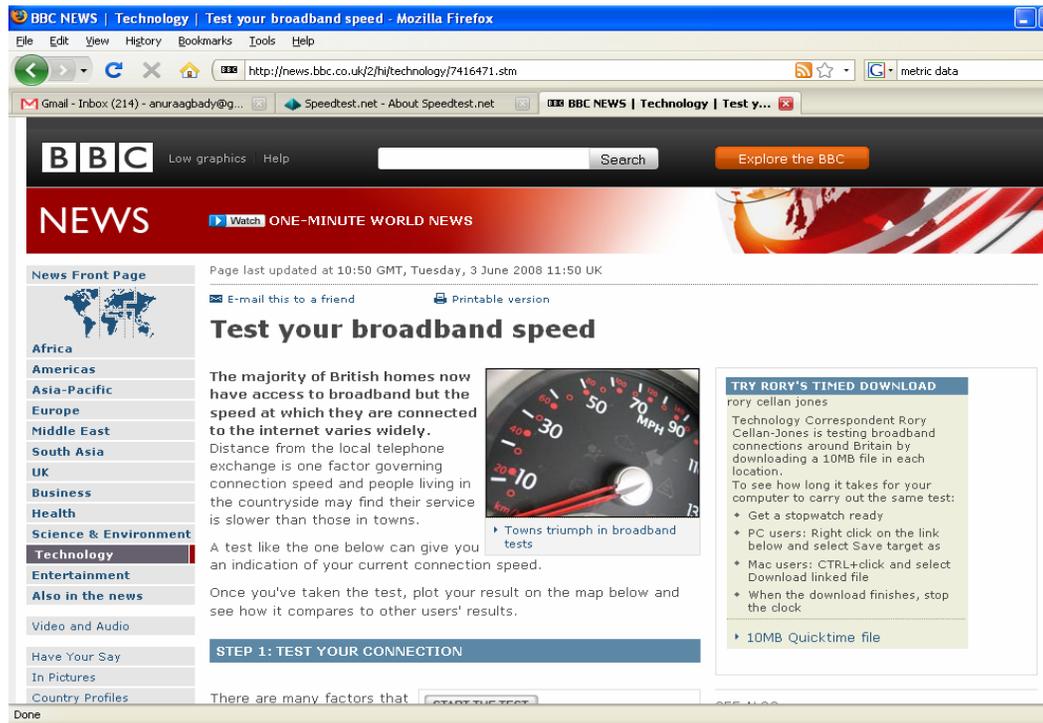
Here, we describe some of the other test tools that are available for free use on the Internet. These are generally less useful than the ones surveyed above. Each tool is described in the same format as in Section 3 above.

1. BBC News

(<http://news.bbc.co.uk/2/hi/technology/7416471.stm>)

Description

- This tool, provided by BBC News, UK, is browser based
- It provides the speed at which a small file (e.g. song) and a big file (e.g. movie) could be downloaded from the BBC website only
- It allows the subscriber to plot his/her location and speed on a map and upload a message.
- Total time taken is less than one minute.
- It displays the pattern of results submitted from across the UK



The screenshot shows a Mozilla Firefox browser window displaying the BBC News website. The address bar shows the URL <http://news.bbc.co.uk/2/hi/technology/7416471.stm>. The page title is "BBC NEWS | Technology | Test your broadband speed". The main content area is titled "Test your broadband speed" and includes a speedometer graphic. The text below the speedometer reads: "The majority of British homes now have access to broadband but the speed at which they are connected to the internet varies widely. Distance from the local telephone exchange is one factor governing connection speed and people living in the countryside may find their service is slower than those in towns. A test like the one below can give you an indication of your current connection speed. Once you've taken the test, plot your result on the map below and see how it compares to other users' results." Below this text is a button labeled "STEP 1: TEST YOUR CONNECTION". To the right of the speedometer is a box titled "TRY RORY'S TIMED DOWNLOAD" with instructions for testing broadband connections. The sidebar on the left contains a "News Front Page" section with a world map and a list of regional links: Africa, Americas, Asia-Pacific, Europe, Middle East, South Asia, UK, Business, Health, Science & Environment, Technology, Entertainment, and Also in the news. The page footer includes "Done" and "Page last updated at 10:50 GMT, Tuesday, 3 June 2008 11:50 UK".

Figure 8 BBC News Speed Tester

Performance Measures

- It only measures download speed

Drawbacks

- Only one parameter i.e. download speed, that too from only one BBC server
- Upload Speed, Latency, Jitter, availability and packet loss are not considered

Rating

Table 7: BBC News Tester Rating

<i>Measure</i>	<i>Score</i>	<i>Comments</i>
Technical merit	Poor	Single metric, single server
Convenience	Use: Good Results: Very Poor	Useful to a user of the BBC website only

2. ZDNet UK

(<http://resources.zdnet.co.uk/speedtest>)

Description

- This tool is provided by zdnet.co.uk
- The tool is browser based
- Total time taken is less than one minute
- Once the test is conducted it plots the speed along with the expected speed for comparison

Performance Measures

It only provides the information regarding download speed and the total time taken.

Drawbacks

- Only one parameter, download speed, is provided from a single pre-determined server
- Upload speed, latency, jitter, availability and packet loss are not considered for generating the results.

Rating

Table 8: ZDNet UK Rating

<i>Measure</i>	<i>Score</i>	<i>Comments</i>
Technical merit	Poor	Single metric, single server
Convenience	Use: Good Results: Very Poor	

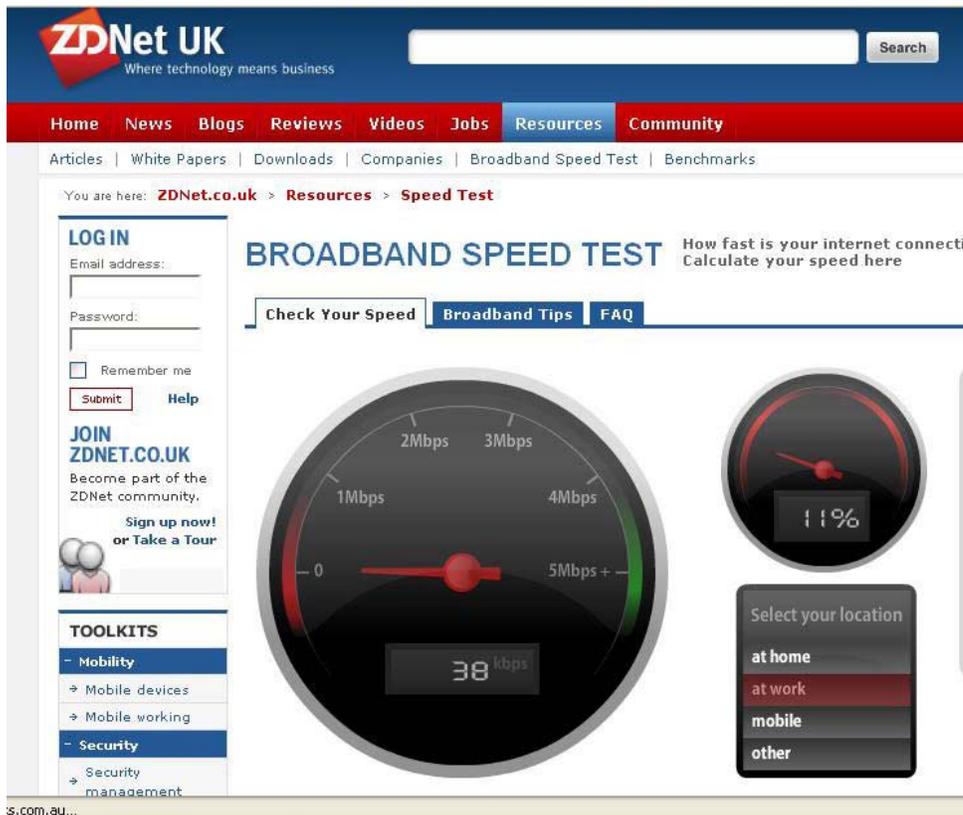


Figure 9 ZDNet UK broadband speed tester

3. Toast Internet Service

(<http://performance.toast.net/>)

Description

- Average bandwidth results from other ISP users that use this testing site are displayed
- It allows testing of the Internet connection from about 20 locations (1 in Syria, the others in the US).
- It allows adding of a server
- It maintains a list of the fastest ISPs and web host
- The tool is browser based
- History of the subscriber's past tests are not maintained in the free version
- Total time taken is less than one minute

Performance Measures

Both upload and download speeds are measured from any one of the list of servers.

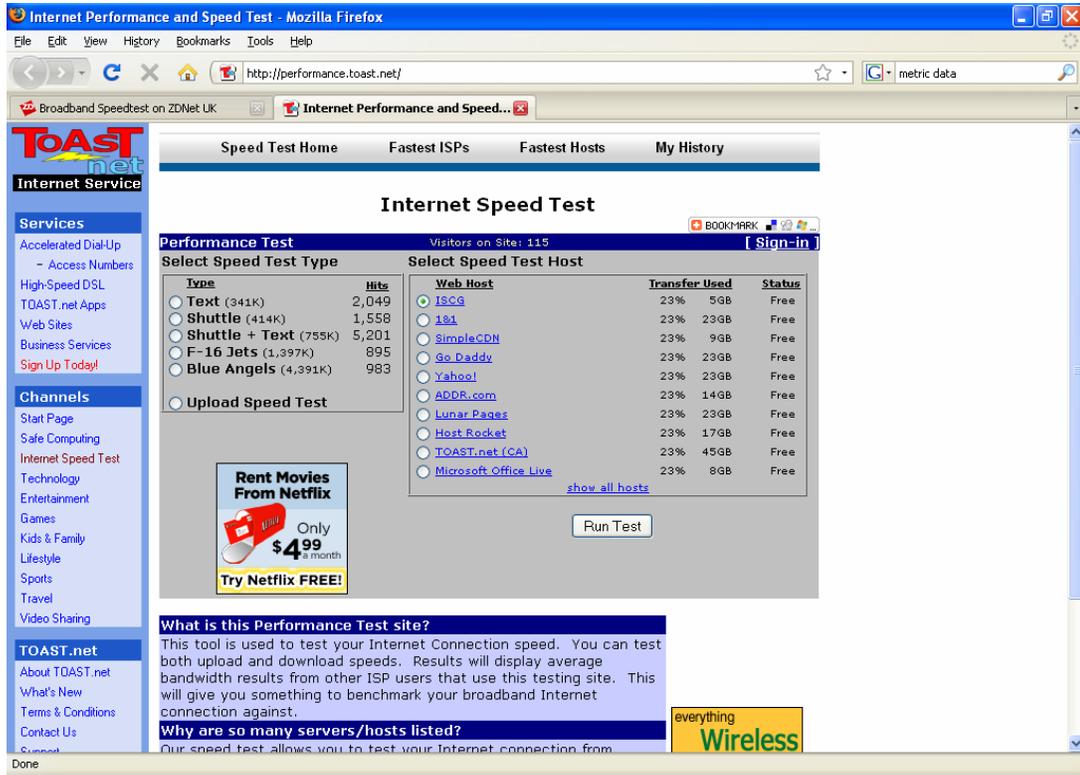


Figure 10 Toast.net: List of servers available for testing

Drawbacks

- Only two parameters, download speed and upload speed, are considered.
- Latency, jitter, availability and packet loss are not considered
- Almost all the servers are located in the US

Rating

Table 9: Toast Internet Rating

Measure	Score	Comments
Technical merit	Marginal	2 metrics, several US-centric servers
Convenience	Use: Very Good Results: Marginal	Aggregation could be misleading

4. Thinkbroadband

(<http://www.thinkbroadband.com/speedtest.html>)

Description

- The tool is browser based
- It takes 2 to 3 minutes for the test to complete.
- Results are logged for statistical purposes and are an indication of the connection speed only.

- Results can also be shared with the service provider to help troubleshoot problems or improve their service.
- To use this tester, Java must be installed and enabled
- The subscriber is cautioned not to use the Internet during a test
- Download is done from a single pre-determined server

Performance Measures

It only provides the download speed from a single pre-determined server. Files ranging from 5 MB up to 1 GB in size are provided for downloading. A *Rough Speed Guide* is provided for comparison:

<i>ADSL Speed</i>	<i>Typical Download</i>	<i>Typical Upload</i>
512 Kbps	460 Kbps	200-240 Kbps
1 Mbps	920 Kbps	200-240 Kbps
2 Mbps	1840 Kbps	200-240 Kbps
8 Mbps	7000 Kbps	400-750 Kbps

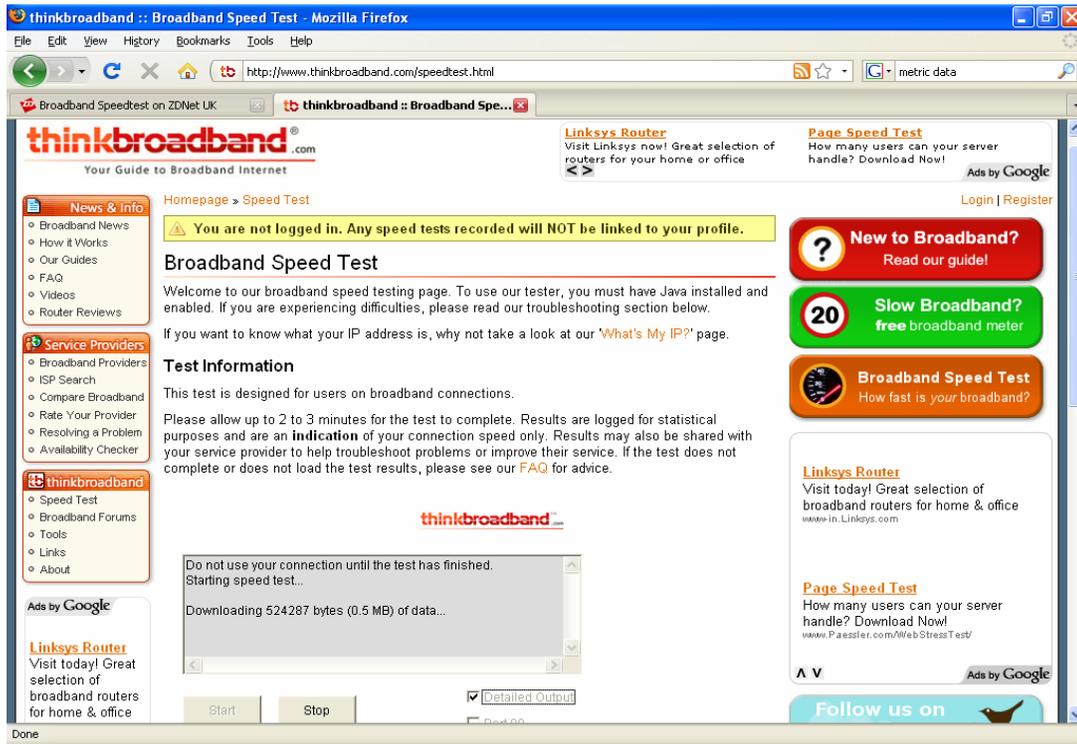


Figure 11 Thinkbroadband: Home page with test running

Drawbacks

- Only one parameter, download speed, is provided, from a single pre-determined server
- Upload speed, latency, jitter, availability and packet loss are not considered
- Total time taken is slightly higher than many of the other testers

- Downloading the Java applet takes time and it will not run unless the browser supports the right version of Java

Rating

Table 10: Think Broadband Rating

<i>Measure</i>	<i>Score</i>	<i>Comments</i>
Technical merit	Poor	Single metric, single server
Convenience	Use: Good Results: Very Poor	

5. Broadband DSL Reports
(<http://www.dslreports.com/>)

Description

- DSLreports.com claims to be the largest online community based on interest in consumer broadband (and related) information, news and tools.
- It allows one to compare and identify the most popular service provider in any region of USA and Canada.
- The tool is browser based
- Total time taken is less than one minute.

Performance Measures

It only provides the information regarding download speed. It has a list of servers of USA and Canada to choose from, to check the speed. It provides a detailed comparative report of various ISP in different categories to compare the results and the performance.

Drawbacks

- Only one parameter, download speed, is measured.
- The tests are specific to USA and Canada.
- Upload Speed, Latency, Jitter, availability and packet loss are not considered

Rating

Table 11: Broadband DSL Reports Rating

<i>Measure</i>	<i>Score</i>	<i>Comments</i>
Technical merit	Poor	Single metric, N. American servers only
Convenience	Use: Good Results: Poor	

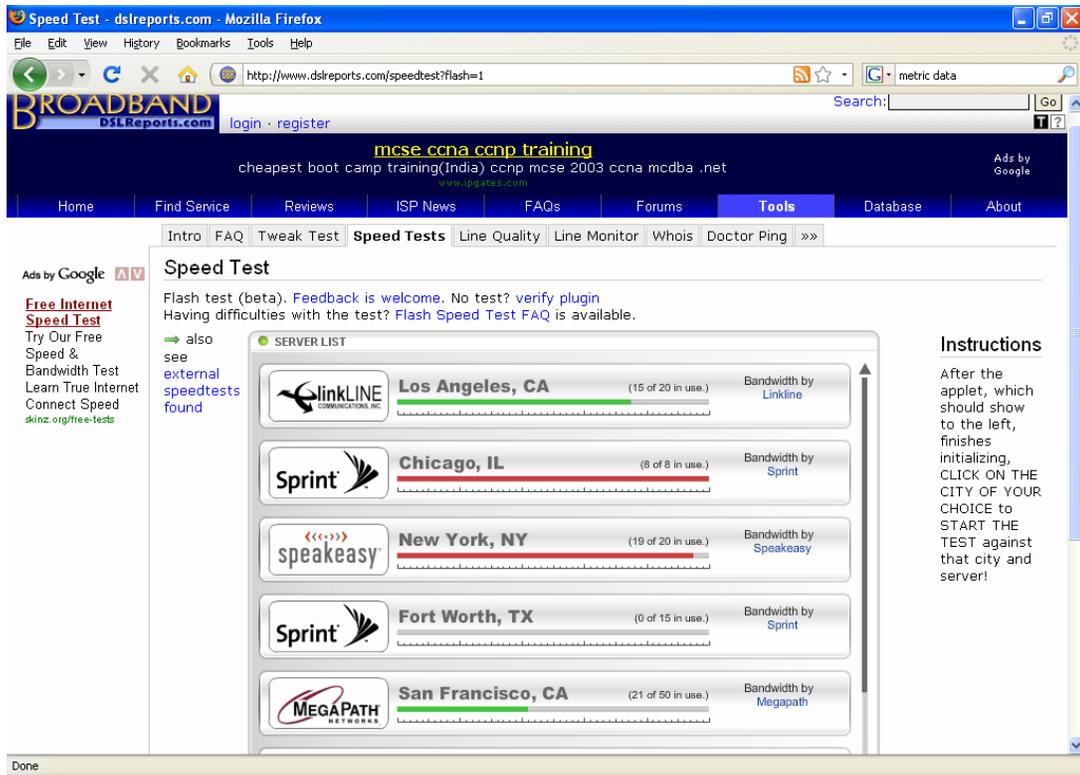


Figure 12 DSL Reports: speed of various US-based ISPs compared

6. Auditmypc

(<http://www.auditmypc.com/internet-speed-test.asp>)

Description

- The tool is browser-based. Both Flash and Java versions are available
- Testing is done using the *packet-pair* technique rather than downloading of a file. This gives an approximate estimate of the throughput but uses less bandwidth compared to the more common file download method.
- It provides a speed guide for comparison
- The tests are done with one pre-determined server

Performance Measures

It only measures upload and download speeds.

Drawbacks

- Only two parameters i.e. upload and download speed are provided
- Latency, Jitter, availability and packet loss are not considered
- A single pre-determined server is used

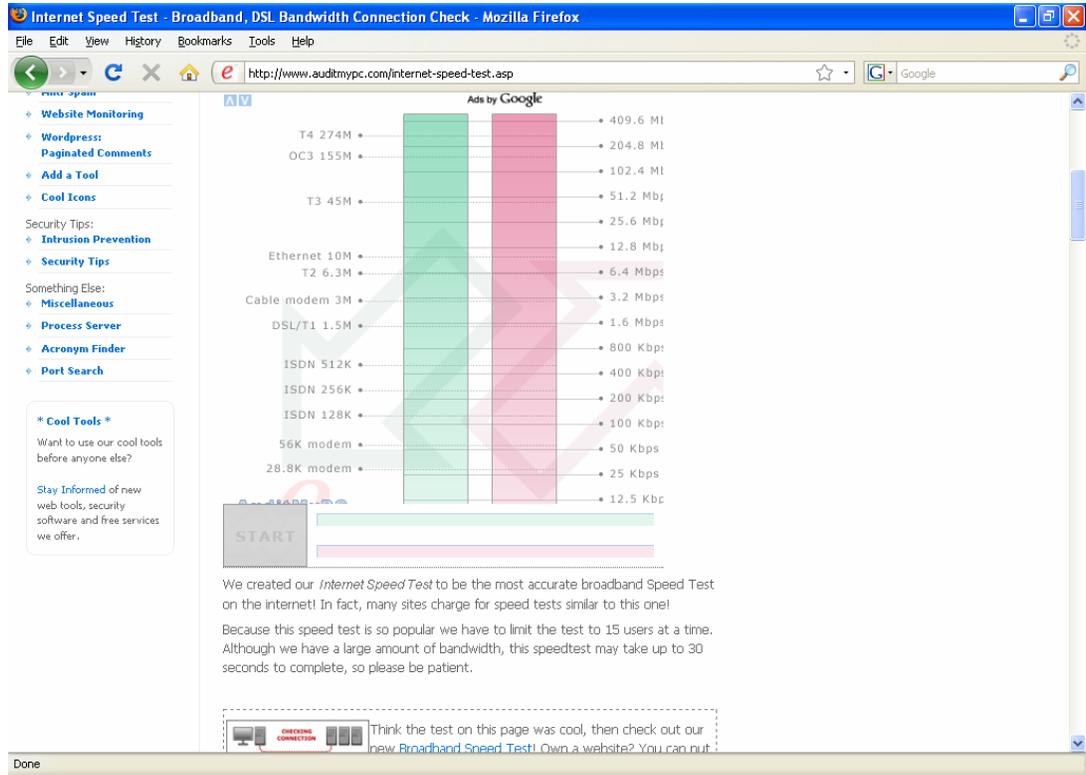


Figure 13 Auditmypc speedtest results

Rating

Table 12: Auditmypc Rating

Measure	Score	Comments
Technical merit	Poor	Two metrics, single server
Convenience	Use: Good Results: Poor	

7. Voiptest (http://www.voiptest.org)

Description

- This test measures the quality and performance of Internet connections for Voice over IP by simulating real VoIP sessions between 5 pre-determined servers and the subscriber's PC
- Total time taken is less than one minute.
- The tool is browser based

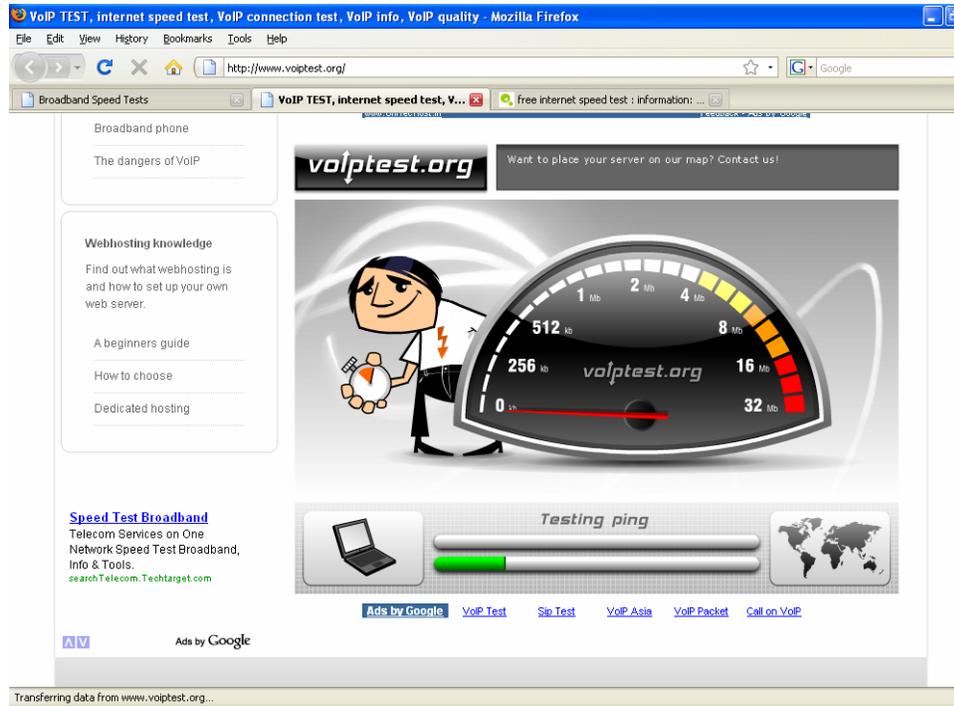


Figure 14 Voiptest.org testing in progress

Performance Measures

It only provides the information regarding latency, upload and download speed, over five different servers located in different continents.

Drawbacks

- Only latency, upload speed and download speed, specific to only five servers in the world, are measured
- Jitter, availability and packet loss are not considered

Rating

Table 13: Voiptest Rating

Measure	Score	Comments
Technical merit	Marginal	3 metrics, but few servers
Convenience	Use: Good Results: Average	One of the few testers that considers an application (VOIP)

8. BSNL Free Broadband Speed Checker

Description

- This is a tool provided by Dataone Broadband, BSNL to test Dataone connections

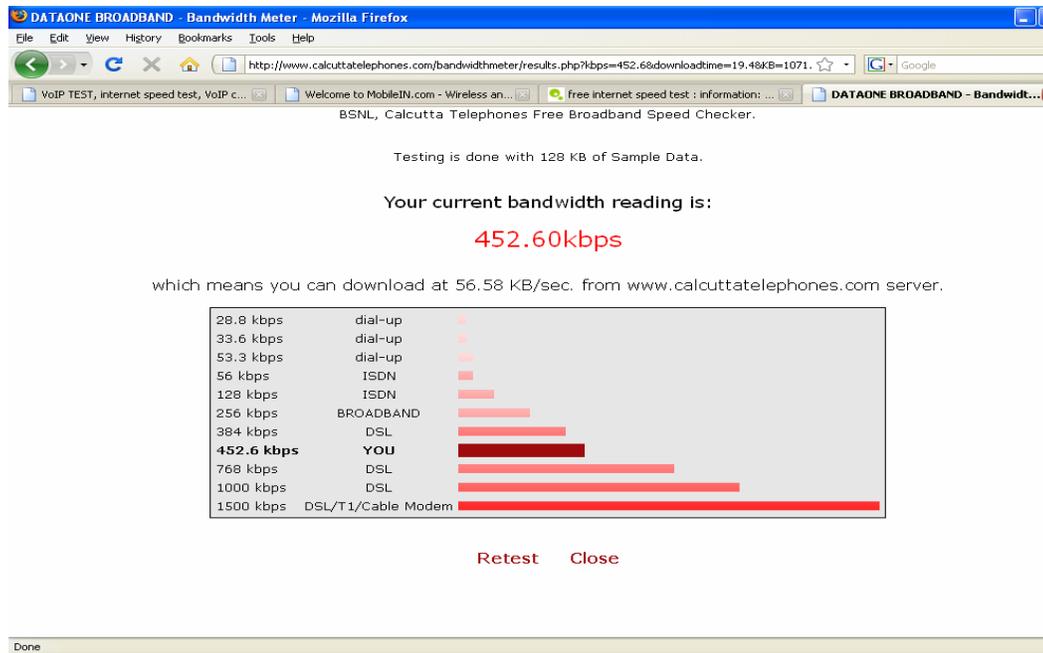


Figure 15 BSNL Dataone broadband speed test results

- The tool is browser based
- Total time taken is less than one minute
- The test is done to a local Dataone server
- Testing is done with 128 KB of sample data
- The measured speed is compared with the speed guide.

Performance Measures

It only provides the download speed from a specific server in the local region of BSNL, eg. in Kolkata the server is www.calcuttatelephones.com.

Drawbacks

- Only one parameter, download speed from a specific ISP server is provided.
- Upload Speed, Latency, Jitter, availability and packet loss are not considered

Rating

Table 14: BSNL Dataone Tester Rating

Measure	Score	Comments
Technical merit	Poor	Single metric, single ISP, single server
Convenience	Use: Good Results: Poor	Useful to a BSNL subscriber only

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