

White Paper Series

RELIANCE
Broadband

Understanding Internet Bandwidth
and Plan Performance

INDEX

Introduction	Page 2
Understanding Bandwidth Units	Page 3
Internet Bandwidth V/s Download Speed	Page 4
Factors Affecting Download Speed	Page 5-7
Optimum Utilization of Bandwidth	Page 8
Conclusion & Terms	Page 9-10
About RCOM	Page 11



White Paper Series

Understanding Internet Bandwidth and Plan Performance

RELIANCE
Broadband

Introduction

Today, Internet has evolved from what it was ten years back. High bandwidth consumer plans with download speed from 10 Mbps to 100 Mbps are available in the Market. Availability of “Bandwidth killer” applications like Video blogs, Online HD gaming etc. have led to increase in demand of High Bandwidth plans.

However, for high bandwidth plans say 100 Mbps plan, User will get bandwidth of 100 Mbps (upto ISP node) but he may not achieve 100 Mbps* speed for files download due to some factors which effect download speed. Same is applicable for all other High bandwidth plans.

*100 mbps cannot be achieved on a single PC, but same may be achieved if we connect multiple PC's (5 or more) in LAN and start multiple downloads on each PC.

2



White Paper Series

Understanding Internet Bandwidth and Plan Performance

RELIANCE
Broadband

Understanding Bandwidth Units

Computer data architecture is based on the binary system of using ones and zeros in a string of eight "**Bits**" to form different characters. Each string of eight bits is called a **Byte**. **8 bits = 1 byte = 1 character** as described by the order of the 8 bits of data. Kbps always refers to kilobits per second, while the designation of KB/Sec refers to kilobytes per second.

1 Byte= 8 Bits

1 Kb = 1024 Bits=128 Bytes

1 KB = 8 Kb=1024 Bytes= 1024*8 Bits

1 Mb = 128 KB

1 MB = 8 Mb= 1024 KB

All high-speed ISPs (Internet Service Providers) describe their services in terms of Kilobits or Megabits, rather than using kilobytes or megabytes. This makes it easy for potential customers to compare transfer rates against their existing dial-up modems.

Following are some important conversions which might help when looking at High-speed Internet

Kbps	Mbps	KB/Sec	MB/Sec
1,024	1	128	0.125
2,048	2	256	0.25
4,096	4	512	0.5
10,240	10	1,280	1.25
40,960	40	5,120	5
10,2400	100	1,2800	12.5

3



broadband plan as per TRAI.

White Paper Series

Understanding Internet Bandwidth and Plan Performance

RELIANCE
Broadband

Internet Bandwidth V/S Download Speed

Internet Bandwidth and Downloading speed are two different things.

High Bandwidth alone does not guarantee that data will arrive/download fast from internet, there are many other factors involved here.

Bandwidth is the capacity of the connection whereas download speed is the actual rate of downloading. Download speed will always be lower since a proportion of packets going over the connection are not part of the data as such - there will be packets for:

- Maintaining the connection,
- Resent packets (corrupted packets)

In simple words, Bandwidth is the size of the Highway and Speed of data download is the speed of car. Size of highway ensures the number of cars passing through it (number of simultaneous downloads) but it does not ensures speed of car passing through it (Download speed).



White Paper Series

Understanding Internet Bandwidth and Plan Performance

RELIANCE
Broadband

Factors Affecting Download Speed

• The Bandwidth provided by the Internet Service Provider:

Your download speed can be only up to the bandwidth provided by the Service provider and it cannot exceed that.

E.g. If Service provider is providing bandwidth of 1 Mbps, then you can download content from internet with speed up to 1 Mbps only and not more than that.

• Traffic at the web server:

Web servers configure a download bandwidth at their end. They only allow download from their website up to certain bandwidth which has to be shared between the users logged on to that web server. If too many users are glued to the website, download may go slow due to this limitation. This also put limitation on maximum download/upload speed

E.g. If a web server say xyz.com has configured 100 Mbps bandwidth on its server and millions of people have logged into xyz.com and downloading content, its server may get slow and may not be able to provide you enough download speed even if you are on a 50 Mbps plan.

• Congestion of Internet:

Internet service providers provision some limited bandwidth at their end to cater its customers. However, this bandwidth is usually under provisioned than the total requirement of its customers to reduce costs. But at times when too many customers get logged in and start utilizing bandwidth which is more than the bandwidth provisioned by the service provider, then Internet congestion happens. This may result into slow internet connection and you will not get enough download speed.

5



broadband plan as per TRAI.

White Paper Series

Understanding Internet Bandwidth and Plan Performance

RELIANCE
Broadband

Factors Affecting Download Speed continued...

- **Download bandwidth configured at web server per User:**

A web servers also configures the download bandwidth per user limiting maximum speed at which you can download content from that website.

E.g. XYZ.com may allow download bandwidth of 100 Mbps but if it has configured maximum 1 Mbps bandwidth for each user logged on to its web server then the you will get a maximum download bandwidth of up to 1 Mbps despite you being on a higher bandwidth connection

- **Location of web server:**

If you are downloading from a web server located at distant location, Latency will increase resulting in slower download speed.

- **Overhead:**

When you send or receive data through internet (upload and download), it does not utilize full bandwidth of the internet since some data is necessary for routing and other protocol needs. This extra data is called as overhead and this also consumes some bandwidth. Since some portion of bandwidth is utilized by overhead, you are not able to upload/download the content with total bandwidth provided by the service provider.

- **Hardware Limitations at the users end:**

A standard PC/Laptop allows aggregate download only up to 15-20 Mbps a time. So, you may be on a higher bandwidth plan but you may get aggregate download speed up to 15-20 Mbps only. Also, TCP/IP Protocols configured in PC for communication also puts a limitation on following:

- Number of simultaneous downloads on a PC
- Maximum download speed for every download



White Paper Series

Understanding Internet Bandwidth and Plan Performance

RELIANCE
Broadband

Factors Affecting Download Speed continued...

• Limitations of Home Wi-Fi:

If you are using a Wi-Fi network, the bandwidth will be subject to change depending upon following:

Typically many of us use 802.11g Wi-Fi standard. Following are limitations for that standard:**

<u>Op. frequency</u>	<u>Throughput</u> (typ.)	<u>Net bit rate</u> (max.)	<u>Gross bit rate</u> (max.)	<u>Range</u> (indoor)
2.4 GHz	~22 Mbit/s	54 Mbit/s	128 Mbit/s	~up to 50 m

Other Wi-Fi limitations affecting the bandwidth are:

- Signal Strength: If Signal strength of Wi-Fi is weak, then bandwidth will further dip
- Number of clients on Wi-Fi network: Bandwidth received per client will decrease as the number of clients on a Wi-Fi network increase and vice versa.

** These statistics are for single User



White Paper Series

Understanding Internet Bandwidth and Plan Performance

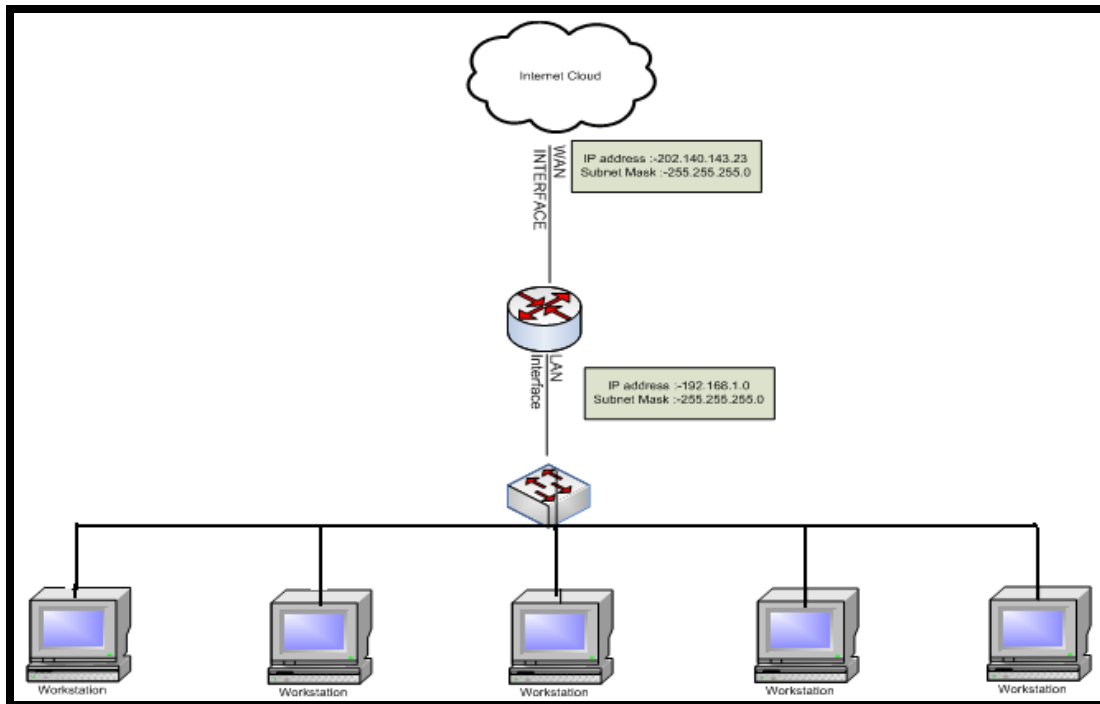
RELIANCE
Broadband

Optimum utilization of Bandwidth

If you connect multiple PC's, for e.g. 5 Laptop/PC via LAN and start multiple downloads at a go on each PC/Laptop, then you can achieve aggregate bandwidth as per plan.

E.g.. If you have subscribed for the 100 Mbps plan then the (download + upload) sum of all downloads happening at the same time will be equal to 100 Mbps in the below setup.

However, you will not get 100 Mbps for the single file download. Single file download on a single machine will never be 100 Mbps.



broadband plan as per TRAI.

White Paper Series

Understanding Internet Bandwidth and Plan Performance

RELIANCE
Broadband

Conclusion

A High bandwidth plan does not guarantee you instant downloads and super fast browsing. However, it ensures smooth surfing experience even if you have multiple downloads in progress.

There are many other factors which affect the browsing experience, bandwidth being one of them. There is no doubt that high bandwidth plan enhances surfing experience and it is an advantage to run High bandwidth applications which cannot be run on Standard broadband connection, but at the same time internet performance varies from time to time and ISP to ISP.

The most effective way to measure performance of your internet connection is through Internet bandwidth/speed measurement tools provided by the service providers. This will give true performance measure within the service provider network.



White Paper Series

Understanding Internet Bandwidth and Plan Performance

RELIANCE
Broadband

Terms:

Throughput:

Throughput is the number of messages successfully delivered per unit time. Throughput is controlled by available bandwidth, as well as the available signal-to-noise ratio and hardware limitations.

Latency:

Latency is the delay between the initiation of a network transmission by a sender and the receipt of that transmission by a receiver. In two-way communication, it may be measured as the time from the transmission of a request for a message, to the time when the message is successfully received.



White Paper Series

Understanding Internet Bandwidth and Plan Performance

RELIANCE
Broadband

About RCOM:

Reliance Communications is India's foremost and truly integrated telecommunications service provider. The Company, with a customer base of 105 million including over 2.5 million individual overseas retail customers and nearly 3 million DTH customers, ranks among the Top 5 Telecom companies in the world by number of customers in a single country. Reliance Communications corporate clientele includes 2,100 Indian and multinational corporations, and over 800 global, regional and domestic carriers.

Reliance Communications has established a pan-India, next generation, integrated (wireless and wireline), convergent (voice, data and video) digital network that is capable of supporting best-of-class services spanning the entire communications value chain, covering over 24,000 towns and 600,000 villages. Reliance Communications owns and operates the world's largest next generation IP enabled connectivity infrastructure, comprising over 190,000 route kilometers of fibre optic cable systems in India, USA, Europe, Middle East and the Asia Pacific region.

