Broadband access wired mediums

Broadband Access

High speed internet access is also called as Broadband. With the help of broadband access we can send large amount data at a same time through a medium. It’s also called as “ Broad Bandwidth” connection.

Bandwidth can be defined as the amount of data transmitted or in other word it can be defined as the width of the connection. Bandwidth can be expressed in bits per second that is the amount of bit of data that can flow through a line. But nowadays the bandwidth speed has changed that’s from bps to Kbps to Mbps and now in Gbps. We have two type of medium through which we can get broadband access one is “ Wired Medium” and the other is “ Wireless Medium”.

Wired Medium

There are many wired mediums through which broadband internet access can be obtained. Few are listed below.

- Cable.
- HFC.
- XDSL.
- Fiber Optic’s.
- Power Line Access.

Cable Internet

It uses the same co-axial cable which is used for viewing Television. In order to provide this Cable internet to the subscriber the cable operator has to

upgrade his equipments. The Cable subscriber can obtain this cable internet service by using cable modem and connect this modem to the computer.

The cable modem works like Television but its differs in the output, the output in the television is a TV program but in cable internet it’s a web page. The cable has a storage or space, through which the television program can be transmitted and this space is called as the “ Bandwidth”. So this bandwidth will bring webpage and television program to the end user. The cable modem transmits full duplex with great speeds ranging from 10 -20 Mbps (regardless of distance) but degrades when it’s shared by multiple users at the same time.

Cable Internet Access is reliable but not secure. By using firewall and proper password protection we can over come the security problem.

Hybrid Fiber Coax (HFC)

HFC is an extension of Cable internet. The signals from headend system to the customer pass over a combination of fiber and coaxial cable. Fiber optic cables will connect the head end system to the neighboring node and co-axial cable is used to connect households to this node.

Figure 2: Hybri Fiber Coax

In HFC the signals will flow in both forward direction (Downstream) that is from head end system to customer via node and reverse direction (Upstream)that is from customer to head end system via node. Since coaxial cable (shared medium) is used for connecting node and customer there will

be lot of interference in Upstream and Downstream of signals. To avoid this interference in coaxial cable the frequency is split into two.

In HFC the Downstream is allocated with more frequency bandwidth than the Upstream because more video content is sent to the homes, so for this reason “ *Non-Symmetrical”* process is followed to configure HFC network. By “ Non-Symmetrical we mean path in one direction (Downstream) has more data carrying capacity. Earlier the upstream was used for information like ordering movie, audio etc.. But now extra features like internet and telephone are added to HFC network and hence the upstream is utilized more.

xDSL

The generic name for DSL technology family is xDSL. DSL (Digital Subscriber Line) uses telephone line to provide high speed internet broad band access the speed of which can be 1. 5 Mbps for a typical residential connection or more.

The various type of xDSL are shown below:

- ADSL
- RADSL
- SDSL
- HDSL
- HDSL2
- VDSL

ADSL (Asymmetric Digital Subscriber Line)

This technology uses existing phone connection to provide high speed internet broadband access. The word Asymmetric means the Downstream and upstream speed differs in other words more data is transmitted in Downstream than Upstream, Digital means the data is converted into digital form i. e. 1’s and 0’s and by “ Subscriber Line” it mean simple copper wire is used for this.

In the telephone exchange this ADSL can be implemented with special equipments and in the customer side it can be obtained by connecting a the phone connection to ADSL modem and ADSL modem is connected to the computer. One major disadvantage of ADSL is that the speed will get reduced as distance between the ADSL provider and Customer increases.

ADSL uses the Frequency Division Multiplexing technique for data transmission. The communication link is divided into three non overlapping frequency band, two-way telephone channel (0 to 4 KHz band-POTS), medium speed Upstream (4KHz to 50 KHz band) and High speed Downstream(50KHz to 1MHz)

RADSL (Rate-adaptive Digital Subscriber Line)

RADSL differs from ADSL . In RADSL depending upon the length and the quality of the line, the modem can adjust the speed of the connection.

SDSL (Symmetric Digital Subscriber Line)

In SDSL Upstream and Downstream have the same speed. SDSL can transfer data up to 3Mbps in both directions. The figure below shows the difference between ADSL and SDSL. From the figure it’s clearly seen from ADSL the

Sending (Upstream) have small pipeline where as in the SDSL both Upstream and Downstream have same pipeline size

ADSL

Bandwidt

h

SDSL

Bandwidt

h

Receive

Data

Receive

Data

Send

Data

Send

Data

Figure 3: SDSL

With ADSL webpage access is not an issue. But ADSL faces problem when it needs to download large amount of data.

HDSL (High Bit Rate Digital Subscriber Line)

HDSL will provide speed up to 1. 5 Mbps in both the directions (Upstream and Downstream) which can be used for businesses that hosts websites.

HDSL 2(High Bit Rate Digital Subscriber Line 2)

This advanced version of HDSL this HDSL2 will provide same throughput in single copper wire and provide telephone service.

VDSL (Very high bit-rate Digital Line Subscriber)

This VDSL is advanced version of DSL technologies which has very high downstream speed (52 Mbps) and upstream (12 Mbps) bandwidth. VDSL architecture is based on two technologies QAM (Quadrature amplitude modulation) or DMT (Discrete multitone modulation) that are not compatible. The most commonly used technologies are DMT.

Fiber Optic’s

In Fiber Optic’s data is transmitted via optical fibers. Optical fiber is a thin wire made up of pure glass with . These Optical fibers are bundled together to form a Optical cable that transmits data to long distances.

The Figure shown below will discuss about the various parts of the Optical Cable. Optical Cable has three parts namely the Core, the Cladding and the Coating.

- Core: The inner most layer of the Optical Cable made up of glass. In this layer the data is transmitted in the form of light.
- Cladding: This layer is above the inner core. This layer is also made up of glass. The main use of this layer is to reflect light back into the core.

- Coating: This is outermost layer of the cable. The main use of this layer is to protect the cable from damage. This optical fiber cable is covered with an outer jacket.

The are two types of Optical fiber, Single mode and Multimode. The Single mode uses laser beam to transmit data, the inner core of which is small in diameter and hence has less to nil modal dispersion. On the contrary, the Multimode has a larger diameter, uses LED and suffers from modal dispersion.

Broadband over Lines (BPL)

This technology provides high speed broadband internet access to homes via electrical outlets. By combining the concepts of modem, radio and wireless networking , the BPL developers developed a way to send data via power lines to homes at speed of 3Mbps.

The BPL developers by adjusting the Power Lines with the help of special equipments can send data on it. The BPL developers could partner with power companies and Internet service providers to bring broadband to everyone with access to electricity.

There are two types of BPL services, In-house BPL that is used to network inside buildings and Access BPL that provides Broadband internet via power lines

Figure 5: Broadband Over Line

Silicon Chipset in modem helps in getting the data from an electrical outlet and uses modulation technique and adaptive algorithm to handle noise in

the power lines. From the figure above we can see that the modem looks like a common adapter which c an be plugged into electrical socket, and an Ethernet wire from the modem will connect to the computer.

Wireless Medium (Micro Wave)

Satellite

This technology uses satellites and satellite dish to provide high speed broadband internet connection and uses microwaves to transmit data signals. With the help of this technology we can link two or more base stations on earth. The signals from the base station are passed to the satellite on one frequency and the satellite will regenerate the signal or increase the signal strength with the help of repeater and will send it to the destination base station.

There two type of satellite used for this purpose, geostationary satellite and low altitude satellite. Geostationary satellite remain at the same spot above the earth (36000 Km) . Because of the huge distance between the base station and the satellite, it will induce a propagation delay and its used mainly in telephone service . Low altitude satellites revolve around the earth and provide continuous coverage for all the area.

There are two types of satellite broadband access, two way satellite internet services and one way satellite internet services. In two way the data can be transmitted in both the direction and in order to do this the satellite dish must be large. In one-way its can only receive data not send data.

There are two types of satellite system asynchronous satellite system and synchronous satellite system. In asyn the upstream and downstream speed will be different where as in synch the speed in both the direction will be same.

Major advantage of this technology is that it can provide high speed broadband internet access to the place where wired medium is not possible. The speed of download is 600k and upload is 128K. Major disadvantage is the price and reliability of the service (it may get affected due to bad weather).

Wireless Medium (Radio Wave)

Fixed Wireless

This technology uses Radio waves to provide high speed broadband internet access. There are two types, point-to-point fixed wireless and point-to-multipoint fixed wireless.

In Point-to-Point signal is transferred from one antenna to other antenna(indoor or outdoor) which is on ground station . The main disadvantage in Point-to-Point is line of sight . Signal cannot reach the destination antenna if its not in the line of sight of the first antenna.

In Point-To-Multipoint the only difference is that the signals via radio waves can be transmitted to many receivers rather than one dedicated receiver. It has the same drawback line of sight.

Wi-Fi

Here it uses radio waves to send and transmit data. To implement this we need a wireless adapter card and a wireless router. The digital information (web page request) from the computer is converted to radio wave with the help of wireless adapter. These radio waves are captured by wireless router which in turn will convert the radio signals back to digital signal and send the information to net via Ethernet cable. The response (webpage) will reach the wireless router which converts them into radio waves which is in turn converted into digital signal by wireless adapter.

WiMax

The main disadvantage of wireless broad band is that it is very expensive and cant be widespread. Wi-Fi works only in Hotspots. To over come these difficulties WiMax technology is introduced which is like a cell phone with broadband access.

It basically has 2 parts WiMax Tower and WiMax Receiver. Wifi max tower work the same way as the cellular tower and has a very large coverage area. The wimax tower is connected to internet always or it can be connected to other wimax tower using line of sight microwave link . WiMax receiver is like a wireless adapter used in Wi-fi technology

Wimax provides two type of wireless service. “ Non Line of Sight” service in which the computer uses an antenna to connect it to the tower. “ The line of sight in” which the antenna is fixed in a roof top and pointed directly to the wimax tower.