**INTERNET ACCESS VIA CABLE TV NETWORK**

**LAWRENCE MICHAEL TOCHUKWU**

**(ST/CS/ND/20/374)**

**A SEMINAR REPRESENTED TO THE DEPARTMENT OF COMPUTER SCIENCE, SCHOOL OF SCIENCE AND TECHNOLOGY, FEDERAL POLYTECHNIC MUBI, ADAMAWA STATE, NIGERIA**

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Abstract

*Internet is a network of networks in which various computers connect each other throughout the world. The connection to other computers is possible with the help of ISP (Internet Service Provider). Each Internet users depend dialup connections to connect to Internet. This has many disadvantages like very poor speed, may time cut downs etc. To solve the problem, Internet data can be transferred through Cable networks wired to the user computer. Different type connections used are PSTN connection, ISDN connection and Internet via Cable networks. Various advantages are High availability, High bandwidth to low cost, high speed data access, always on connectivity etc.*

**Keywords**: Cable Modem, Cable TV network, Digital Subscriber line, Dial-up Connection, Internet Access,

**Introduction**

The Internet is a global system of interconnected computer networks that use the standard Internet Protocol Suite (TCP/IP) to serve billions of users worldwide. It is a network of networks that consists of millions of private, public, academic, business, and government networks, of local to global scope, that are linked by a broad array of electronic and optical networking technologies. The internet carries a vast range of information resources and services, such as the inter-linked hypertext documents of the World Wide Web (WWW) and the infrastructure to support electronic mail. There are mainly three ways to connect to internet; namely: dial up, broadband and wireless where broadband service is available in three main platforms viz Cable modem, Digital Subscriber Line (DSL) and Satellite .Here specifically we will lay stress on Cable modem which uses the same connection that delivers cable TV .This platform is fast and reliable but not available in all areas. The huge growth in the number of Internet users every year has resulted in the traffic congestion on the net, resulting in slower and expensive Internet access. As cable TV has a strong reach to homes, it is the best medium for providing the Internet to house - holds with faster access at feasible rates (Jyothi *et al.,* 2016).

Internet is a network of networks in which various computers connect each other throughout the world. The connection to other computers is possible with the help of ISP (*Internet Service Provider*). Each Internet users depend dialup connections to connect to Internet. This has many disadvantages like very poor speed, may time cut downs etc. Miraculous developments in telecommunication systems and information technology have created marvels for the new generation i.e. Internet using a phone line. Internets via phone connections are painfully slow, especially when downloading photographs, graphics, or video images and large files. To solve the problem, Internet data can be transferred through Cable networks wired to the user computer. The cable modem technology for the Internet provides an 'always on' feature for individuals to access the Internet rapidly, while its digital broadband network technology allows user to move around quickly (Manco *et al.,* 2019).

Various advantages are High availability, High bandwidth to low cost, high speed data access, always on connectivity etc. The huge growth in the number of Internet users every year has resulted in the traffic congestion on the net, resulting in slower and expensive internet access .As cable TV has a strong reach to homes, it is the best medium for providing the internet to house-holds with faster access at feasible rates (SanthaMeena & Manikandan, 2017).

**Literature Review**

Internet Access through Cable TV Network is a form of broadband Internet access that uses the cable television infrastructure. Like digital subscriber lines and Fibre to the premises, cable Internet access provides network edge connectivity (Last mile access) from the Internet service provider to an end user. It is integrated into the cable television infrastructure analogously to DSL which uses the existing telephone network. The cable TV signals are often removed by filtering at the line tap outside the customer's premises. Cable TV networks and telecommunications networks are the two predominant forms of residential Internet access. Recently, both have seen increased competition from fibre deployments, wireless, and mobile networks (Manco *et al.,* 2019).

Cable Internet access is the principal competitor to DSL and is offered at a range of prices and speeds overlapping that of DSL, but tends to concentrate more on the high end of the market.

Broadband cable Internet access requires a cable modem at the customer's premises and a cable modem termination system at a cable operator facility, typically a cable television head end. The two are connected via coaxial cable or a Hybrid Fibre Coaxial (HFC) plant. While access networks are sometimes referred to as last-mile technologies, cable Internet systems can typically operate where the distance between the modem and the termination system is up to 100 miles (160 km). If the HFC network is large, the cable modem termination system can be grouped into hubs for efficient management (Sharma et al., 2013).

Downstream traffic, the direction toward the user, bit rates can be as much as 400 megabits per second for business connections, and 100Mbit/s for residential service in some countries. Upstream traffic, originating at the user, ranges from 384Kbit/s to more than 20Mbit/s. One downstream channel can handle hundreds of cable modems. As the system grows, the cable modem termination system (CMTS) can be upgraded with more downstream and upstream ports, and grouped into CMTS hubs for efficient management (Manco *et al.,* 2019).

Most Data Over Cable Service Interface Specification (DOCSIS) cable modems restrict upload and download rates, with customizable limits. These limits are set in configuration files which are downloaded to the modem using the Trivial File Transfer Protocol, when the modem first establishes a connection to the provider's equipment.

**Access on Internet**

We are all quite familiar with the Internet browsing via fax modem through dial-up. The Internet is accessed using a telephone line as the transmission media. The analogue telephone lines originally meant for voice transmission now carries data but at very low speeds. The basic disadvantages of this method are the occupation of the telephone line while the Internet is being accessed, and the telephone bill, in addition to the fees for Internet account, which can touch the roof! The disconnections and redialing required quite often during the browsing, is distressing more so when the connection gets cut while you are downloading important information or large files. Whereas broadband access technologies enable data transfer at high speeds. Therefore, any medium or technology that allows data transfer speeds of more than 64kbps can be called as broadband technology. The medium can carry numerous voices, video and data channels simultaneously since each channel takes up a different frequency and there is no interference with one another. A co-axial cable TV is a classic example of broadband technology as it can broadcast several channels simultaneously, but only in one direction. The same technology principles are now applied for delivering rich multimedia content in two-way direction.

**Cable Network**

For access of Internet through the cable network you need a cable modem instead of a telephone modem. The cable modem is however, not just a modem, its encryption and security features are in-built and user can also access television channels simultaneously through the cable connection, optionally, as shown in figures 1 and 2. A cable modem is a device that allows high-speed access to the Internet via cable TV network. It typically has two connections, one to the cable wall outlet and the other to a computer and TV through a splitter. With cable TV network and Using a phone line, connections are painfully slow, especially when downloading photographs, graphics, or video images (Sharma, Verma & Sharma, 2013).

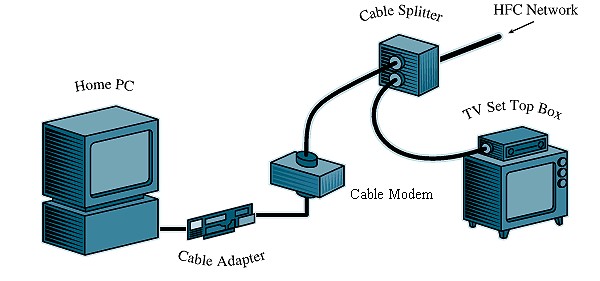


Figure 1: Single-user premise equipment configuration (Sharma et al., 2013).

The cable modem technology for the Internet provides an always-on feature for individuals to access the Internet rapidly, while its broadband network allows user to move around quickly. One gets unlimited time of surfing at a very high speed. Accessing the Internet on the public switched telephone networks (PSTN) still has a lot of problems. Such as drops outs. Its takes along time to download or upload large files. One has to pay both for the Internet connectivity as well as for telephone usages during that period. Since it is technically possible to offer higher bandwidth by their cable, home as well as corporate users may make like it. Many people cannot afford a PC At their premises. Hardware obsolescence in the main problem to the home user. Who cannot afford to upgrade his PC every year? Cable TV based ISP solution s offer an economic alternative (Kim, Yeom, Bi & Kim, 2015).

Future residential cable data services are expected to deliver internet access, work-at-home applications, small business access, LAN-to-LAN interconnected, and LAN emulsion services over cable TV (CATV) innovation, improvements, and modification over the existing networks and their constituents such as modems, Modern termination system, routes, and network systems. Services like the fast Internet access. Broadband enhances cable technologies and coaxial cable modems, etc are enabling profitability entries. Not only the exiting cables TV (CATV) operates, but also al so these ISPs can enter this new marker sector, can benefit from the boom offered to the early birds (Lim, 2016).

Internet- An Information Communication Networks

Internet is the network of all networks, which connect various computers to one another throughout the world. The fascination of internet is not only in its connectivity of computers, but also in the fact that every one can be the user is on that networks, regardless of whether or not they can come from a business or home environment. With regard to the fact that internet was first indented for development and research work, it quickly surpassed that initial role, especially when the first big commercial computer companies like Microsoft, Hewlett packed, IBM and later, many other companies in fields other than computer science, began to connect to Internet practically speaking, today there is not a form of media which did not mention the word the Internet at least once, whether the local newspaper or Television program (Jyothi et al., 2016).

The reason for the unbelievable speed of development and use of Internet lies in the fact that the January 1993, multimedia application MOSAIC was developed by experts at the NCSA (National Center for Super Computing application). At the university of Illinois in the USA became widespread. That application was designed for browsing the global information system known as Word Wide Web (WWW). Its ease of use, latency of demanding Internet network protocols and a very simple installation of different computers and platforms caused actual explosion of new www servers. By the end of the year 2000, experts predicted that there will be 40 million people connected to Internet. The large majority of those users will connect from home (Lim, 2016).

# Expectations of Data Transfer Through the Cable TV Network

Recently, an idea came to mind about data transfer trough’s a cable TV network that uses existing cable TV connections for digital data transfer. Due to the existing connections, such a forms of idea transfer can be relatively inexpensive, which is convenient for providers an offers of Internet services, as well as for the end users. In this case, we would get a connection capable of up to 30 Mbps to our computer at home for less money than some people spend on their monthly telephone bill. Currently in the USA, for approximately USD 50-100 monthly you can have a connection to Internet through a cable TV network with a speed of 10 Mbps. In contrast to a telephone line, for that amount of money users can browse all day and night through Internet and communicate live within other users using videoconferences, without any traffic jams in data transfer. It is important to know that in a single second we can transfer more information than through a standard telephone line (28.8 kbps) in a few minutes or through ISDN, which offers slightly more powerful data transfer (128 kbps) (Kowshiga, Saranya, Jayasudha, Sowmiya, Balamurugan, 2015).

**Data Transfer Through a Cable Network**

The basic architecture of networks delivering Internet access via cable TV (CATV) is shown in fig. A cable data modem (CM), with an Ethernet or pc interface, serves as an access interface between the customer premises and the CATV network. CM connects the customer presses equipment, such as PC or Internet-cabled TV, to the CATV networks. CMs of a number of subscriber’s devices are connected on the cable to a cable modem data termination systems (CMTS) at the head end (HE) (Lim, 2016).

The internet services over CATV networks are an ideal substitute and improvement over conventional dial-up services Upstream- and downstream-data from the consumer premises to the internet are transported through the same cable pair from the CMTS to CM as shown in fig. A number of CM sub networks are connected to the CMTS. CMTS is equipped with traffic filtering capabilities to eliminate broadcasting messages over the cable to avoid significant throughout degradation. Cable TV that is known us today can be imagined as a one-way street. Programs that are on certain channels are transmitted to TV sets Unfortunately, two-way (Kowshiga et al., 2015).

Because the users of cable systems are mainly connected one-way, that is, from the direction of the Head end to the television set, it is necessary to enable communication in the opposite direction. In order to achieve that, we have to assign a **spectrum of signal** **frequencies** to the cable TV system that will be used for the signal that moves from the Head end towards the user, and a spectrum of signal frequencies from the user towards the Head end. Furthermore, current one-way amplifier between input and output signals, and will amplify the correct frequency range in each direction. Finally, the Head end should have a special component called IP- Router installed in it, which will take care of accurate reception of all signals from outside and of routing signals to Internet (Manco, 2019).

**Comparisons**

The revolution of digital technology and evolution of cable TV network (broad band technology) helps to access Internet, the cable modem's speed varying widely. In the downstream direction from network to the computer, speeds can be anywhere up to 36Mbps. Few computers will be capable of connecting at such high speeds; a more realistic number for computers is 3 to l0Mbps<.In the upstream direction from computer to network, speed can be up to l0Mbps. However, most modem producers will probably select a more optimum speed between 200kbps and 2Mbps. for instance; a file that takes eight minutes to download over a 28.8kbps modem connection would take two minutes to download on ISDN, compared to eight seconds via cable modem. In the upstream direction (from computer to network), speeds can be up to 10 Mbps. However, most modem producers have selected a more optimum speed between 500 Kbps and 2.5 Mbps,and many cable operators limit the upstream bandwidth to 128 or 384kbs. An asymmetric cable modem scheme is most common. The downstream channel has a much higher bandwidth allocation (faster data rate) than the upstream (Basant, Sayed, AbeerBadr, Ahmedb & Vishal, 2019).

Once broadband technology becomes available to large sections of the society, a whole range of applications will become possible to consumers. There will be high-speed Internet access, real time video conferencing, video streaming, music downloads, interactive television, online education and remote classroom distance learning, online shopping, videoon-demand, online games and teleworking. Broadband technologies can deliver information faster and because of the efficient and use of the communication pipes, a greater number of users can be connected to the Internet without affecting the speed of downloading or uploading data (Basant et al., 2019).

Typically, in an academic business environ merit, this helps to boost employee efficiency, increase their productivity and reduce cost. In the cable modem development, an asymmetric setup will probably be more common than a symmetric setup. In an asymmetric scheme, the downstream channel has a much higher bandwidth allocation, faster data rate than the upstream. One reason is that the current Internet applications tend to be asymmetric in nature. Activities such as web navigation and news group reading send much more data down to the computer than to the network. Mouse clicks (URL requests) and e-mail messages are not bandwidth-intensive in the upstream direction. Image files and streaming media i.e. audio video are very bandwidth intensive in the downstream direction. Hence, using cable modem is much beneficial than the telephone dial-up-modem. A cable modem can be part modem, part tuner, part encryption or decryption device, part bridge, part router, part network interface card, part simple network management protocol agent and part Ethernet hub. Typically, a cable modem sends and receives data in two slightly different fashions. In the downstream direction, the digital data is modulated and then placed on a typical television carrier (Basant et al., 2019).

The signal can be placed in 6MHz channels adjacent to TV signals on either side, without disturbing the cable television video signals. primarily because Internet applications tend to be asymmetric in nature. Activities such as World Wide Web (http) navigating and newsgroups reading (nntp) send much more data down to the computer than to the network. Mouse clicks (URL requests) and e-mail messages are not bandwidth intensive in the upstream direction. Image files and streaming media (audio and video) are very bandwidth intensive in the downstream direction (Lim, 2016).

**Network Setup**

A· propose typical cable network is shown in figure 4. It consists of Internet backbone connectivity from internal service protocol. It then goes to the router and to the switch. The switch connects to the server as well as the cable modem termination system (CMTS). The CMTS output goes to the up converter before finally being fed in to the cable network. Information will reach your doorstep, which is a great extended development of satellite technology and communication technology to help develop and design such type of networks to save the wealth of nation and its potential to parental organization to adopt such a technology. (Santhameena et al., 2017).

The kind of technology has been already. existing in the US and UK for the last few years. There are several methods for computer connection, but Ethernet 10 Base T is emerging as the most predominant method. Although it probably would be cheaper to produce the cable modem as an internal card for the computer, this would require different printed-circuit cards for different kinds of computers, and additionally would' make the demarcation between cable network and the customer’s computer too fuzzy.

**Network Technology**

1. It modulates and demodulates signals
2. Much more complicated than their telephone counterparts
3. Cable modems can be part modem, part tuner, part encryption/decryption device, part bridge, part router, part network interface card, part SNMP agent, and part Ethernet hub
4. Typically, a cable modem sends and receives data in two slightly different fashions
5. In the downstream direction
6. The digital data is modulated and then placed on a typical 6 MHz television channel, somewhere between 50 MHz and 750 MHz

**Services**

The emergence of communication technology and information technology lead to electronic library with the help of internet, and expert systems development and a widespread use of information networks for the dissemination and interactive use of information covering every facet of human life will become the order of the day.

New services and ideas are born daily. The Internet on cable will offer high-speed interactive content to homes and workplaces over coaxial distribution architecture. The network provides the high speed cable modem; 24-hours a day, unlimited access to the internet; e-mail and chat; a Netscape navigator browser; and an internet guide featuring local and world-wide content cable modems enable data connections with much higher speeds than ISDN.

**Advantages**

1. High availability: Many house holes in the world are equipped with cable TV. India has a cable penetration of about 50 Million homes and these household holes could theoretically be connected to Internet via such a cable TV connection. Today only in a few regions one can use this technology. But in the foreseeable future all cable TV provider will also provide this service.
2. High band-width to low cost: Although a specific bandwidth cannot be guaranteed, the cost of such an Internet connection is extraordinary cheap. It is too early to make any statement about the performances. The question is, how fast will be when everybody is using it?
3. Permanent connection to low cost: No other technology gives you the advantage of permanent connection to Internet to such a low cost. Only sharing x DSL connection can reach the price level.
4. Phone line is not busy: You are able to work and surf in Internet and making a phone call at the same time. The phone line is never needed. In the future, it will be possible to make the phone calls directly over the cable network.
5. High speed data access: Cable modem can offer the download speeds from the Internet in excess of 1MB/second (Mbps) at least 20 times as fast as traditional telephone modem. Web pages that take minutes to paint in with a dialup connection popup instantly with a dialup modem.

**Conclusion**

Internet access via cable TV network is interesting in many points of view: it is fast, cheap, easy to install and you have the advantage of permanent Internet connection. For teleworkers this is a very attractive alternative to get Internet connectivity. The HFC network dispenses the mess of a large no of head-ends in a city, thus saving a considerable amount of money by way of adopting optic-fibre cable as means of transmission system. The optical-fibre has such inherent qualities as low loss to the signal large bandwidth, and immunity to the electrical disturbances that has superseded all means of transmission systems.

**Recommendations**

Using HFC technology the cable TV system cannot only provide Internet services but also increase the number of video channels to 100. Coaxial cable can be upgraded to handle frequency bandwidth up to 870MHz, thereby providing analog and digital TV to the subscriber. This upgrade technology is the most easy and effective way of providing broadband network other than cable TV to the mess population of India.

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