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INTERNET ACCESS VIA CABLE TELEVISION NETWORK AS BETTER ALTERNATIVE FOR HOME NETWORK DEPLOYMENT

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ABSTRACT

The Internet carries vast range of information, resources and services among private, public, academic, business and government networks that are linked by a broad array of electronic, wireless and optical networking technologies. Its performance has become extremely important in view of their ever expanding usage, and the complexity of its functions. However, the huge growth in the number of internet users every year has resulted in traffic congestion on the net due to limited bandwidth, resulting in slow speed and expensive internet access. Also, like any Radio Frequency (RF) transmission, wireless networking signals are subjected to wide varieties of interference as well as complex propagation effects. Moreover, wireless network is a bit more difficult to setup properly due to its security vulnerabilities. This work is on the need for Internet access via Cable TV Networks. Cable TV has a strong reach to homes and offices and possesses the following features compared to wireless network. It has high availability of internet services, high bandwidth to low cost of data transfer, high speed data access, more secured data transfer, very easy to configure, less prone to interference, less susceptible to attenuation (far distance) and cost effectiveness. The aim of this work perhaps is to educate public on this new system of internet technology.

KEYWORDS*: Radio Frequency, Wireless Network, Cable Television, Attenuation, Internet, Transmission Towers*

INTRODUCTION

Internet access via cable television network can be defined as a process of delivering internet service using cable television infrastructures. However, according to Vicomsoft Ltd (2002), Cable TV Networks began in the USA over thirty years ago to provide TV access to locations that had difficulty in receiving TV signals transmitted by normal transmission towers. This included many inner city locations where TV reception was poor due to interference from buildings. In addition, Geographical conditions around some towns, and cities (such as mountains) made it difficult for every building to have its own tall costly aerial (antenna). This gave rise to the formation of Cable Network Companies that will be charged with the responsibilities of delivering this service to the people. The companies were to obtain license or franchise for a specific Geographic location and sale access to the users for monthly subscriptions.

Ferri (2009) noted that "initially, cable TV systems provided only one-way broadcasting services such as standard and premium channel television". But, upgrading of this earlier system to support the two-way communications gave rise to internet access, pay-per-view and voice and video-on-demand services. Today, many cable TV carriers have merged with large telecommunications companies in order to take advantage of the enormous market potentials that exists in the industry. Such companies include Cablevision, Delight net, Comcast, etc. In the mid 1990's, a major shift occurred in the broadcast industry, the conversion from analog systems to digital systems provided broadcasters with the tools they needed to bundle multiple types of services onto a television channel signals. This included cable modems, digital television, and even telephone services. The ability to integrate several services into one transmission signal allows the cable television to offer many new services without significant investment in the new cable systems. Analog Cable Television (ACTV) systems typically provide 50-100 video channels while digital Cable Television systems provides hundreds of video channels, as well could provide high-speed internet access, and telephone services. According to Karas Dan (2011), as cable systems evolved to include fiber optic cable and two-way (duplex) transmission amplifiers, cable networks evolved to allow data transmission in both directions. The two-way cable system requires cable modems at the User-End (Customer's premises) and a coordinating modem at the Head-End (Central distribution Point that is, at your ISP office) of the system. A modem at the head-end coordinates the customer's modem and interfaces data to other networks such as the Internet.

Moreover, the standard used in the operation of Cable Modems today is called DOCSIS (Data Over Cable Service Interface Specification) which was developed in 1995. The rationale behind DOCSIS development was to provide a means of reducing production costs by using a common development platform in order to ensure interoperability.

AIM AND OBJECTIVES OF THIS WORK

This paper is aimed at educating people on this technology that enables one to access the internet cheaply and conveniently. The objectives are:

- To explore issues and challenges facing the internet users.
- To present a system architecture of internet access via Cable TV networks,
- To propose a mechanism that can provide solutions to the challenges facing the home internet users with feasible economic returns.
- To present a theoretical framework of this technology

SCOPE OF THIS WORK

In telecommunication, Cable Internet Access, often shortened for Cable Internet is a broad topic. It borders on how to use cables such as copper cable, coaxial cable, fiber optic cable, etc to transmit networks signals that can provide internet access. However, this paper is limited to accessing the internet via cable TV networks.

SIGNIFICANCE OF STUDY

After going through this work, the reader will be fully educated on the relevance of internet access via cable TV networks. Those who have cable TVs in their homes or offices will also be fully informed on how to convert them into internet masks.

However, internet access via cable TV networks has practically addressed some many limitations observed in wireless internet access especially in Nigeria. Hence, we suggest that the general public should invest into this technology as this will save costs and provide them with premium internet services at the comfort of their homes.

CABLE TV NETWORK SYSTEMS

Cable Internet Access often shortened for Cable Internet is a form of broadband Internet access that uses the television infrastructure. It provides network edge connectivity (last mile) to the end users. The cable network includes a head-end amplifier that combines the broadcast and data signals for transmission to the subscribers. High-speed Internet access could be obtained by including

a cable modem termination system (CMTS) which is located within the head-end (i.e. the main distribution point) that connects to a 10/100Mbps Ethernet router. In the network, the head-end is connected to fiber or coaxial trunks that carry the signals into the neighborhoods where they can be tapped to provide service (network signals) to other residences.

The head-end is the initial distribution center for a cable television (CATV) system. According to Warner (2009), the head-end is where incoming video and television signal sources (e.g.

video tape, satellites, and local studios) are received, amplified, and modulated onto TV carrier channels for transmission on the ACTV cabling system. The cable distribution system is a cable (fiber or coaxial connected to a small dish at the user's premises) that is used to transfer signals from the head-end to the end-users. This cable can be attached to the television through a decoder. The decoder is an electronic device that adapts a communications medium to a format that is accessible by the end-users as shown in figure 1 below.
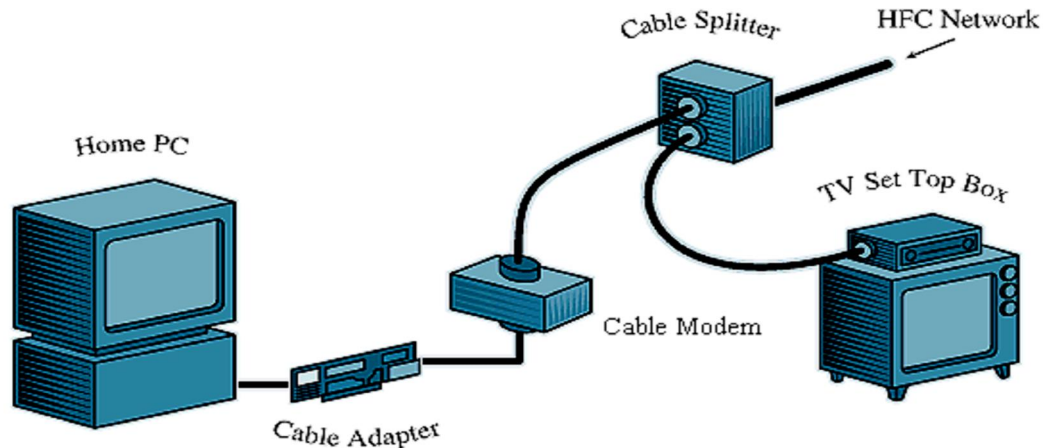

Figure 1: The diagrammatical representation of cable TV internet network framework

Source: www.ijarcs.info

ACCESSING THE INTERNET VIA CABLE TV NETWORK

Internet Access through Cable TV Network is defined as a form of broadband Internet access that uses the cable television infrastructure such as digital subscriber lines, fiber optic cable, copper cable, etc to provide Internet services, Karas Dan (2009). Cable Internet access provides network edge connectivity (last mile access) from the Internet service provider to the end user. This could be integrated into the cable television infrastructure analogously to Digital Subscribers Line (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 for those who do not need TV subscription. In broadband Cable Internet access, the network 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 Fiber Coaxial (HFC) plant, although in Nigeria, a small satellite dish is required to connect to the Cable TV head end which can now be wired to the user's TV through the use of coaxial cables. If the HFC network is large, the cable modem termination system can be grouped into hubs for efficient

management. Downstream traffic bit rates directed toward the user can be as much as 400Mbits per second for business connections, and 100Mbit per seconds for residential service. Upstream traffic, originating at the user, ranges from 384Kbit per second to more than 20Mbit per second. One downstream channel can handle hundreds of cable modems, and 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. Data Over Cable Service Interface Specification (DOCSIS) is a set of standards for transferring data by ACTV and cable modems. The DOCSIS interface specifications enable multivendor interoperability for transporting Internet Protocol (IP) traffic. 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 (TFTP), when the modem first establishes a connection to the internet service provider's equipment.

Cable network technology shares the access network bandwidth among its users. This

arrangement allows the network operator to take advantage of statistical multiplexing (SM) which is a bandwidth sharing technique employed by the (ISPs) to distribute network signals fairly to the users in order to provide an adequate level of service at an acceptable price. Vicomsoft (2009) pointed out that "the television and the Internet transmission take place simultaneously on the same cable but at different frequencies. This allows the user to view TV and access the Internet at the same time"

CONNECTIVITY OVER THE CABLE PLANT

Recall that the key question in providing residential Internet access is what kind of network technology to use in order to connect the customer to the Internet Point of Presence (IPOP). For residential Internet delivered over the cable plant, the answer is **broadband LAN** technology. This technology allows transmission of digital data over one or more of the 6 MHz channels of a ACTV cable. Since video and audio signals can also be transmitted over other channels of the same cable, broadband LAN technology can co-exist with currently existing services. The broadband LAN is built on top of two 6 MHz channels: one transmitting data from the head-end to subscribers (downstream), and the other transmitting data from subscribers to the head-end (upstream). At the head-end, **a frequency translator** connects the two channels into **a channel pair**, so that data can be sent from one customer to another.

Materials required in setting up a Cable TV Internet Service:-

Putting up a cable television system requires the following equipments;

1. Home PC (personal computer)
2. Cable TV Adapter
3. Cable splitter
4. High frequency Cable (coaxial)
5. TV set
6. Cable Modem

Comparison between Digital Subscribers Line (DSL) Service and Cable Network:-

DSL and cable modem network access are two alternative ways to connect to network service provider without the use of more expensive dedicated servers, such as Frac-T1/T1. DSL and cable modem networks achieve the same result of providing dedicated access to a network service; usually the Internet, but each do so using different technologies. For example, DSL uses telephone technology while cable system makes use of cable modem technology

DSL Modem versus Cable Modem:-

There is no clear choice between Digital Subscribers Line (DSL) and Cable Modem (CM) because each service has its own advantages and disadvantages. The main disadvantage of cable modems, when compared to DSL service, is that they share bandwidth at the cable head-end; the end-users and their neighbors share the same cable and as a result of this the Internet access point (IAP) tends to be the congestion point. Another disadvantage is that the end-users cannot choose the Internet Service Provider (ISP) of their choice. But DSL provide the end-user with a dedicated line to the ISP. Also, there is no bandwidth sharing with other users on the same network but just like cable modem, the Internet access point tends to be the congestion point also.

Cabling Requirements:-

There is no extra wiring required, your Cable Company will put a junction box in your home or office using the same television aerial cable. Your television and Internet access will be routed through this single connection.

The Cost of Cable TV Internet Access:-

The cost of the Cable Modem for Internet Access is very reasonable, especially with the high availability of bandwidth. The service costs tend to be slightly more than the monthly charges for a dial-up modem connection to an Internet Service Provider (ISP). That is, the cost will be higher if you dial always to your ISP for network connection. So, it is better you subscribe monthly for data services.

Implementation of Cable TV Network In a Multicomputer Environment:-

Yes! This could be achieved by using the normal configurations as in the single computer environment. However, instead of connecting the cable modem to the computer directly, you connect the cable modem to a LAN switch or an Ethernet router/wireless router. The switch can be connected to as many computers as possible depending on the number of Ethernet ports in it. The switch provides each computer with an individual IP address so as to enable it communicate with the Internet in both upstream and downstream manner as shown in figure 2 below.
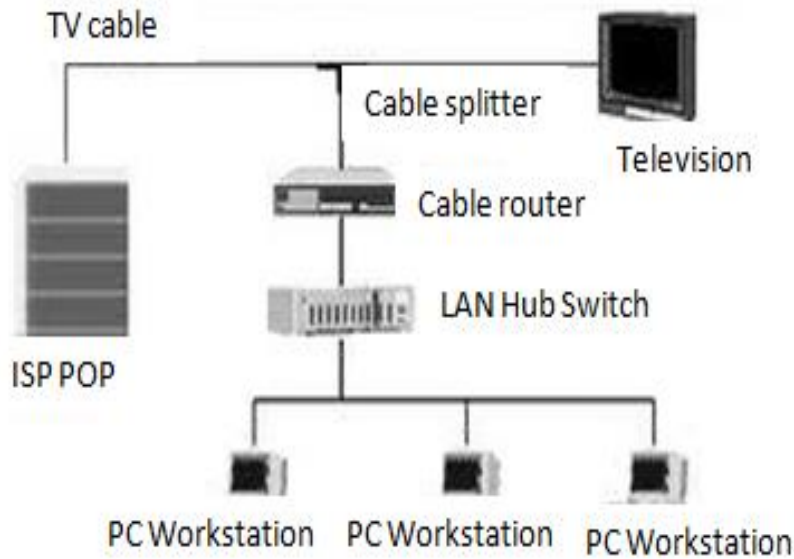
Figure 2: Cable TV Network Infrastructure in a Multiple Computer Environment

The Security of Cable TV Internet Service:-

Wired networks are inherently more secured than wireless networks and more users require passwords to access the network. This makes it easier to limit access to your network to authorized persons. On the other hand, security is the major drawback in wireless networks. If you are efficient in security, then your network will be open to unauthorized access. Even if you use sufficient security measures including passwords, wireless network is still vulnerable to hijacking or interception by a determined hacker. A wireless network also suffers from dropped signals, transmission interference from other electronic devices and transmission slowdowns if several users access the network at the same time. The only way by which an intruder may get inside of the individual wired network is via the outside Internet connections; however, these intrusions could usually be prevented through the use of firewall as well as routers that utilize substantial security. For total peace of mind, use a Firewall product such as the Vicomsoft, InterGate, etc. which can be configured to ensure that your computer or other computers on your LAN are not at risk and other antivirus and anti-spy wares applications to secure your systems.

The Advantages of Cable Internet Services:-

The advantages of cable networks include but not limited to the following;
1. General immunity to interference from other signal sources.
2. Enhanced physical security of the network (i.e. you have to be physically connected to a network device before accessing it).
3. High speed data transmission
4. High bandwidth size
5. It is less susceptible to attenuation (Distance)
6. It is cost effective because the cost of data is always tied to cable TV subscription
7. The service is convenient

The Disadvantages of Cable Internet Services:-

Every system that provides internet services are faced with one or two challenges, hence cable Internet network is not an exception to that. Therefore the limitations of cable TV network are as follows;
1. Physical space required for cabling,
2. Inflexibility in redeploying existing nodes
3. Initial acquisition and maintenance costs for cabling
4. Network speed is affected by the number of users at a time
5. Furthermore, this service is not available to all cable TV networks.
6. It is affected by power fluctuations

Approved Users:-

Everybody is allowed to use this service as far as you have the cable TV network facilities in your home or office. All that is required of you is to get your Internet Service Provider (ISP) that will get you connected to Internet Point of Presence (IPOP). Although you have to ensure that your cable provider is offering internet service because it is not all of them that are offering the service right now. Some companies that offer the service now is Sprintnet, Eastlink, Megacable, Cablevision, Telecable, Comcast, Delight Net, BrigtHouse Network, Time Warner Cable, etc.

Management of Internet Cable TV Network:-

It is the joint responsibility of the cable TV network provider and your Internet service provider to ensure that you are permanently connected to the Internet. Moreover, it is a stress free way of accessing the internet from the comfort of your home. It is enjoyed mostly when you are not sharing your network cable with your neighbour because it used to slow down the speed at which you get access to the internet.

Performance:-

It is worthy to note that Cable TV Internet Access Network transmit at the same speed of normal Cable Internet Network Access. Wired computer networks have faster transmission speed than wireless ones. Depending on the type of business you want to use the service for, as a business owner, a major decision you must consider is whether to install a wired or wireless computer network. Your ultimate decision will depend on several factors related to the specific needs of your business. Also, Answers.com, an online publishing website also made the same assertion: wired networks are typically faster than wireless networks. Taking certain factors into considerations such as receptions and interferences, wired networks are always faster than wireless network.

Reliability of the Services:-

If your business makes heavy use of streaming presentations or other bandwidth- intensive operations, wired networks offer the fastest transmission speed. Ethernet, cable networks or fibre optic wire networks all offer top transmission speed. DSL networks using telephone landlines offer somewhat slower speed but are still often faster than wireless networks.

COMPARISON BETWEEN ACTV INTERNET SERVICE AND WIRELESS INTERNET SERVICE

Computer network for the home and small business can be built using either wired or wireless technology. Wired (cable) technology has been the traditional choice in homes but **wireless fidelity;** (wi-fi) technologies are gaining ground very fast. Both wired and wireless can claim advantage over each other; both represent viable options for home and other Local Area Networks (LANs) options when you compare them under the following conditions; ease of installation, total cost, reliability, performance and security as presented in the table below.

	CABLE NETWORK	WIRELESS NETWORK
1	It has less chance of having its data intercepted.	. Wireless signals are broadcasted to different devices, thereby giving room for interception of signal/data
2	It is very reliable to use	It is less reliable to use
3	A wired network can be shielded in order to avoid signal loss or data interception.	Its network is not shielded hence, its signals can easily be lost or its data intercepted
4	The internal structure of a wired network is arranged in such a way that it can counteract any noise it generates.	Its signals can easily be affected by noise and attenuation (distance).
5	It is usually cheaper to set up	It is expensive to set up.
6	It is more difficult hacking into wired network	It is very easy to hacking into a wireless network.

CONCLUSION

Internet access via cable TV network with the aid of broadband technology is in no doubt have opened up a new realm of information access, storage and delivering of Internet services to people in Nigeria and abroad. It offers very high speed Internet access without traffic jam at less cost. Cable Internet offers high connection speed. However, in this paper, we have been able to educate our readers on this technology on its merits and demerits. Our interest in this work therefore, is to create more awareness on this technology by describing in clear terms the requirements and the cost of setting it up. It is therefore imperative that this innovative technology should not be allowed to go into oblivion.

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