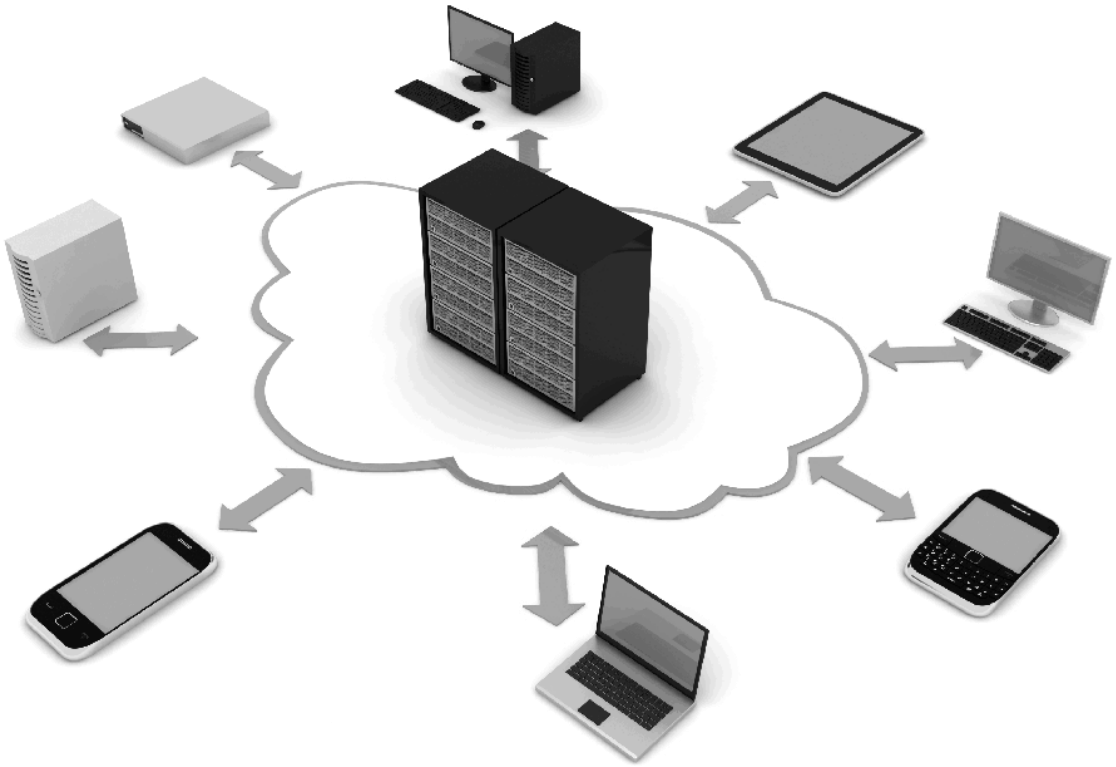
Computer Network



Jayaweera W.M.P.N.
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Department of ICT,
Faculty of Technology,
University of Ruhuna.

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Introduction to the Computer Network

In present, computer networks are a part of our life. Without computer networks, at least we can't do our day today activities. As an example, we cannot do our studies without computer networks. As university students of Faculty of Technology, University of Ruhuna, we are using LMS, and TECHMIS daily which are directly operated under computer networks.

Because of the development of Computer Networks, the world has been a very small place. It's just few seconds needed to share information with a foreign country now. We can communicate and share things using Computer Networks even beyond this planet. It's worthy to research about the computer networks which are connecting the modern world.

History

I'm going to discuss about the history of computer networks (more on the Internet) and the main service of the internet, Word Wide Web. I'm discussing about Word Wide Web because it played the main role for the development of the Internet.

- When we are talking about the history of Computer Networks, it runs past to 1960s. But data sharing concept is too older than that. In 1910s, there was Teleprinters, which are used with telegraph technology. Time to time, networking concept has been showed and disappeared in history.

- In 1949, the Modem was born. It allows computers to connect over telephone lines. The Modem was made for military services. Modem name was created by joining the words Modulation and Demodulation. In 1953, Modem was implemented on Computers. It's commercialized by Bell Telephone in 1958.

- Ted Nelson and also Douglas Engelbart brought the modern networking concepts in 1950. The words, "hyperlink" and "hypertext" are introduced by Nelson.

- In early 1960s, many people can share single Computer using terminals. This concept was named as Timesharing Computers. But those computers were unable to connect each other. While this timesharing computer worked as a network, Timesharing computers gave birth to many modern concepts like file sharing, email and also chats.

- IBM's SABRE reservation system was designed in 1964. It introduced the concept Online Transaction Processing. This system designed for American Airlines. It had the ability to deliver flight information within 3 seconds. SABRE system linked 2000 terminals around 65 cities and IBM 7090 Computers.

- Multiplexers came to the stage in 1968. It allowed using a single line to share between 15 terminals. Until this technology was introduced, single line was provided services for a single terminal. By assigning different frequencies for different terminals, Multiplexers was able to run 25 - 45 terminals using a same line. Because of this technology, it reduced the networking cost.

- In 1969 late October, the ARPANET was born, but the idea about the ARPANET was come in 1961 by Leonard Kleinrock. And the term 'Packet' was introduced by Donald Davies in 1965. It was the 1st general purpose computer network which had connected different kind of computers together. ARPANET is the first network which is started using packet switching method. The term ARPANET is came from Advanced Research Agency Network. ARPA had fund an another network project simultaneously. It was named as ALOHANET, located in Hawaii. Between 1969 - 1970 there also another network called NPL network based on Britain. And also there were some considerable network projects. But, ARPANET is highlighted above all of them.

- The birth of the Internet is happened in 1969 October 29, 10.00pm, when the first data transaction was started between UCLA (University of California, Los Angeles) and SRI (Stanford Research Institute).

- In 1971, Ray Tomlinson sent first email through ARPANET. It was a service which had implement before in timesharing systems. Ray Tomlinson used @ sign with his Email protocol. Email was suddenly very popular within the ARPANET and at that time, 50% of network traffic is caused because of emails.

- Also in 1971, the ALOHANET built the foundation to Wi-Fi networks. It was not the Wi-Fi, but it was the basic structure to Wi-Fi. It was a UHF wireless packet switching network.

- In 1973, ARPA funds the outfitting of a packet radio research van at SRI (Stanford Research Agency) to develop standards for a Packet Radio Network (PRNET).

- Ethernet technology was founded in 1973 by Robert Metcalfe. It is a widely used LAN protocol which uses Carrier Sense Multiple Access and Collision Detection. It's a fast and reliable network solution which is still using among computers.

- Ginny Strazisar developed the first IP router in 1976.

- Within this era, computers were connected via the networks which are discussed above. But, still there was a task to connect two or more networks together. It was called as internetting. If it's possible to connect two or more networks together, it will become the "network of networks" which is we are calling now as the Internet. In 1973, Vint Cerf and Bob Kahn came with the idea about TCP/IP networking. At that time, there was a big problem to solve; it was how to connect ARPANET, PRNET (Packet Radio Network) and SATNET (Satellite Network) together.

- In 1977 Cerf and Kahn connected those three networks together with TCP/IP networking and they invented the network of networks, which is the Internet.

- Internet protocol version 4 was defined in 1981 as IPv4 which is still using widely. It was the first major version of internet protocol. Among those years, many networks started to initiate. Lot of them was used to connect universities and research centers together.

- In 1983, ARPANET was completely moved to TCP/IP protocol. Also in 1983 first DNS (Domain Name Server) was implemented by Paul Mockapetris and Jon Postel.

- First backbone of the Internet was added to ARPANET In 1988, it named as T1. Also in 1988, WaveLAN network technology was introduced to the market. It's considering as the official precursor to Wi-Fi. The firewall technology is also introduced in 1988.

- Twisted pair cables eventually emerged during the 1990s as the leading cabling standard for Ethernet, starting with 10 Mbps. Years lately, they developed to the transfer rate of 10 Gbps (10GBASE-T).

- The first network switch is presented by Kalpana in 1990; it was a network hardware company in US.

- The well-known Tim Berners-Lee found the HTML/URL based World Wide Web as a service on the internet in 1990. Tim found a web browser himself but it was a text only browser.

- Archie Query Form introduced in 1990 and it's considering as the first search engine. It had the ability to search FTP sites and create an index of downloadable files.

- 2G is short for second-generation cellular technology. 2G cellular networks were commercially launched on the GSM standard in Finland by Radiolinja in 1991. With General Packet Radio Service (GPRS), 2G offers a theoretical maximum transfer speed of 50 kbps, with EDGE (Enhanced Data Rates for GSM Evolution), there is a theoretical maximum transfer speed of 1 Mbit/s.

- The Mosiac web browser was introduced in 1993. It was written by Marc Andreessen and Eric Bina. It was available for UNIX, Mac and PC. It added graphics with in the web pages. It was a very popular browser those days. This browser also a reason to wide popularity of the internet and the World Wide Web. But this browser lasted only one year, but Microsoft licenses a version of Mosiac and they rebranded it as Internet Explorer. Microsoft included with Windows OS for free.

- There is also a web browser called Netscape those days. But it had a more commercialized background. When Microsoft started to giving Internet Explorer for free, Netscape started to falling down. Netscape got Open Source and it has led to the development of FireFox Open Source web browser.

- Yahoo! Search Engine appeared in the World Wide Web. It is still a much popular search engine.

- IPv6 was introduced in 1996 for give the solution to the rapidly growing internet devices. IPv6 has very wide range of IP address.

- Google's former name, "BackRub" was started being developed at 1996 by Larry Page and Sergey Brin while they were Ph.D. students at Stanford University in California. Google has officially released on 1998, Google is the most popular web browser in the history and still there is no search engine to compete with Google.

- In 1997 IEE 802.11, which means the standard for Wi-Fi was introduced. The transmission speed of Wi-Fi was 2Mbps. In 1999 IEE 802.11a standard established officially and it increased the data transmission speed up to 25Mbps. Wi-Fi moved to 5GHz band and introduced to the public. The WEP (Wireless Equivalent Privacy) encryption protocol also introduced.

- Wi-Fi devices were available to buy in 1999. Apple released "Airport" which gave the ability to connect to Wi-Fi networks same year.

- Mobile Web was initiated in Japan, in 1999. Japanese mobile phone operator NTT DoCoMo created the i-mode networking standard for mobile data. By 2002, over 34 million of subscribers started to use it. The i-mode protocol created a simplified version of HTML for work well with small screens and

limited buttons. The WAP (Wireless Access Protocol) also contributed to bring mobile browsing very popular.

- First pre-commercial 3G network was launched by NTT DoCoMo in Japan in 1998, branded as FOMA. It was first available in May 2001 as a pre-release of W-CDMA (Wideband - Code Division Multiple Access) technology. The first commercial launch of 3G was also by NTT DoCoMo in Japan on 1 October 2001.High Speed Downlink Packet Access (HSDPA) & High Speed Uplink Packet Access (HSUPA) was released in late 2008 as an upgraded technology of 3G. It has data speeds up to 384kbs for WCDMA (3G), up to 7.2Mbps for HSPA (H) and a theoretical maximum of 21.6 Mbit/s for HSPA+ (H+). Those speeds are depending on many other facts.

- The experiments on 4G networking is reported in 2002. Since 2009, 4G LTE (Long Term Evolution) standard has strongly evolved. On 14 December 2009, the first commercial LTE deployment was in the Scandinavian capitals Stockholm and Oslo by the Swedish-Finnish network operator TeliaSonera. 4G networks provided up to 50Mbps uplink and 25Mbps uplink. This technology is very popular these days.

- Optical Fibre technology was developed to transfer data through wired media, and it started to popular rapidly among wired networks. June 2013, researchers demonstrated transmission of 400 Gbps over a single channel. It was a huge improvement of wired media.

- The first fairly substantial deployments of 5G were in April 2019, In South Korea. Verizon (US Mobile Operator) opened service on a very limited number of base stations in the US cities of Chicago and Minneapolis. Download speeds in Chicago were the maximum of 900 Mbps. Upload speeds were 57 Mbps max. The round-trip delay time was 25 milliseconds. It was reported in May 2019 that Verizon's 5G service would regularly hit 1 Gbps in some locations.

We have discussed a lot of wired and wireless networking technologies which were evolved during past years since the network concept is began. Now, this world is totally depending on internet or networking.

Definitions

A computer network is a group of computer systems and other computing hardware devices that are linked together through communication channels to facilitate communication and resource-sharing among a wide range of users.

- (Techopedia.com, 2019)

There are many types of networks, including:

Local Area Networks (LAN)

This term refers a Network which spreads in small area, such as a room or a building or few floors of a building and even few buildings which are built closely in a small geographical area.

Personal Area Networks (PAN)

PAN is described as the interconnection of network devices within the environment of an individual user. Roughly it spreads around 10 meters. This is also can consider as a LAN.

Home Area Networks (HAN)

A Home Area Network is a network that operates within a small boundary such as a home or an office, this also a kind of LAN.

Wide Area Networks (WAN)

WAN exists over a large geographical area. It connects LANs or MANs together to build a large scale network. Internet is also kind of a WAN.

Campus Area Networks (CAN)

This type of network also connects few LANs together. But its smaller than MAN and WAN.

Metropolitan Area Networks (MAN)

Metropolitan Area Networks are formed by connecting LANs together. It can be spread within a university or a city. MAN is smaller than WAN.

Enterprise Private Networks

An enterprise private network is a computer network that a number of disparate offices connected each other in a secure way over a network. An enterprise private network is mainly set up to share computer resources.

Internetworks

Internetworks are the networks which connects other networks together. That other networks can be using different technologies to communicate within the network, but after interconnecting, all networks should have the ability to exchange data through the internetwork. The Internet is a great example for internetworking.

Global Area Networks (GAN)

A global area network (GAN) refers to a network composed of different interconnected networks that cover an unlimited geographical area. The term is loosely synonymous with Internet, which is considered a global area network.

General Usage

Networks are used to:

- Facilitate communication via email, video conferencing, instant messaging, etc.
- Enable multiple users to share a single hardware device like a printer or scanner
- Enable file sharing across the network
- Allow for the sharing of software or operating programs on remote systems
- Make information easier to access and maintain among network users

My Personal Usage of Network

When my mobile phone has the ability to connect to the internet, the internet is always with me in my pocket. I'm using the service WWW for many purposes. They are,

Academic Purposes

- Searching for the information related to my studies. (WWW)
- Online tutorials. (WWW)
- Video lessons. (WWW)
- Online courses. (WWW)

Non Academic Purposes

- Use social networks (WWW)
- Listen to the music. (WWW)
- Watch entertaining videos. (WWW)
- Watch movies. (WWW)

Email

Email is one of the services offered by the internet. I often am using email services for sharing documents.

University Network

TecLMS - Our faculty is maintaining an online Learning Management System called TecLMS. It's powered by the popular LMS tool called Moodle. I'm using it daily for checkout lecture notes and to submit my assignments. It's a tool that is very useful for students as a result of computer networks.

Tecmis - Tecmis is also maintaining by Faculty of Technology, University of Ruhuna. It is used to give announcement effectively to the students. It's also a result of computer networks, which is very useful for any student.

Laboratory LAN network - We are daily using our computer lab as ICT students. There is a LAN network which connects all of the computers in computer lab. There are server computers and client computers.

VoIP Facilities

Voice over Internet Protocol is very popular nowadays. When we are talking to foreign countries through telephone lines, the connecting fees are very high. When you are using VoiP services which also a services of the Internet, it cost only for the data transmission. Many free VoIP clients are available to download for many OS platforms. Examples are,

1. Skype
2. WhatsApp
3. Viber
4. Imo
5. Google Duo etc.

Cloud Computing

Cloud computing is still a new concept. Cloud computing is the delivery of different services through the Internet. These resources include tools and applications like data storage, servers, databases, networking, and software.

Google Drive

Google Drive is a very good example for cloud computing. It gives you the ability to store data and it gives you a lot of tools for editing your files stored in your drive. Such as Google Notepad, Google Docs, Google Presentation, Google Spreadsheets etc. You need only a web browser to access those tools.

I'm a regular Google Drive user; I'm saving all of my study materials in Google drive. I'm also using it to edit documents. You can access your files which are saved in Google Drive from anywhere which has internet facilities.

Google Cloud Platform

Google cloud platform is also great example for cloud computing. You can create Virtual Machines inside Google servers. Also you can control them remotely with your browser. You can use those Virtual Machines as Virtual Private Servers.

Web Hosting

I have hosted a website to access through internet (WWW) last year. It's a personal site which described about me. Web hosting is directly comes with the client server architecture, which is used in the Internet. All the websites are hosted in the servers which can be accessed by client computers or devices.

I used Google Firebase static website hosting service which is provided freely. You can also select a paid option, but the free package is enough for my needs.

I bought a domain from a domain registrar called Namecheap. (http://prabhashlk.com) I also configured it to link that domain with my website.

I'm also maintaining a blog site which is also connected to my domain name. (http://blog.prabhashlk.com) Google Blogger is a very good place for start a blog site, which is also like a website but specially created for share blog posts via the internet.

Lan Networks

Wi-Fi Router

I'm using a Wi-Fi router to LAN my laptop & smartphone, and connect to the Internet. Sometimes I share files through the LAN connection between my smartphone and laptop. By definition, it can be called as a PAN.

Bluetooth

I'm still using Bluetooth technology for sharing multimedia items with friends. Bluetooth technology is outdated by the Wi-Fi technology, but still useful when using Bluetooth speakers, headsets and other wireless audio devices.

My Own Views about Internet

I'm using the internet since 2009. It means my internet experience is 10 years old. Personally, I can't live without internet. Before a year ago, my monthly broadband usage was close to 70GB per month. After starting my university life, the data usage is lowered.

Mostly, Internet is a good place, but you need to be careful. There are also many bad things happening through the internet, but the internet is not responsible for that. The fault is on the people who using it. Humans are bad, not the internet or machines.

Anyway, I do not recommend using the internet directly for the children who are under 18 years old. They can use the internet, but it must be under control by parents. There are many parental control features with the services which uses the internet.

There are some services under the internet which also not good for adults also. One of them is Darkweb or Darknet. It is a network which you may need special tools to access. You cannot access that network using a regular browser. Those networks have some kind of a good side, but mostly they are bad according to me.

Privacy and the Internet

This is the topic we are not pay our attention but still very important. You have a right to keep your privacy with you, but nowadays, your privacy is in a great danger.

Let's start with the web browser. The WWW is the most popular service on the internet. We need a web browser to access it. Consider Google Chrome, which is very popular among everyone. Google Chrome collects every data on your web surfing. They are using that data to make money. They sell that data with a shadow profile of yours to advertisement networks. If you are surfing among technology sites, that advertisement networks shows you technology related advertisements. It is called targeted advertising. In modern world, data is valuable than crude oil.

The second example is Facebook, The most popular social media website in the world. Facebook stores everything what you are doing inside Facebook. That's not all, they also collects the data about the sites you are visiting while Facebook is running on a separate browser tab. Last year, Facebook CEO got charged for selling Facebook users data to a company called Cambridge Analytica.

Those are very simple examples for endangering your privacy. Many people have no idea about keeping their privacy while browsing the web and using the internet. Maybe, the companies like Google and Facebook knows about you more than yourself!

Good influences

Before computer networks or the internet was started, the knowledge is not distributed significantly. People have to wait until the knowledge or information arrive them. But nowadays, internet provides a huge base of knowledge. If you need to learn about something, only thing you must to do is searching. You will get tons of information before you snap. Because of the internet, people are more update about what is happening. It's a good influence.

Internet makes things easy for you. Nowadays, people are living under tight schedules. Using the internet, you can make your life easy. If you need to go somewhere, use a navigation service. If you are hungry, order some foods online. Do you need a ride to somewhere? Hire a car online. If you are sick, channel a doctor via the internet. Those are very few examples only. When considering our busy schedule, those are good influences.

Computer networks connecting people. Long time ago, people used Postal mail for communicate. After the development of telephone lines, people started using telephones. i the popularity of computer networks, people moved very rapidly to the

internet. (The biggest computer network) Today, we are using the internet to connect with people. You can do conversations with your family and friends face to face via the internet, no matter where he or she lives. Computer networks allow you to keep in touch with your friends and family. I consider it as a good influence.

Bad influences

I have discussed the good influences above, and there also bad influences come inside those good influences.

As previously discussed, internet make things easy for you. Because of that, people are getting unhealthy day by day, because people do not having enough exercises which is must needed. People are getting lazy and they are losing their diligence. People nowadays are highly depending on computer networks. Without computer networks, every day today work will stop.

The bad influence of social media is widely discussed problem. Spreading fake news, hated speeches, misleading people are the most common threats which are causing because of the social networks. Sri Lanka also a victim of this bad influence. Sri Lankan government banned social media for many times in recent history.

Addiction to the internet is also a bad influence. This addiction will be good if you addicted it to the right way. But the thing is, people always attracted and addicted to unnecessary things. Social Media addiction is a bad influence which is a huge problem nowadays. People created social media to close people, but it is not always happening. Specially, youngsters are addicted to social media and they started to lose their connection to the parents and family. It's a very bad influence and it's causing many problems at the present.

When we are discussing about the bad influence, the term “network security” also comes to the front. When talking about network security, the topic hacking is getting everyone’s attention. After the development of computer networks, the risk on computer networks also got significantly high. Many hacker attacks are reporting almost every day through networks. For getting secured inside networks, the subject cyber security had evolved.

We have try our best to avoid the bad influences which are causing because of the internet, and try to use computer networks for the advancement of human society.

Comments & Conclusion

When considering about the Computer Networks, they made for make things easy for humans. Our responsibility is to use them to the right purposes.

As I mentioned before, computer or computer networks are not evil. The people who are using them are evil. As an example, humans made software to do tasks easily, also humans made computer viruses to make things worse. It is common to computer networks also.

You can use computer networks more productively if you are avoiding the bad influences. Besides that, you also need to keep in mind what you are doing and what are your priorities. Avoid bad things, avoid bad influences, protect your privacy, you will surely be able to use computer networks good for our society and yourself.

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