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History of Computer Networks

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ABSTRACT
Network is something utilization of connection interfaces between device computer or goods electronic others so you can each other communicate or correlate. Application network the done with use interface device. Device network often applied on computer, so between computer can each other connected and mutual interconnection. With has each other connected so between computer can interact and send data. Data transmission is carried out To use spread information And data processing becomes something information . So that man as user information can take advantage of it in necessary jobs speed and data accuracy and accuracy information. Various network models computer seen of type and benefits network the such as one to one, one to anywhere, many to one and many to many. Development system network computer This started since 1960s by company electronics famous like ARPANET. Development network computer the will explained on discussion following.

Keywords: *Computer, Histori, Network*

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INTRODUCTION

A computer network is a network consisting of two or more computers that are connected together and can interact with each other and share resources such as information, hardware and software such as printers, files and the internet. Computer networks have experienced significant evolution over time. This chapter discusses the history of computer networks from the beginning to the present.

In the 1960s, the first computer network was created in the United States by the Department of Defense. The network was called ARPANET, and was used to connect computers from different universities. ARPANET's initial goal was to help communicate between researchers and scientists throughout the United States.

In the 1970s, ARPANET expanded and connected more computers and networks. At this time, the UNIX operating system began to be used to connect computer networks and enable communication between networks (Hartatik, 2017) .

In the 1980s, local networks (LANs) began to develop. LAN allows multiple computers to connect locally and share resources. Ethernet is the most popular network protocol at this time.

In the 1990s, the Internet became popular all over the world. Computer networks began to be used to connect different countries and continents. It was also during this time that new networking technologies such as the World Wide Web (WWW) and the first web browser, Mosaic, were launched.

In the 2000s, network technology became increasingly sophisticated and complex. Computer networks continue to develop and are capable of connecting millions of computers and other devices. Wireless network technology is starting to be developed, which allows devices to connect to networks without cables. Nowadays, computer networks have become an. important part of everyday life. Networks are used to communicate, work, learn, and play. Networks are also used in various fields such as business, government, health, and education.

In conclusion, computer networks have experienced a significant evolution from their inception to the present. Networks have evolved into larger, more complex, and more integrated networks. Nowadays, computer networks have become an important infrastructure in human life and continue to develop and increase their speed and efficiency.

Before explaining the history of computer networks, first explain the history of computers. PC (*Personal Computer*) is known as a computer, so its physical form cannot be moved quickly. With these problems faced, a portable computer (laptop) was created that can be taken anywhere quickly. So its use is more flexible and practical. Because you can carry it quickly when needed. Through a computer network can be used.

Figure 1. PC and Laptop and Notebook

1. PC (*Personal Computer*)

PC is an abbreviation of "Personal Computer", which in Indonesian can be translated as "Personal Computer". This term refers to a type of computer intended for use by one person or several people in a home or office, as opposed to large computers used by organizations or institutions. PCs are generally designed for general purposes, such as office use, education, entertainment, and other personal computing. This term also often refers specifically to computers running on the Windows operating system, although technically, PC can also refer to computers running on other operating systems such as macOS or Linux . .

2. Laptop (Lap.top)

The word "laptop" comes from English. This word first appeared in 1983 and comes from the words "lap" which means lap or thigh, and "top" which means top. The term "laptop" is used to describe a portable computer that can be placed on the user's lap or thigh. Laptops have become popular because of their ease in being carried around and used in different places. Today, laptops have become one of the most commonly used computing devices worldwide.

In the beginning, computers were large, heavy devices, confined to special spaces such as computer rooms on campus or research laboratories. However, over time, the need arises for more portable computers that could be used outdoors, at work, or at home.

In the 1970s, several early portable computer concepts emerged, but they were still limited in terms of performance and size. These concepts include micro-based computers installed in suitcases or bags , but they cannot be considered strictly modern laptops.

In the early 1980s, a number of companies began designing and producing portable computers that were more similar to modern laptops. Products such as the Epson HX-20 and Osborne 1, although far from today's laptops, provided early steps in the development of portable computer technology. The most significant development occurred in 1981 with the launch of the first portable computer which can be recognized as the direct ancestor of the modern laptop, namely the IBM PC. While still far from the size and weight of a modern laptop, the IBM PC paved the way for more advanced portable computer concepts.

Over the next decade, there was a surge in innovation and development of portable computer technology. The emergence of laptops such as the Toshiba T1100 and Compaq Portable brought significant changes in terms of portability, performance and design.

In the 1990s and beyond, laptops became increasingly popular and affordable for ordinary consumers. Innovations in battery, processor and storage technology are making laptops slimmer, lighter and stronger. Additionally, developments in display technology and wireless connectivity have allowed laptops to become truly portable and multifunctional devices.

Laptop manufacturing involves a long and complex evolution in the world of computer technology. From the initial concept to the emergence of the modern laptop we know today, this journey has included contributions from many innovators, engineers and companies around the world. Laptops have not only changed the way we work and communicate, they have also allowed us to access computing more easily and efficiently wherever we are. As devices continue to evolve, laptops are expected to continue to be one of the most important tools in modern life .

3. NoteBook

In the increasingly connected 21st century, technological devices have become more than just tools; they are portals to the digital world. One of the major milestones in the development of this technology was the creation of the notebook computer, which

radically changed the way we work, learn and communicate. Let's explore an interesting journey in the history of the creation of notebooks.

In the late 1980s to early 1990s, the need arose for more compact, portable, and powerful computers. This is mainly due to the increasing trend of mobility in the workplace and daily lifestyle.

Laptops, the direct predecessors of modern notebooks, became popular in the 1990s. However, while more compact than desktop computers, laptops are still relatively large and heavy, limiting user mobility. Along with the demand for smaller and more compact devices, the concept of notebooks began to emerge. Technology companies are starting to realize the huge market potential for devices that can be easily carried anywhere and can be used flexibly in a variety of environments.

In the early 1990s, a number of electronic device manufacturers began introducing the first products that could be considered notebooks. These devices offer smaller size, lighter weight, and better battery life than conventional laptops. As technology advances, notebooks became increasingly popular in the late 1990s and early 2000s. Drops in price and improvements in performance make them more affordable and more attractive to consumers looking for devices that are easy to carry anywhere.

In the early 21st century, notebooks have become one of the most commonly used technological devices throughout the world. They have undergone a major transformation in terms of design, performance, and features, allowing users to perform various tasks more easily and efficiently. As technology continues to develop, the future of notebooks seems bright. Innovations such as thinner designs, touch screens, and faster wireless connections continue to expand the boundaries of notebook capabilities. They remain one of the most important tools in modern life, facilitating mobility, productivity and connectivity in an ever-evolving digital era.

Figure 2. Physical development of computers

RESEARCH METHODOLOGY

From the research carried out as a history of the development of computer networks, it was obtained:

The method used in this research is the library research method and the research description research method. By using this method, it is hoped that we can describe and carry out direct literature observations as a model and the benefits of the network model as well as developments in the use of the network. By tracing the development of this network, the influence and development of network utilization can be clearer and more transparent.

RESULT AND DISCUSSION

From the research carried out as a history of the development of computer networks, it was obtained:

1. Types of Computer Networks

Types of computer networks usually used, namely (Day and Gaddy, 2017) :

a. PAN (Personal Area Network)

type of network consists of smaller areas such as offices and homes. Usually this is only used for internet and printer purposes. In addition, it does not require large resources to use a PAN network.

b. LAN (Local Area Network)

This type of LAN network helps connect network devices with relatively narrow coverage conditions. Examples of LAN network applications are school , office and home network systems. Many people tend to use certain connection types, especially with Token Ring and Ethernet. Apart from that, LAN also offers wireless network technology with WiFi known as WLAN (Wireless Local Area Network).

c. CAN (Campus Area Network)

CAN networks are similar to MANs, but are more limited to campuses and academic areas. This network is mainly used for lab exercises, emails, class updates, **etc.**

d. MAN (Metropolitan Area Network)

MAN is a connection between one computer network device that connects it with other devices on the same network within the city scope. This type of network is bigger than a LAN network.

e. WAN (Wide Area Network)

WAN is a collection of LANs that are geographically distributed. WAN networks typically use technologies such as ATM, X.25, and Frame Relay for long-distance connections.

f. Internet

Computer network devices The internet is the largest computer network ever created by humans. The reach of the Internet covers almost every corner of

the world. Anyone can access different sources on different computing devices such as PC, mobile, laptop, tablet and T V.

g. VPN (Virtual Private Network)

VPN is a solution to provide a safer internet connection. VPN can create a secure path for data transfer requests. Nowadays, there are many platforms that sell VPN for free and offer premium access.

1. Understanding Computer Networks

The history of computer networks includes a long and complex development, starting from basic concepts to becoming a global network that connects billions of devices throughout the world. Here is an overview of the history of computer networks:

2. Evolution of Computer Networks: Exploring Their Historical Roots and Development

The evolution of computer networks is a long journey that started from basic concepts to become a global network that connects billions of devices throughout the world. Let's see in more detail how the evolution of computer networks has taken place since the 1940s:

Figure 3. Sharing interactions between computers

a. 1940s

In the 1940s, the concept of modern computer networking had not yet been fully formed. However, there were several early developments that became the basis for the development of computer networks in the future. The following are some important events surrounding computer networks in that era: Colossus (1943-1945): Colossus was one of the first computers built by the British during World War II to assist in decrypting German codes. Although not a computer network as we know it today, Colossus was an important milestone in the history of computing and laid the foundation for the development of modern computers.

Network Theory Concepts: In the 1940s, several scientists began to develop the basic concepts of network theory. One important example is the work of Claude Shannon which discusses information and communication theory.

ENIAC (1945): ENIAC (Electronic Numerical Integrator and Computer) was one of the first computers developed in the United States. Although not connected to computer networks as we know them today, ENIAC marked the beginning of the development of modern computers and played an important role in the subsequent development of computer technology.

World War II and Network Connections: During World War II, there were several attempts to link computers and communications equipment for military purposes . Although still far from the concept of modern computer networks, these efforts provided the initial impetus in the development of technology that later became the basis for computer networks.

Even though the development of computer networks as we know them today did not exist in the 1940s, this era marked the beginning of thought and technological development which later became the foundation for the development of computer networks in the future.

b. 1950s

In the 1950s, although the concept of computer networks had not yet been fully realized, there were several early developments that brought us into the era of modern computer networks. The following are some important events surrounding computer networks in that decade: In the 1950s, computer scientists and engineers began to develop the basic concepts of computer networks. They consider how computers can connect to each other to share resources and information.

Whirlwind was one of the first computers developed at the Massachusetts Institute of Technology (MIT) in the early 1950s. Although not a computer network in the modern sense, this project introduced the concept of using computers for real-time surveillance and rapid data processing. Some organizations are starting to build simple computer networks for the purpose of electronic data exchange. For example, the RAND Corporation in the United States began developing internal electronic information exchange systems in the 1950s.

Project SAGE (Semi-Automatic Ground Environment) is a United States air defense project involving the construction of a computer network for air monitoring and defense against air attacks. Although this project focused more on military needs, it played an important role in the development of computer networking technology. In the 1950s, scientists such as Donald Davies in England and Paul Baran in the United States began to develop the concept of packet switching, which became the basis of the technology used in modern computer networks.

Although computer networks in the 1950s were still limited in scope and functionality, this era marked the beginning of the thinking and development of technology that became the basis for modern computer networks. The development of basic concepts such as the use of computers to share information and exchange data electronically brings us towards a more advanced era of computer networks in the future.

c. 1960s

In the 1960s, the concept of computer networks began to undergo further development, although it was still in its infancy. Several important events surrounding computer networks in that decade include: One of the most important events was the development of ARPANET (Advanced Research Projects Agency Network) by the United States Department of Defense in 1969. ARPANET was a research project that aimed to connect several universities and research institutions to share computing resources and information. This project is considered the forerunner of the modern Internet. Packet switching technology, which is the basis of the modern Internet, continues to be developed. In the 1960s, scientists such as Donald Davies in England and Paul Baran in the United States continued to develop this concept, which allowed data to be sent in small packets efficiently over networks.

In the mid-1960s, ARPANET began to be used by various military and academic institutions in the United States. ARPANET later developed into two separate networks: ARPANET, which was used for research and development, and MILNET, which was used by the military.

In this decade, several network communication protocols and standards began to be developed. For example, in 1969, Leonard Kleinrock at UCLA published his seminal work on queuing theory, which became the basis of packet switching technology. Computer developments in the 1960s, such as increases in speed and storage capacity, also contributed to the development of computer networks. More sophisticated computers enable more efficient data processing and exchange. Although still in its infancy, the developments that occurred in the 1960s marked an important step in the evolution of computer networks. With ARPANET as the starting point, this era became the foundation for further developments leading to the Internet we know and use today

Figure 4. Computer networks of the 1960s.

d. **1970's**

During the 1970s, the development of computer networks accelerated and brought us closer to the modern form of computer networking. The following are some important events surrounding computer networks in that decade: The TCP/IP (Transmission Control Protocol/Internet Protocol) protocol was developed in the 1970s by Vinton Cerf, Robert Kahn, and their team . This protocol became the basis of the modern Internet and is still used today.

ARPANET's First Test: In 1972, ARPANET underwent its first successful test when computers at UCLA successfully connected to computers at the Stanford Research Institute. This was an important milestone in the history of computer networks because it was the first demonstration of inter-network communication.

Modern email was first developed in 1971 by Ray Tomlinson. With the development of the TCP/IP protocol, users can send electronic messages over computer networks, opening a new era in digital communications. In 1973, Bob Metcalfe and David Boggs at Xerox PARC developed Ethernet technology, which became one of the most commonly used local network (LAN) technologies today. In the mid to late 1970s, ARPANET began connecting with other computer networks, such as the military's MILNET network, forming larger and more complex interconnection networks. In 1972, the International Network Working Group (INWG) was formed to study and develop standards for computer network interconnection. This committee later developed into the International Organization for Standardization (ISO) which is responsible for international computer network standards.

In 1979, Jim Ellis and Tom Truscott introduced Usenet, an online discussion forum system that used the Network News Transfer Protocol (NNTP) protocol. Usenet is one of the origins of modern internet forums. The developments that occurred in the 1970s marked an important step in the history of computer networks. With the TCP/IP protocol as the basis, the development of email, Ethernet technology, and inter-network communications, this decade

brought us closer to the modern Internet that connects billions of devices around the world.

Figure 5. Computer networks of the 1960s.

e. **1980's**

In the 1980s, computer networks experienced significant development, bringing us closer to the modern Internet and complex network infrastructure. The following are some important events surrounding computer networks in that decade: In the early 1980s, the TCP/IP (Transmission Control Protocol/Internet Protocol) protocol became the standard for data communication in networks. This protocol was adopted as the standard for ARPANET and became the basis of the modern Internet. The concept of local networks (LAN) is starting to develop rapidly. Technologies such as Ethernet are becoming popular for connecting computers in a specific location, such as an office or university.

In the mid to late 1980s, the Internet began to experience commercialization. Networks originally used for research and military purposes are starting to open up to commercial use, paving the way for the development of a new economy based on Internet technology. DNS, which maps domain names to IP addresses, began to be developed in the 1980s. DNS allows users to access websites using easy-to-remember domain names, such as google.com, rather than complicated numeric IP addresses. The National Science Foundation Network (NSFNET) was launched in 1986 in the United States as a national supercomputing network. NSFNET became one of the main drivers in the early growth of the Internet and accelerated the spread of computer networks across the country. In the 1980s, Bulletin Board Systems (BBS) and Usenet became popular as a way to communicate and share information online. BBS is a computer system used to share messages, files, and applications, while Usenet is a global network of discussion groups. In this decade, the development of computer technology continues. Personal computers are becoming more affordable and easy to use, allowing more people to connect to computer networks. These developments

brought us closer to the modern Internet that we know today. Through standards such as TCP/IP, the growth of local networks, and the introduction of DNS technology, the 1980s saw an important milestone in the evolution of computer networks toward more complex, globally connected infrastructure . .

Figure 6. Computer networks in the 1980s

f. **1990s – present**

Ethernet increasingly dominated LAN technology in the 1990s, and the alternatives became increasingly varied. These include Full-duplex Ethernet and Gigabit Ethernet. Full-duplex Ethernet with a speed of 20 Mbps appeared in 1992 and was standardized in 1997. Meanwhile, Gigabit Ethernet was made with 1000Mbps which began to be used in 1999.

This decade was also successful in giving rise to wireless technology. In 1997, the Wi-Fi standard was born with a speed of 2Mbps which could reach sub-districts with transmission rates of up to 25 Mbps and used the 5GHz frequency.

Figure 7. Current computer network system

g. 2000s – present

In the 2000s, computer networks experienced rapid development, with the significant growth of the internet, the adoption of wireless technology, and the

emergence of online social platforms. The following are some important events and trends in the history of computer networks in that decade: The number of internet users continued to increase drastically throughout the world during the 2000s, especially in developing countries. This is accompanied by an increase in internet connection speeds and the adoption of broadband technology. Facebook was launched in 2004, which marked the beginning of the modern social media era. Websites like Twitter, LinkedIn, and YouTube also thrived during this decade, allowing users to interact, share content, and network online. The use of wireless technologies such as Wi-Fi and Bluetooth is becoming more widespread. It enables wireless internet access, whether at home, work, or in public places such as cafes, airports, and hotels.

In the mid to late 2000s, smartphones started to become popular and affordable for consumers. It changes the way we interact with the internet, enabling easier and more portable access to various online applications and services. The concepts of virtualization and cloud computing are starting to develop. Companies and individuals can rent computing and storage capacity from cloud service providers, reducing the need for physical infrastructure and operational costs. As the internet becomes more integrated into everyday life, network security becomes increasingly important. This has led to an increase in the development of network security technologies such as firewalls, antivirus, and data encryption. The lack of IP addresses in the previous version, IPv4, is becoming increasingly apparent. In the 2000s, the adoption of IPv6 began, which has a larger address space, allowing further growth of the internet.

The concept of the Internet of Things (IoT) is starting to gain traction, where various devices, from household appliances to vehicles, connect to the internet and exchange data automatically. This development brings us to the modern era of more connected and integrated computer networks. The internet is becoming an integral part of everyday life, fundamentally influencing the way we work, communicate and access information. In general, the development of computer networks can be seen as follows:

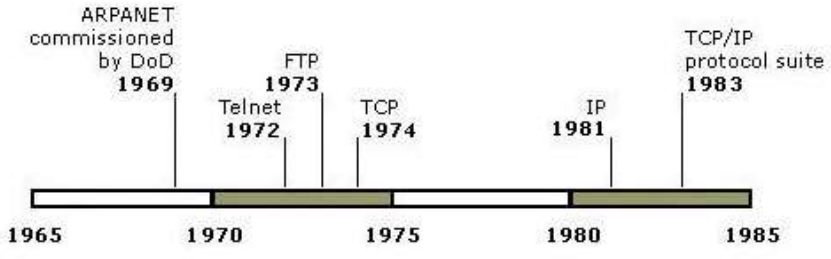

Figure 8. Development of computer network protocols

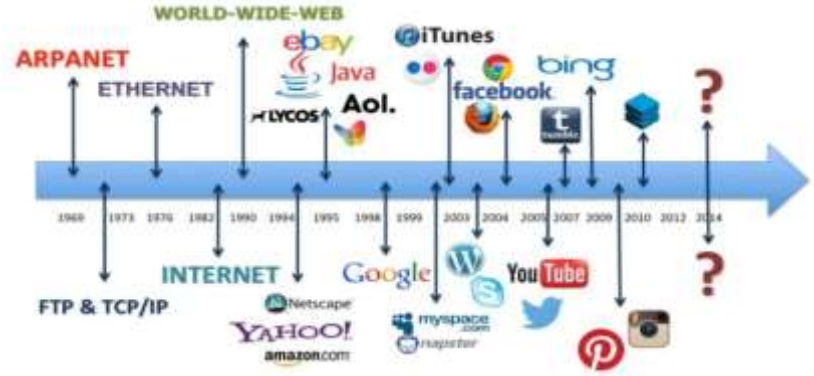

Figure 9. Development of computer network applications/WWW

CONCLUSION

From the explanation above, the conclusions obtained from the results of the research carried out are as follows:

1. Benefits of Computer Networks

   The following benefits of computer networks are :

   a. Share information or documents with each other.
   b. Data can be managed safely and can be safeguarded.
   c. Networks make it easier to communicate between countries or regions.
   d. Information can be obtained very quickly.
   e. Human activities can be helpful in everyday life.

2. Current Computer Network Systems

   As technology develops, today's computer networks cover various aspects and have very advanced characteristics. Some of the main points that can be explained regarding computer networks today involve:

   a. Internet and Global Connectivity

      Today's computer networks are widely represented by the internet, which has become the backbone of global communications. The Internet connects billions of devices worldwide and enables instant access to information, services and online resources.

   b. High Speed and Capacity

      Today's network infrastructure has improved greatly in terms of speed and capacity. Advanced fiber optic networks and wireless technologies enable data transfer at high speeds and large capacities, supporting increasingly complex applications and services (Hasanuddin Sirait; et al, 2018) .

   c. 5G Network (*Generation* 5th)

      Fifth generation (5G) mobile networks have become a reality, providing faster and more reliable wireless connectivity. This has a major impact on the development of the Internet of Things (IoT) and supports better user experiences, such as high-quality video streaming and online gaming.

   d. Cloud Computing

Today's networks are often closely related to the concept of cloud computing. Cloud services enable distributed data storage and processing in data centers spread throughout the world, providing high scalability and accessibility (Suyatno, 2016) .

e. Network Security

Network security is a major concern. With increasing cyber threats, data protection and information privacy efforts have become a major focus. The use of encryption, firewalls and advanced security technology is an integral part of today's networks (Eka Putri, Kartikadewi and Abdul Rosyid, 2021) .

f. IoT (*Internet of Things*)

The increasing use of connected devices, such as smart sensors, wearable devices, and smart appliances, has expanded network coverage. IoT enables devices to communicate with each other and collaborate to provide smarter and more efficient services.

g. SDN (*Software-Defined Networking*)

The SDN concept decouples network control from physical hardware, providing greater flexibility and management. This allows administrators to centrally manage and configure the network.

h. Versatility and Mobility

Today's networks support high mobility. Users can connect to the network from various locations and devices, either via Wi-Fi, cellular network, or wired connection.

It is important to remember that technological developments continue, and computer networks continue to change over time to meet increasingly complex and rapidly evolving demands

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