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A Research on Computer Networking: Protocol, Challenges & Applications

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ABSTRACT

Computer networks are a collection of linked computers used for the interchange of digital data. When a server at the Massachusetts Institute of Technology was connected to the next server in Santa Monica, California, the term of a network was first presented in 1962. Since then, we've seen huge rises in the amount of computers and computer networks. Attacks on resources resulting from poor network security are one of the main issues for networks. A group of computers sharing resources that are available on or offered by network nodes is known as a computer network. Via Digital links, Computers communicate with one another using standard communication protocols. We explore giving an detailed view of Protocols, Network Security , Challenges and Applications of the computer network concept in this research study.

Keywords*:* Computer networks, Protocols, Network security, Challenges , Applications .

1. INTRODUCTION

A data network or computer network refers to a telecommunications network that enables the data interchange between computers. Networked computing devices send information among themselves via data connections in computer networks. Either cable media or wireless media serve to make links (connectivity links) amongst nodes. The Internet is the most widely used computer network. Network nodes are computing devices that generate, transmit, and conclude data. Nodes can also be hosts such computers, mobile phones, workstations, and switches and routers. When two of all these devices can interact with one another via a network, whether connected directly or not, it is said that the devices are networked together. The utilization of email and instant messaging services, besides access to the World Wide Web, software and store systems, printers, and fax machines, is provided via computer networks. Computer networks range in terms of the actual transfer media they operate, the communications protocols used to control network traffic, the scope, topology, and team objectives of the network.

2. HISTORY

It's not new to create devices can communicate with one another for purpose of communication. A computer can now be connected to the Internet, additional PC, or even a home entertainment. Other efforts at telephony, such the telegraph and telephone, have now evolved into more complicated devices. Early computers had to directly share the same space, which made it tough to share data and other information. Investigation revealed this was unworkable and invented a mechanism to "connect" the computers so they could more properly share resources. Thereby, that the very first computer network developed

That several uses, including secure voice transmission in defense channels, were made possible by the then-new communication protocol known as packet switching. The communication technologies of the rest of the 20th century were established on these new circuits, and then after further improvement, they were used in computer networks. These networks were the basis for the early ARPANET, the predecessor to the internet. On June 3, 1968, the Advanced Research Projects Agency (ARPA) presented a proposal for the project, which was later accepted. This concept, named "Resource Sharing Computer Networks," would allow ARPA to increase their research in a wide range of defense and scientific domains in additional to further file transfer. The network increased after being tested in four distinct destinations, and the additional protocols developed for it resulted in the creation of the current World Wide Network.

Early PC-based Local Area Networks, often known as LANs (Local Area Networks), started to emerge in 1977. Once restricted to academics and enthusiasts, they soon made their way into enterprises and households, but the breakout into the latter two fields is a relatively recent occurrence. Even farther LAN modifications emerged, such as metropolitan area networks (MANs) to cover vast areas like a college campus and wide area networks (WANs) for communication between universities. The speed and convenience of utilising computers to communicate and transfer data has permanently changed how people conduct business as a result of their widespread use in the corporate world. The corporate world now relies heavily on networks. People can stay connected even when they are outside of a fully wired workplace environment because to universal computing and mobile devices that can access the Internet.

3. COMPUTER NETWORK FEATURES

Policy and Implementation: By using a network, peoples can speak to one other using e-mail, text messaging, chat sessions, phone calls, video calls and video conferences in an effective and simple manner allowing files, data and other information sharing authorized users have access to information and data stored on other networked computers in a network environment.

Permits the sharing of data, files and other sorts of information: Authorized users canaccess information stored on other networked computers thanks to a network's capacity to share files, data and other firms of information. To complete tasks, distributed computing makes advantage of computing resources across a network**.**

Share network and hardware :Sharing of network and computational resources is possible through networks. Users have access to and control over the resources made available by network elements, such as printing a file on a common network printer or using a shared file system.

Confidentiality: By guaranteeing that the user has permission to access specific files and apps, the network enable security.

4. PROTOCOLS IN NETWORKING

Ethernet: By far, the most popular protocol is Ethernet. Carrier Sense Multiple Access/Collision Detection, also known as CSMSA/CD, is the access technique used by Ethernet. Ethernet is primarily a standard communication protocol used to create local area networks. It transmits and receives data through cables. It is an IEEE standard that has evolved over the years in terms of speed and bandwidth, and there are newer versions and standards being developed to meet the increasing demands. This facilities direct internet connectivity to a device and hence is often used in home and small business where there are only a couple of connected devices such as a computer and printer. It is a safe and fast source of internet connectivity. Ethernet network while traditional is a reliable technology for small offices, campuses and so on.

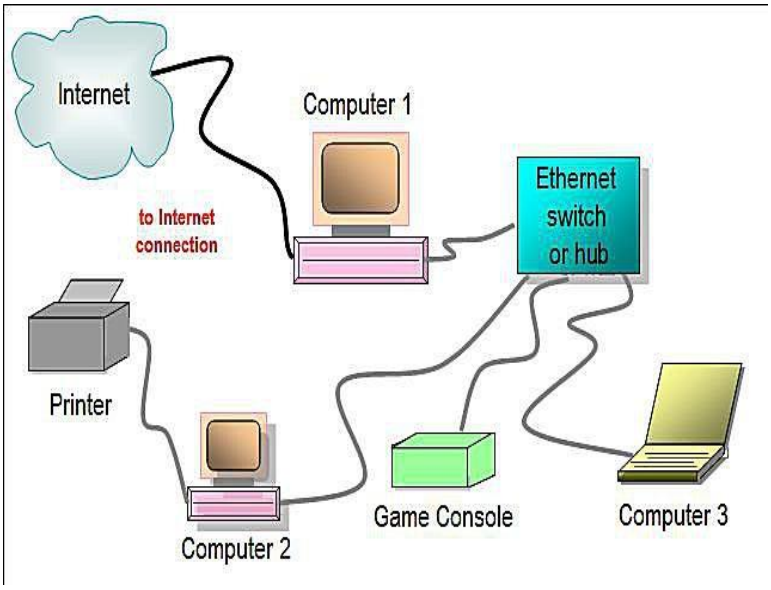

FIGURE: ARCHITECTURE OF COMPUTER NETWORK

Fast Ethernet: As the name implies, this kind of high-speed internet can send and receive data at speeds of up to 100 Mbps. Twisted pair or CAT5 cable is typically used to support this type of network. When connected to a network, a laptop, camera, or any other device runs at 10/100Base Ethernet and 100Base on the fiber side of the link.

Gigabit Ethernet: This network type transmits data at a high rate of around 1000 Mbps or 1 Gbps. In this form of connection, all the pairings in the twisted buffer string participate to the data transport frequency. This network type is often used in CAT5e or other high-tech line-based video calling systems. Gigabit Ethernet is more prevalent in today's ultramodern era.

L**ocal Talk**: Apple Computer, Inc. created the network protocol known as "Local Talk" for Macintosh computers. Local Talk employs a process known as CSMA/CA (Carrier Sense Multiple Access with Collision Avoidance). In contrast to CSMA/CD, a computer advertises its intention to transmit before actually doing so in this protocol. A group of computers can be linked together via the serial port using Local Talk adapters and special twisted pair wire.

Token Ring:IBM created the Token Ring protocol in the middle of the 1980s. Token-passing is utilised as the access method. By using Token Ring, the computers are linked together such that the signal moves logically

around the network from one computer to the next. From one computer to the next, a single electronic token rotates around the ring.

FDDI: A network protocol called Fiber Distributed Data Interface (FDDI) is primarily used to connect two or more local area networks, frequently over considerable distances. Token-passing is the access method employed by FDDI. Dual ring physical topology is employed by FDDI.

ATM:The network protocol known as Asynchronous Transfer Mode (ATM) delivers data at rates of 155 Mbps and greater. Unlike other protocols, which transport packets of varying length, ATM transfers all data in short, fixed-size packets. A wide range of media, including image, CD-quality audio, and video, are supported by ATM. ATM uses a star architecture that can function with both twisted pair and fiber optic connection.

5. NETWORK SECURITY

Network security: What Is It? What is network security, as it relates to the question? Your IT partner should clarify that any measures taken to safeguard your network are referred to as network security. These actions specifically safeguard your network and data's usefulness, dependability, integrity, and safety. A range of risks are targeted by efficient network security, which prevents them from propagating or accessing your network. How Does Network Security Safeguard Your Network? Internet based risks to network security are common today. The most typical ones are:

1. Trojan horses, worms, and viruses

2. Adware and spy software

3. Zero-day assaults, sometimes referred to as zero-hour assaults

4. Hacking attempts

5. Attacks using denial of service

6. Data theft and interception

7. Identity fraud

Several levels of security are required. Others remain standing even if one fails. Hardware and software both help to secure networks. To defend you from new threats, the software needs to be handled and updated

frequently. Typically, a network security system has a large number of parts. Ideally, all parts function as a unit, reducing maintenance and raising security**.**

The following are typical network security elements:

1. Antivirus and Antispyware

2. Firewall, which prevents illegal access to your network

3. Intrusion prevention systems (IPS), which may recognize quickly propagating threats like zero-day or zero-hour attacks

4. Virtual private networks (VPNs), which allow for safe remote access

6. CHALLENGES IN COMPUTER NETWORK

Range: In computer science, range refers to the interval that includes the upper and lower bounds of an Array's variable values**.**

Performance Degradation: We've all experienced data integrity and network speed loss due to poor transmissions, which is also known as performance degradation. Every network, large or small, has a performance issue, but in large networks, the issue is magnified because communication must be established over a larger area and with the assistance of many network devices.

Security Issues: This security issue arises when it comes to computer networks. It is a major issue in computer networks and a significant challenge for network security engineers. It generally entails protecting the network from various cyber-attacks, preventing unauthorized users from entering and accessing the system, and maintaining network integrity. All of these security issues increase with network size, and when network size is large, the likelihood of security issues increases.

Slow Network Connectivity: Slow network connectivity is more frustrating when a simple task takes a long time to complete over the network. It is frequently caused by large file transfers over a large area via network. When users work over a computer network, it becomes an unwelcome challenge.

Energy Consumption: It is the amount of energy consumed during the packets transmission by each node and calculates the overall energy of the whole network.

Service Quality: Service quality is a measure of how an organization understands its users' needs and fulfills their expectations. Understanding how to improve the service quality of your product is the key step to growth for any organization. Measuring and improving service quality is a valuable art.

TABLE : CHALLENGES IN COMPUTER NETWORK

Challenges	Challenges in Computer Network
Range	The WBAN range is limited, a few meters away from the body. Hence, reliable wireless communication is performed inside or close to the human body .
Energy consumption	WBAN requires constant energy to work properly, which necessitates a constant power supply .
Security	Due to the low power supply, it is difficult to add complex security mechanisms .
Placement	It is difficult to put many nodes in a limited space
Performance Degradation	Data integrity and network speed loss due to poor transmissions
Service quality	One of the most important challenges in WBAN is to improve service quality
Slow Connectivity	It is frequently caused by large file transfers over a large area via network.

7. APPLICATIONS

Applications of wireless technology:

Mobile telephones*:* One of the best-known examples of wireless technology is the mobile phone, also known as a cellular phone, with more than 4.6 billion mobile cellular subscriptions worldwide as of the end of 2010.

Wireless data communications: Mobile computing cannot exist without wireless data connectivity. Users may need to be able to use many connection types and switch between them because the various technologies are different in terms of local availability, coverage area, and performance.

A wireless local area network called Wi-Fi makes it simple for portable computing devices to connect to the Internet. Wi-Fi, which is standardized as IEEE 802.11 a, b, g, and n, can reach speeds comparable to some forms of wired Ethernet. The de facto norm for access in private re The range of cellular data service extends 10-15 miles from the closest cell station. From existing equipment like GSM, CDMA, and GPRS to 3G networks like W-CDMA, EDGE, or CDMA2000, speeds have grown as technologies have advanced. Where other wireless connections are not accessible, such as in mostly rural or distant areas, mobile satellite communications may be employed. For use in transportation, aviation, maritime, and military applications, satellite communications are particularly crucial.Sidences is Wi-Fi. In data collecting networks, noise, interference, and activity are detected using wireless sensor networks. This enables us to identify relevant quantities, track and assemble data, create useful user interfaces, and carry out decision-making processes.

Wireless Energy Transfer: The method of transmitting electrical energy wirelessly, without the use of connecting cables, from a power source to an electrical load without a built-in power source. There are two distinct primary strategies for transferring wireless energy. Either far-field techniques involving beam power/lasers, radio or microwave transmissions, or near-field techniques utilizing induction, can be used to transfer them. Magnetic and electromagnetic fields are used in both techniques.

Computer Interface Devices: Many makers of computer peripherals moved to wireless technology to fulfill their client base in response to complaints from customers who were annoyed by cord clutter [citation needed]. However, more recent versions have used compact, elevated devices, some of which even incorporate Bluetooth, to interface between a computer and a keyboard and mouse. Originally, these modules used large, severely constrained transceivers. These systems are now so commonplace that some users are lamenting the lack of wired peripherals. Batteries power computer interface devices like a keyboard or mouse, which employ radio frequency (RF) receivers to transmit signals to a receiver through a USB connector. The RF architecture increases the effective use range, typically up to 10 feet, and enables wireless signal transmission. Signal quality can be lowered by distance, physical impediments, competing signals, and even human bodies. At the end of 2007, when it was discovered that Microsoft's implementation of encryption in some of their 27 MHz models was seriously vulnerable, worries about the security of wireless keyboards started to surface.

8. CONCLUSION

Although practically every aspect of civilization is built on the maturity level idea of a network, computer networks and protocols have fundamentally altered how humans communicate, work, and enjoy. Digital networking is further strengthening us for the future by forging firmly into spheres of our lives that no one had anticipated. Our lives will continue to evolve and improve as new protocols, standards, and apps are developed. The majority of existing digital networking technologies are not state-of-the-art, but rather are protocols and standards created at the start of the digital networking era that have endured without fail for more than thirty years, even if the new will only be better.

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