

“Module 6: Assignment 1 - Networks and Data Communications”

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T1

1. In today's world, communication and information exchange between individuals and businesses are essential. It aids a variety of businesses, allows for communication, and provides access to information. Data access has changed as a result of the ability to store and retrieve data across networks, which has an impact on people's lives and future economic possibilities.

Key points

- The Internet has changed how we get information and improved our daily lives by giving programmes, information, documents, email, music, streaming video, and other services.
 - Personal networks are used to enable online transactions, payments, restaurant reviews, social networking, and job interviews.
 - Inter-enterprise networks make it simpler to cooperate, use cloud services, access information and data, and integrate.
 - Because it enables consumers to access a broad variety of items online and enables organizations like Ford and Toyota to communicate and work with business owners, suppliers, and customers, the Internet is essential for companies like Amazon and eBay.
 - Additionally, “the network may download and store films and music, making them available from anywhere” (Wiley, 2020, p. 389).
2. High-quality and reliable data transmission is essential for many applications for the following reasons:
 - Productivity may be facilitated and improved via communication. It reduces communication costs by sending massive data files as a single data payload. This makes data transit rapid and effective.
 - Verifying and fixing mistakes With packet-based communication, errors may be checked for and fixed at the packet level. This suggests that rather than having to resend the entire message, errors in the packet may be found and fixed while the message is being delivered. As a result, there is less chance of data loss or corruption during transfer.

- Data routing may be conveniently divided into data packets. Packet-based routing is essential since data traveling over a large region will pass through several networks and connections before arriving at its destination. It ensures that information reaches its target location in a timely and accurate manner.
- Many applications are supported: Numerous applications demand reliable, high-quality data transfer. “Applications like voice conversations, video streaming, data transfer between computers, and online services all depend heavily on reliable and swift data transfer to enable consumers to get the most of the product” (Wiley, 2020, p. 394).

T2

1. The use of language is essential for information distribution. Language, which may be “used to handle information, programmes, documents, private conversations, requests, text, audio, and video, among other things, is the fundamental aim of communication. For instance, it may be applied in a variety of ways” (Wiley, 2020, p. 393).

This message illustrates the informational exchange between the following message's sender and recipient. Signals that stand in for messages are sent using a communication system. Packets, which are data units that may be delivered over a network and returned to the receiving end with the original contents, are used to package the message. Packages may arrive in a different order from when they were sent out and may travel differently than anticipated. Packages are routinely counted and reprocessed as soon as they arrive to ensure correct ordering.

The message is understood by all of the apps operating together, and their recognition processes determine the message's meaning. It is common practice to facilitate application communication and make managing and maintaining large networks easier by using HTTP and other standard protocols.

2. Information communication involves a procedure that has an impact on how the message is understood by both the sender and the recipient. This process ensures that both participants to the conversation get the message. Using widely used protocols like HTTP (Hypertext Transfer Protocol) may make managing and administering large networks easier. In this system, specific procedures are referred to as the fundamental rules that permit communication.

In the creation of content, “the collaborative analysis process is essential. For instance, a participating web service's page request is identified when the HTTP keyword "GET" is used. As long as your application follows the text, you are not compelled to utilize the law. However, standard systems promote system compatibility and facilitate collaboration” (Wiley, 2020, p. 429).

Applications utilize non-standard techniques in addition to conventional ones for a number of reasons. Contrarily, non-standard practices are limited to their devotees and may or may not be accepted as standards. To communicate successfully and efficiently on the Internet, it is essential to gain from the process of assessing the meaning of the message.

T3

1. Digital communication uses streams of bytes to represent messages. This indicates that the message has been divided into 8-bit bytes, or bytes. Digital data is binary in nature, with each bit having a value of 0 or 1. Byte stream representation can be used to send and store information in a fashion that is computer-readable. It offers a uniform data preparation and processing procedure, regardless of the type of data given.

When data is represented as a stream of bytes, it may sometimes be handled and changed more easily on computers. “A byte stream may be transmitted via a network (such as an Ethernet connection), and after it is received, it can be understood and decoded by another device in order to reconstruct the original message” (Wiley, 2020, p. 485).

2. An example of a data unit used in data communication is a data packet. They offer details on the package. Similar to envelopes, there are many different shapes and sizes for packages. Devices have several formats, and each format has a specific purpose. A packet includes details about the data it holds, as well as information about the sender, receiver, and destination. They want to understand each element of the network they go through.

For several reasons, data packets are crucial to data transport. First, by “reducing communication costs, it streamlines work and boosts communication effectiveness. They make it possible to transport large files with just one overhead” (Wiley, 2020, p. 394). Furthermore, without delivering the entire message, packets may be examined and modified at the packet level.

In wide-area communications, packets can also be used to send messages. a local area network with the ability to transport data between various networks and communications systems. By sharing a channel with packets from many sources, they increase channel availability and utilization as well.

Furthermore, by giving clear information with start and stop signals, data packets facilitate the integration of sending and receiving systems. Additionally, it makes it possible for computers to process data in units rather than characters or bytes.

T4

1. A communication method is a method used to send messages between two or more devices. It includes network interface controllers, signal transmission, and transmitters that carry the signal. A channel can be divided into multiple channels, each with unique characteristics such as media type, signal strength, and bandwidth capacity. This channel can be transmitted like a telephone connection or indirectly like wireless transmission. It plays an “important role in supporting message exchange between sender and receiver nodes to ensure effective data communication” (Wiley, 2020, p. 470).

2. The ability of a communication channel to carry data is referred to as bandwidth and is frequently expressed in bits per second. It refers to “the amount of data that may be carried across the channel at once” (Wiley, 2020, p. 398).

Since it limits the quantity of data that can be transmitted, bandwidth is a key concept in channel capacity. Complete. Greater bandwidth enables the transmission of more data, resulting in faster and more effective communication.

In terms of channel capacity, bandwidth has a significant impact on the overall speed and accuracy of data transmission. More data can be sent at once thanks to quicker speeds made possible by wider bandwidth. This is especially important in cases that need for quick and accurate file transfers, such as downloading web pages and sending large files.

In conclusion, bandwidth is an essential component of channel capacity that directly affects speed and effectiveness. data transfer. “Greater bandwidth enables the transmission of more information, resulting in faster and more trustworthy connections” (Wiley, 2020, p. 488).

T5

1. **Logical Topology of Networks:** The logical topology of a network refers to the operational connections between several networks. It outlines the distribution and flow of information among network nodes. grasp how a network functions and how data is transported from one place to another requires a solid grasp of logical topology. It may be represented using a variety of communication methods, including TCP/IP, Frame Relay, Ethernet, and USB, and it is unaffected by the physical topology of the network.

Physical Topology of Networks: The connections and equipment that make up the network's actual configuration are defined by its physical topology. It describes the physical links that connect the nodes and the actual route that data follows as it moves across the network. For network designers who need to know where cables and hardware are placed in a room or building, physical topology is essential. “The

bus, star, net, and ring are examples of physical uses. The physical topology selected depends on the network design parameters and each has benefits and drawbacks” (Wiley, 2020, p. 402).

2. Different types of network topologies could be explained as follows:

- **Mesh Topology:** Mesh networks have a large number of end-to-end paths, making them dependable and secure. Although this is impossible for most installations since the number of thread connections increases exponentially as the number of nodes increases, each node in a totally mesh network links directly to every other node.
- **Bus Topology:** A bus topology has just one communication connection connecting each of the nodes. Each node joins the data bus in order to send and receive data. Bus topology is prone to traffic even if it is easy and inexpensive to construct.
- **Star Topology:** Each node is linked to a central hub or switch. Direct communication between nodes is made possible by the central device that connects nodes to one another. Due to “its high performance and durability, the star topology is frequently employed in area networks” (Wiley, 2020, p. 401).
- **Ring Topology:** Each node of a closed loop structure known as a ring topology is connected to its neighbors to form a ring. Each node in the ring retransmits the signal it has received to the following node. Ring networks were formerly well-liked for their administration qualities, but they are currently seen to be outdated in terms of architecture.

These different network topologies have their own advantages and disadvantages, and the choice of topology depends on the specific requirements and constraints of the network design.

T6

1. Routers and gateways play a crucial role in interconnecting networks by facilitating the transfer of packets from one network to another.

- **Routers:** A router is a specialist device that connects networks that are similar. They choose the optimum path to take packets they receive from one network to another. Routers handle a range of protocols and employ packet switching techniques. Even if the physical connections connecting the networks may be different, they allow packets to be transferred between them.
- **Gateway:** A gateway transports numerous connections by carrying out a number of tasks. It aims to connect networks to multiple protocols and modify packet headers according to network requirements. “Gateways are frequently used on mainframe systems to transition between TCP/IP networks and conventional network protocols. The TCP/IP protocol is still widely used, but less so now” (Wiley, 2020, p. 418).

In a nutshell, gateways and routers are essential elements of the Internet. While gateways interpret packet headers between various networks, routers connect similar networks. Network connection and data packet transmission are both effectively supported by both devices.

2. Standards play a crucial role in ensuring compatibility and interoperability in various aspects of computing and communication systems.

- Standards provide specifications and regulations for hardware, including connections and electrical devices, to ensure that various items may work together without difficulty. Similar to hardware standards, software standards (such programming languages) promote compatibility and teamwork by guaranteeing that programmes made for one type of computer work well on another.
- Data entry and visualization Different computers can process and report information willingly thanks to the usage of text formats (Unicode) and image formats (PNG, JPEG). This makes it possible for data to be integrated and exchanged across several platforms and programmes.
- Communication protocols include: The guidelines and procedures for data transfer and communication are provided by TCP/IP and other communication protocols. This “strategy

promotes enhanced cooperation by enabling equipment and systems from many suppliers to successfully communicate” (Wiley, 2020, p. 47).

- Business specialists, management teams, and organizations regularly work together to create models. This cooperative approach ensures that the model reflects the needs and interests of several stakeholders, leading to enhanced cooperation and partnerships between various systems and technologies.
- Efficiency and cost-effectiveness: By using a uniform design, organizations may do away with the need for troubleshooting and design. Software and hardware that have been outsourced and satisfy industry standards can increase productivity and profitability.

Standardization is essential for assuring the compatibility and interoperability of computer and communication systems, to sum up. In order to encourage information exchange and effective communication, they set a number of rules and regulations that allow varied hardware, software, and systems to work together without any problems.

T7

1. Due to the communication standards and protocols it offers, the Ethernet protocol standard is essential in today's LANs. This standard specifies the LAN network protocol as well as the maximum cost, data connection, topology, and performance.

The majority of LANs in use today are constructed using Ethernet, which is described and defined by IEEE standards. Switched Ethernet (IEEE 802.3), Wi-Fi (IEEE 802.11), and hub-based Ethernet (also IEEE 802.3) are just a few of the several Ethernet topologies that are available. The “incorporation of many Ethernet types onto a single network is made possible by this sweetener” (Wiley, 2020, p. 404).

Ethernet specifications vary depending on the kind of media, bandwidth, and top speed. There are several maximum standards, including Fast Ethernet (100 BASE-TX), Gigabit Ethernet (1000 BASE-T), and 10G BASE-X (10 Gigabit Ethernet).

2. A hub is a focal point that makes connecting and upkeep in the connection area easier. In a multi-bus architecture, network interface modules from various devices are connected to a hub and share a "bus." The hub just broadcasts the device to all connected devices in its unprocessed state. In contrast, "hubs are viewed as worthless since they cannot be split up and cannot function on one of their nodes, which causes problems with high-speed communication" (Wiley, 2020, p. 406).

A switch can replace a hub in an area network configuration. They outperform hubs and employ a star topology. A central switch, which can offer a direct connection between two nodes, is connected to each network segment. Several pairs of nodes can communicate at full bandwidth simultaneously thanks to Ethernet switch-based switching. The ability to separate switches and run them on various lines enables more efficient network connection management. Modern phones use a method called switched Ethernet.

T8

1. Characteristics of Wireless LANs (WLANs) are as follows:
 - Using wireless technology, WLAN links gadgets together in a space like a building, home, or school. Since there are no longer any physical cables needed, connections may be made quickly and easily.
 - Wi-Fi standards, which include specifications like 802.11a, 802.11b, 802.11g, 802.11n, and 802.11ac, are often used to operate WLANs. These variations offer different amounts of information while operating on various radio frequencies.
 - Since WLAN devices share a radio frequency, they may communicate with one another and operate together. Faster devices, however, can reduce the cost of switching to slower ones. Various radios can be connected to by some devices.
 - Channels and bandwidth: The total bandwidth is distributed by WLAN into overlapping channels. "The kind of wireless connection and the bandwidth authorized by the nation or area decide the number of channels" (Wiley, 2020, p. 407).

2. Challenges and limitations of Wireless Networks are as follows:

- Status of Hidden Nodes: One of the challenges in wireless networks is the discovery of hidden nodes, or nodes that cannot be found because of interference or being out of range. Interruptions and communication failures between sites might emerge from this.
- An external challenge is another barrier to wireless communication, which occurs when the body is obstructed by structures or other obstructions, making direct connection impossible. As a result, the signal quality and connection reliability will decline.
- Wireless networks continue to struggle with interference caused by several broadcasts using the same frequency. This is known as channel separation. This may affect overall network performance and signal quality. To reduce interference, specific channels must be used to segregate channels that are used simultaneously.
- drop data rates and latency: Websites operating on wireless networks at high bit rates might need to drop their data rates to make them compatible with slower devices. Furthermore, the delay caused by interference in wireless networks is sometimes greater than in wired networks since the strength of the transmitted signal affects the receiver, prohibiting maintenance.
- Wireless nodes in a “network communicate with one another through access points. The entire network will suffer if the website is down or having problems” (Wiley, 2020, p. 437).

T9

1. By providing access to other networks, the backbone plays a crucial role in the local area network (LAN). They act as central nodes for several LANs, enabling communication between users and other websites like the Internet.

Backbone networks divide LANs for different users or offices inside a firm, increasing network performance overall. By substituting several smaller LANs for a single larger, heavily utilized LAN, they partition traffic. Various local networks may link to the backbone network as needed.

Spinal cord integration is a feasible and common strategy. Using fiber optic cables and switches, the backbone might reach larger areas, such as university campuses. “Communication within places is made possible by this” (Wiley, 2020, p. 409).

2. Access to other networks (such as the Internet) is also provided by the backbone. They serve as gateways or routers, connecting the LAN to other networks through carriers. This enables local network users to access external resources, share data with other networks, and make advantage of the city and surrounding area. The backbone of the network is essential for ensuring constant connections and fast data transfer between various networks, hence enhancing overall performance and effectiveness.

A Network Access Point (NAP) is a connection that transfers traffic between several Internet sites. For the purpose of data exchange and enabling worldwide connection, they serve as physical sites where ISPs connect to the Internet. NAP serves a critical role in WAN architecture by enabling the exchange of Internet connections between diverse networks and ISPs. They evaluate and disseminate high-quality data, making sure it gets to its target audience quickly and reliably. By providing an alternate route for data transfer in the event of an accident or crash, NAP additionally improves connectivity and security. Overall, network access points are essential components of WAN infrastructure, enabling seamless connectivity and efficient data exchange between different networks and ISPs (Wiley, 2020, p. 414).

T10

1. Using a transmitter and a receiver to create a wire path, a circuit switch is a piece of telephone equipment. This channel remains open even when there is no data to deliver, squandering network resources. A more complex method called packet switching separates data into tiny packets and delivers each packet on its own. There are several ways for the network to make use of and reproduce these packets. Since it enables higher utilization of network resources, packet switching is more effective.

Compared to electrical switching, packet switching has a number of benefits. By processing packets depending on network use, it first ensures efficient use of network resources. This increases the total network capacity by allowing several packets to be transmitted simultaneously over various channels. Second, “compared to electrical transmission, which is primarily designed for speech communication, packet switching is more flexible since it can handle a variety of data types, including audio, video, and text. Last but not least, packet switching is less costly since it does not require any modifications to support the data of today” (Wiley, 2020, p. 422).

In conclusion, there are two types of data transmission: packet switching and circuit switching. While packet switching breaks data into smaller packets, circuit switching creates a channel for each connection. Packet switching offers advantages such as better resource utilization, flexibility, and cost-effectiveness, making it the more common and preferred technique in modern networks.

2. For transferring and directing data packets across a network, routers are crucial. They are specialist tools that snoop on networks and move packets across them. “The router's CPU decides where to send the packet when it reaches the router's port and updates the switch to route it to the appropriate egress destination” (Wiley, 2020, p. 418).

On the basis of packet switching algorithms, routers make decisions. These algorithms determine the shortest path a packet can take to get to its destination. Data packets can be sent via a variety of links, including wireless and conventional Ethernet, using routers, which connect related networks.

To do this, it extracts the current address and uses routing databases and algorithms to generate the address of the next node. If extra translation is required, the router will do so to make sure the packet is compatible with the following network.

Particularly routers need to be able to send and receive data via the network. They choose the route packets will take to go to their destination, connect different connections, and check that packets are delivered in the right format and direction.

References

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