Mathokoza Mntambo

ID: UB76859SCO86054

Bachelors in Computer Science

WNT 095: Wireless Networks

Atlantic International University
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TABLE OF CONTENTS

Introduction.

A wireless network links computers or network devices without using network wires. These devices use radio communications to exchange information. This technology delivers information from one device to another without using physical cables and includes cellular, radio, infrared and satellite. You can communicate straight with other wireless devices or link to an existing network through a wireless Access Point (AP). When setting up the wireless adapter, the operating mode for the type of wireless network is selected.

Wireless technologies attract substantial consideration from industrialist. With the growing installation costs of network wiring, there are sound economic explanations for considering wireless networks. The capacity to operate in ultra-clean or harsh environments and mobility provide additional motivation to consider wireless connections.

Literature Review.

In 1970, the University of Hawaii established the first wireless connection to wirelessly communicate information amongst the Hawaiian Islands. However, it was not until 1991 when the Institute of Electrical and Electronics Engineers (IEEE) began to discuss regulating WLAN technologies. The IEEE approved the original 802.11 standard - the 802.11 technology term basically refers to Wi-Fi, in 1997.

In 1999 wireless was presented to the general community with the 802.11 a and b ratifications. The speeds for these standards were very low but it was acceptable because there were very few laptops and no handheld mobile devices that used Wi-Fi.

By 2003 some mobile gadgets that used Wi-Fi started to emerge and portable laptops became more standard for both personal and business use. 802.11g was then approved, bringing up to 54 Mbps in the 2.4 GHz space. As we got closer to today, in 2007, the evolution of the smartphone actually came along and about with it came the authorization of 802.11n.

The “n” standard carried about quicker processing speeds of up to 450 Mbps for Wi-Fi and supported 2.4 Ghz and 5 Ghz gadgets. Today, smart gadgets are strong enough to substitute specialized, very expensive laptop technologies so wireless has had to catch up. This is where we get into the present realm of 802.11ac. 802.11ac is the tremendous new wireless technology that takes us into the phase of Gigabit Wi-Fi.

Overview of Computer Networks and Wireless Networks.

Wireless networks are computer networks that are not linked by wires. They basically utilize radio waves for communication amongst the network nodes. They let devices to be linked to the network while roving around inside the network exposure.

The figure below, Figure 1, shows a typical wireless network with different devices on the network.

Fig. 1

Types of Wireless Networks

Wireless LANs − Joins two or more network gadgets by means of wireless distribution techniques.

Wireless MANs − Links two or more wireless LANs covering a metropolitan area.

Wireless WANs − Links large areas covering LANs, MANs and personal networks.

Advantages of Wireless Networks

It offers clutter-free environment because there are no cables.

It increases the movement of network devices linked to the system.

Easier to setup and install.

New network devices can be easily linked to the current setup since they need not be cabled to the existing equipment.

Wireless networks need very little or no wires. This decreases the equipment and setup expenses.

Examples of wireless networks include mobile phone networks, wireless sensor networks, satellite communication networks and terrestrial microwave networks.

Cellular Concepts and Designs.

Old-style mobile service was the same as TV/radio broadcasting: One highly powerful transmitter placed at the highest spot in a big area. In a cellular system, instead of utilizing one powerful transmitter, numerous low-power transmitters are positioned throughout a coverage area. The cellular concept was a main breakthrough in resolving the problem of user capacity and spectral congestion. It presented very high capacity in a little spectrum allocation without any main technological changes.

Cellular networks allow gadgets like Internet of things (IoT) and smartphones devices to communicate wirelessly. Cellular technologies have progress from first generation (1G) analog technologies to cutting-edge high-performance fourth generation (4G) and fifth generation (5G) systems in about four decades. Throughout the growth of each wireless generation, these networks have shared a quantity of common core attributes.

However, the precise network architecture varies from generation to another, a typical cellular network comprises of a radio access network (RAN), services network and a core network (CN). The RAN comprises base stations (BS) that connects with the wireless gadgets utilizing radio frequency (RF) signals and it interfaces between the devices and the base station. The RAN assigns radio resources to the gadgets to make wireless communications a certainty. The CN executes functions such as operator authentication, security activation, service authorization, IP address provision and setup of appropriate links to enable the transfer of operator traffic like voice and video. The services network consists of user-specific servers and IP multimedia subsystem (IMS) to deliver a variety of services to the wireless member, including text messages (SMS), voice calls and video calls.

Despite the rise in complexity of wireless devices and standards, cellular technologies sustain a set of common principles that form the foundation behind the design of cellular systems.

Getting to Know Wireless Networks and Technology.

Wireless communication technology is a current substitute to traditional cabled networking. Where cabled networks depend on cables to link digital gadgets together, wireless networks depend on wireless technologies. Wireless technologies are broadly used in both business and home computer networks.

A system known as an access point (AP) is the central of a wireless network. An access point’s main task is to broadcast a wireless signal tuned and sensed into by computers.

Since wireless networks are naturally connected to wired networks, access points usually act as a gateway to a cabled network's resources, like an Internet connection.

Computers require to be equipped with wireless network adapters to link to an access point and join a wireless network. These are typically built precise into the device, but if not, an add-on adapter is attached to an expansion slot or USB port.

Normal wireless technologies include:

Wi-Fi - especially as a wireless hotspot technology and common in family networks.

Bluetooth - for embedded and low-power software.

Cellular internet.

Wireless home automation standards.

Physical Layer Fundamentals – LAN.

In order for a network communication to occur, a physical connection to a LAN must be guaranteed. These physical links are used based on the environment and circumstances. Therefore, a home or small office network is usually linked through a wired connection, with the aid of switch. Information is in these cases conveyed through a physical cable. Alternatively, many businesses are now using the wireless connections for smaller end gadgets like smartphones, tablets and even laptops. Wireless connections are allowing the information to be transmitted using radio waves. Principally, a physical connection can signify a cabled connection utilizing a straight-through cable or wireless connection utilizing radio waves. It permits packet to be "physically" sent over networks.

A network is a cluster of two or more linked computers and a LAN is a network confined within a small geographic area, typically in a building. Home Wi-Fi networks and small corporate networks are examples of LANs.

How do LANs work?

Most LANs join to the Internet using a central point known as a router. Home LANs usually use one router, while LANs in bigger spaces may additionally utilize network switches for more effective packet transfer. LANs almost always use Ethernet, Wi-Fi or both in order to join devices in the network. Ethernet is a rule for physical network connections that involves the use of Ethernet wires. Wi-Fi is a protocol for joining to a network through radio waves.

Network Topology.

Network topology is the representation description of the arrangement of the logical elements and physical of a communication network. It is the arrangement or layout with which computer structures or network devices are linked to each other in order for them to exchange information.

- *Bus network topology* - It is also known as backbone network topology. This layout joins all devices to a core cable via drop cables. This network topology is just simple, less cable required thus easy to install.

- *Mesh network topology* – A host is linked to one or multiple hosts. This topology has hosts in point-to-point linking with every other host or may also have hosts which are in point-to-point linking to few hosts only.

- *Ring network topology* - Two point-to-point links attach a machine to the two machines located on any side of it forming a ring of devices. When one device tries to communicate or send message to a device which is not next to it, the data journeys over all intermediate devices.

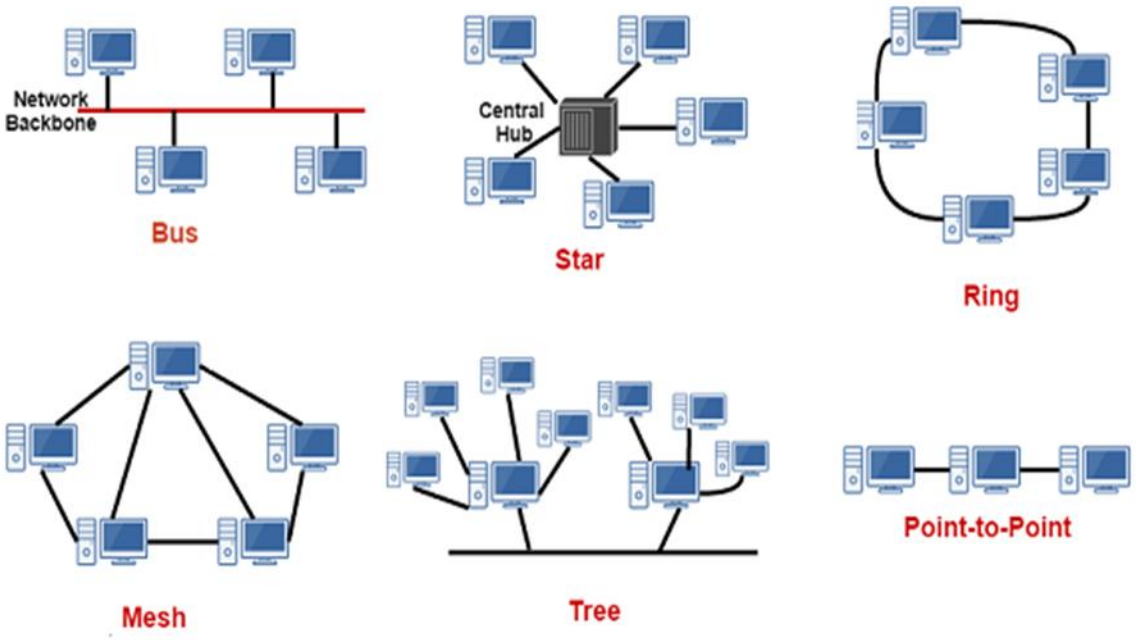
- *Star network topology* - The most common network topology joins each device in the network to a hub in the center. Devices can only talk with each other via the central hub. The hub device can be a hub, repeater, switch, bridge or router.

- *Hybrid network topology* – This a grouping of two or more topologies.

- *Tree network topology* - This topology involves of a parent-child order in which star networks are inter-linked via bus networks. It is also known as Hierarchical Topology.

The following figure (Figure 1) shows network topologies.

Fig 1: Network Topologies.



Medium Access Control.

Medium Access Control (MAC) address is a hardware address use to exclusively recognize each node of a network. It offers addressing and channel access control systems to allow the numerous terminals or network nodes to communicate in a definite network. In wireless networks, several terminals require to communicate simultaneously and a medium access control (MAC) protocol lets several terminals to communicate over the wireless channel and to share its capacity. The Medium Access Control (MAC) rule

is utilized to offer the data link layer of the Ethernet LAN system. MAC rules multiplex numerous information streams of different terminals to share the same channel and deal with issues like how a terminal gets a channel when it requires one, addressing and so forth.

The design of MAC procedures closely relates to the state of the physical channels. Originally MAC protocols were created for wired communications where multiple computers want to convey data packets simultaneously in a local area network (LAN). With cabled networks, the physical medium can be fiber optics or copper, which are in overall very consistent with plentiful bandwidth. Packet loss in cabled networks is primarily due to collisions and the MAC designs are quite simple.

Radio Resource Management (RRM).

A significant job of RRM is to bridge the undependable radio medium to bring the service an operator request from a wireless or fixed network users in the network. These QoS promises are not very well seconded in these day's WLAN standards, the leading technology for high-speed communication.

Centralized RRM is a promise substitute for wireless communication with QoS assurances. A user requires to negotiate with the network to get the support and service it needs. The negotiation part is for the guarding of the existing system users. A disadvantage with centralized systems is their complication. The bunch concept can reduce the difficulty and can to a great degree retain the advantages of centralization.

Mobility Management.

Mobility management is a function that helps mobile gadgets operations in Global System for Mobile Communications (GSM) or Universal Mobile Telecommunications System (UMTS) networks. Mobility management is utilized to trace subscriber and physical user locations to offer mobile phone services such as and Short Message Service (SMS) and calls.

GSM and UMTS are each made up of discrete cells or base stations that cover a precise geographical area. All cells are joined into one area, letting a cellular network to house a wider area or a location area. Roaming is amongst the elementary actions of mobility management. It allows users to utilize mobile services when going outside of the geographical area of a precise network.

Wireless Networking: Getting Started.

A wireless network lets you to link smartphones, laptops and other portable devices to the Internet service without an Ethernet wire. To create a wireless network with internet access, a wireless router is needed.

Configure the router

- Use a computer to set the router's default settings, including setting a unique password and name for the wireless network.
- Using a web browser, enter the default IP address for the router into the address bar to access the router’s settings.
- The router's settings site will appear. Find and choose the Network Name setting, and enter a distinctive network name.
- Find and choose the Network Password setting, and select an Encryption option. There are numerous kinds of encryption that can be used, but WPA2 is recommended because is normally considered to be the safest.
- Enter the desired password. Ensure the use of strong password to assist ensuring no one else can use the network without permission.
- Find and choose the Save button to save the settings.

Connect

The method for joining a wireless network varies a little depending on the type of device or computer being used, but any device will need these basic steps.

- Find the computer's network settings and look for nearby wireless networks.
- Select the network and enter the password.

- If successfully connected, open a web browser and try directing to a web page like www.yahoo.com. If the page opens, it means the wireless connection is working properly.

Introduction to Mobile IP.

Mobile IP is a communication rule (formed by spreading Internet Protocol, IP) that permits users to go from one network to another using the same IP address. It makes sure that communication continues without the user's connections or sessions being dropped. The role and concept of Mobile IP are very vital in the area of mobile computing technology.

How Mobile IP Works?

This can be described in 3 stages:

Agent Discovery - In this stage, the mobile nodes learn their Home and Foreign Agents. The Foreign and Home Agent present their services on the network utilizing the ICMP Router Discovery Protocol (IRDP).

Registration - The registration stage is accountable for notifying the current location of the foreign and home agent for the right forwarding of packets.

Tunneling - This stage is utilized to create a virtual link as a pipe for moving the information packets between a tunnel entry and endpoint.

Conclusion.

The world is more and more becoming moveable and wireless networking is receiving larger attention in the recent past, particularly with hardware technology price drops and breakthroughs. Mobility when joint with computing power creates a deadly grouping and that is why persistent research is going on to create even better wireless technologies. The union of all the wireless technologies to make one single network is the biggest task ahead, as they all utilize different networking technologies. This could lead us to a world where ubiquitous and seamless computing will become a certain realism and not just a future dream.

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