Introduction to Computer Networking

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Wireless Networks

OBJECTIVES:

After studying this chapter you will be able to-

- Explain the working of Wireless Networking.
- State Wireless standards.
- Discuss advantages and disadvantages of wireless networking.

INTRODUCTION

Wi-Fi is a brand originally licensed by the Wi-Fi alliance to describe the underlying technology of wireless Local Area Networks (WLAN) based on IEEE 802.11 specifications. Wi-Fi was intended to be used for mobile computing devices, such as Laptops in LANs, but is now often used for increasingly more applications including Internet Access, gaming, and basic connectivity of consumer electronics such as televisions and DVD players.

A person with a Wi-Fi device such as computer, telephone or personal digital assistant (PDA) can connect to the internet when in proximity of an access point. The region covered by one or several access points is called a hot spot. Hot spots can be range from a single room to many square miles of overlapping hot spots.

Wireless Networks uses radio waves as its carrier. (RF 2.4 GHz to 5 GHz).
Wi-Fi stands for Wireless Fidelity.

WORKING OF WIRELESS NETWORKS

The typical Wi-Fi setup contains one or more Access points (APs) and one or more clients. A AP broadcasts its SSID (Service Set Identifier, Network Name) via packets that called beacons, which are broadcasted every 100 ms. The beacons are transmitted at 1 Mb/s and are relatively short and therefore are not of influence on performance. Since 1Mb/s is the lowest rate of Wi-Fi it assures that the client who receives the beacon can communicate at at least 1Mb/s . Based on the settings (e.g. the SSID) , the client may decide whether to connect to an AP. Also the firmware running on the client Wi-Fi is of influence. Say two APs of the same SSID are in the range of the client, the firmware may decide based on signal strength to which of two APs it will connect.

Wi-Fi uses spectrum near 2.4 GHz, which is a standardized and unlicensed by international agreement.

EXAMPLES OF WI-FI DEVICES

Wireless Access Point (WAP)

A wireless access point connects a group of wireless stations to adjacent wired local area network (LAN). An access point is similar to an Ethernet Hub, but instead of relaying on LAN data only to other LAN stations, an access point can relay wireless data to all other compatible wireless devices as well as LAN stations connected by wires.

Wireless Routers

A wireless router connects a group of Wi-Fi enabled devices (i.e. PDAs, laptops etc) to adjacent wired network (such as cable modem or DSL modem). A wireless access router is a wireless access point combined with an Ethernet Hub. A wireless router forwards between your wireless subnet and any other subnet.

EXAMPLES OF WI-FI DEVICES

Wireless Ethernet Bridge

A wireless Ethernet Bridge connect two separate networks.

Wi-Fi supported operating systems:-

1] Microsoft Windows XP, Vista and Windows 7 have a good support for wireless.

2] Mac Operating system has good Wi-Fi support and operating system includes native support for Apple “AirPort” Wi-Fi cards.

3] Linux has excellent support for most of wireless cards.

Wireless Capabilities :-

1] It provides temporary connections to and existing cable (Wired) networks.

2] Provides backup (redundant) to an existing wired networks.

3] Extend the networks beyond the limits of copper or even fiber optic cables.

Usage of Wireless Networks:-

1] Busy areas such as lobbies, and reception areas.

2] For people who are constantly on move such as doctors in hospitals, in isolated areas.

3] Buildings or departments where physical settings changes frequently.

3] Structures such as historical buildings where cabling would be difficult.

WIRELESS STANDARDS

IEEE 802.11 is a set of standards carrying out Wireless Local Area Network (WLAN) computer communication in the 2.4, 3.6 and 5 GHz frequency bands. They are created and maintained by the IEEE LAN/MAN Standards Committee (IEEE 802).

802.11a

Release date	Op. Frequency	Throughput	Net Bit Rare (max.)	Gross Bit Rate (max.)	Max Indoor Range	Max Outdoor Range
October 1999	**5 GHz**	**20 Mbit/s**	**54 Mbit/s**	**72 Mbit/s**	**~75 ft/25 meters**	**~150 ft/50 meters**

802.11b

Release date	Op. Frequency	Throughput (typ.)	Net Bit Rate (max.)	Gross Bit Rate (max.)	Max Indoor Range	Max Outdoor Range
October 1999	**2.4 GHz**	**~5 Mbit/s**	**11 Mbit/s**	**11 Mbit/s**	**~150 feet/45 meters**	**~300 feet/90 meters**

802.11g

Release date	Op. Frequency	Throughput (typ.)	Net Bit Rate (max.)	Gross Bit Rate (max.)	Max Indoor Range	Max Outdoor Range
June 2003	2.4 GHz	~22 Mbit/s	54 Mbit/s	128 Mbit/s	~150 feet/45 meters	~300 feet/90 meters

802.11n

Release date	Op. Frequency	Throughput (typ.)	Net Bit Rate (max.)	Gross Bit Rate (max.)	Max Indoor Range	Max Outdoor Range
September 11, 2009	5 GHz and/or 2.4 GHz	50–144 Mbit/s	600 Mbit/s	450 Mbit/s	~229 feet/70 meters	~820 feet/250 meters

ADVANTAGES OF WIRELESS NETWORKS

1) Allows LANs to be deployed without cabling, potentially reducing costs of network deployment and expansion. Spaces where cables cannot be run, such as outdoor areas and historical buildings, can host wireless networks.

2) Wi-Fi silicon pricing continues to come down, making Wi-Fi a very economical networking option.

3) Wi-Fi products are widely available in the market. Different brands of access points and client network interfaces are interoperable at the basic level of service.

4)Wi-Fi networks support roaming, in which a mobile client station such as a laptop can move from one access point to another as the user moves around in the building areas.

Disadvantages of Wireless Networks

1] Power consumption is fairly high, making battery life and heat a concern.

2] The most common wireless encryption standard, Wired Equivalent Privacy or WEP has been shown to be breakable even when correctly configured.

3] Wi-Fi networks have limited range. A typical Wi-Fi home router using 802.11b or 802.11g standard with a stock antenna might have a range of 45 Meters (Indoor) and 90 Meters (outdoor).

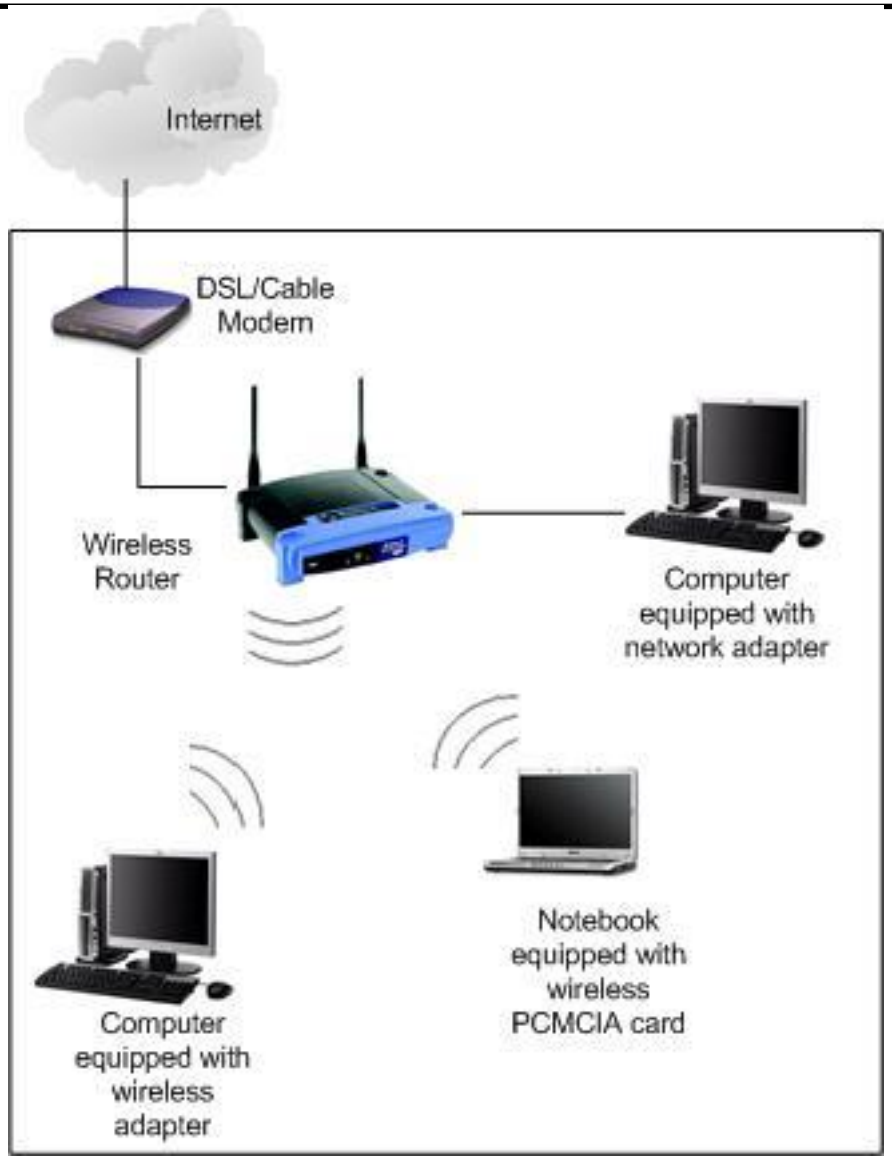
4] Wi-Fi networks can be monitored and used to read and copy data (including personal information) transmitted over the network when encryption is not enabled.

5] The frequency which 802.11b and 802.11g operates is 2.4GHz which can lead to interference with cordless phones in the super high frequency range.

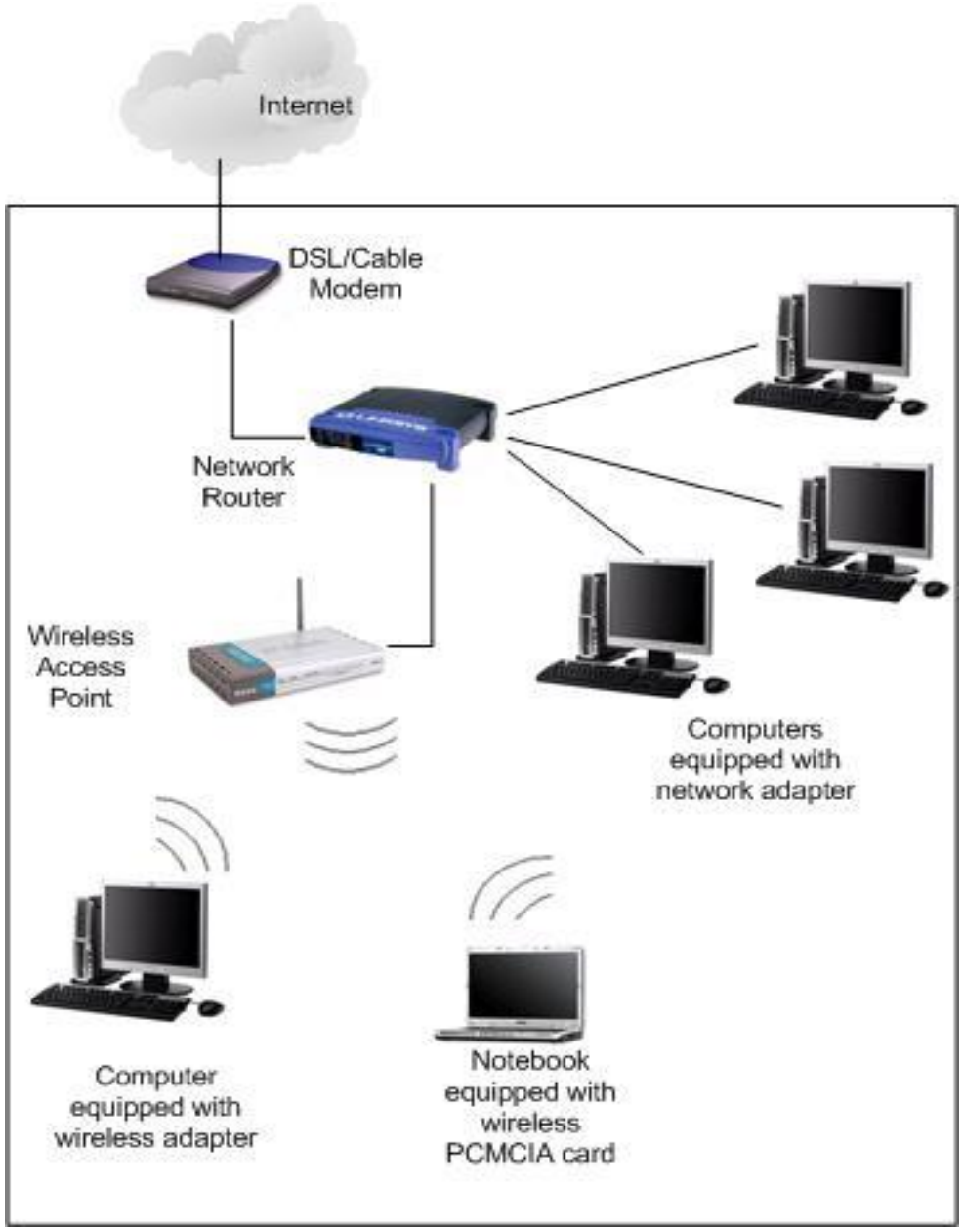
WIRELESS SECURITY

Wi-Fi Protected Access (**WPA** and **WPA2**) a certification program created by the Wi-Fi Alliance to indicate compliance with the security protocol created by the Wi-Fi Alliance to secure wireless computer networks. This protocol was created in response to several serious weaknesses researchers had found in the previous system, WEP (Wired Equivalent Privacy)

The WPA protocol implements the majority of the IEEE802.11i standard.Specifically, the Temporal Key Integrity Protocol (TKIP), was brought into WPA. TKIP could be implemented on pre-WPA Wireless Network Interface Cards that began shipping as far back as 1999 through firmware upgrades.



If you already have wired Ethernet Network at home you can attach wireless access point to existing network router and have wireless access at home


Internet
DSL/Cable
Modem
Network
Router
Wireless
Access
Point
Computers
equipped with
network adapter
Computer
equipped with
wireless adapter
Notebook
equipped with
wireless
PCMCIA card