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Department: Computer Engineering

Assignment :- 1

Subject: Wireless and Mobile Networks

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Assignment No. - 1

Que.1) What is difference between Wireless and Wired Networks? Explain their advantages, disadvantages and limitations.

Ans.)

Activity/ Category	Wireless Network	Wired Network
Freedom of movement for users	Users can access network from anywhere within range.	Users location limited by need to use cable and/or connect to a port.
Sharing Files	Easier with wireless network as you do not need to be cabled to network, though transfer speeds may be slower.	Generally less convenient as you have to be cabled in, but transfer speeds often faster.
Cables	Far less complicated, disruptive, and untidy cabling needed.	Lots of cables and ports needed which can be a headache.
Business	For businesses dealing with public, customers like and often expect wireless, so wireless can increase income.	Wired networks are not convenient for public use, but sometimes acceptable for a traditional office.
Connection speeds	Usually slower than wired.	Usually faster than wireless.
Security	Less secure than wired. Both bandwidth and information can sometimes be accessed.	More secure than wireless.

Advantages of Wired Networks:-

- The network offer higher data rate and hence fast transfer of information.
- The wired connection is more secure unless someone breaks the connection and tap the signal.
- It is simple to configure.
- Cables offer higher bandwidth.
- Shieldings are used to withstand against interference.
- It offers higher reliability and better quality of service (QoS).

Disadvantages of Wired Networks:-

- Wired connection does not provide mobility during usage.
- Installation of wired network is very difficult. Moreover it is difficult to troubleshoot in faulty situation.
- It requires more time to install.
- It requires devices such as amplifiers, regenerators, repeaters, hubs and switches in order to extend the coverage distance.
- There are more chances of damage to wired technology products compare to wireless counterpart.

Advantages of Wireless Networks:-

- **Flexibility**: As wireless frequency penetrates the walls, wireless networks are easy to install anywhere based on choice. This flexibility is one of the great benefits of wireless network where wired cable can not be installed.
- **Easy Installation**: Wireless networks are easy to install and easy to maintain compare to messy wired counterparts. This will help when network grows and will have hundreds to thousands of customers.
- **Network Planning**: Wireless network planning is very easy compare to wired network due to wireless software configuration of frequency, power and other parameters.
- **Location**: Wireless communication helps in connecting remote inaccessible areas behind the walls or buildings or hilly terrains.
- **Mobility**: The great benefit of wireless communication is mobility of usage unlike wired communication.
- **Price**: The wireless communication end devices are available at very low cost due to competition in handset manufacturing segment.

Disadvantages of Wireless Networks:-

- Wireless signals can be easily hacked and hence it will hamper privacy. To avoid this, security algorithms (AES, WEP, WAP2) and modulation techniques (FHSS, DSSS) are employed in wireless networks.
- The earlier wireless networks were slower. Now-a-days wireless LANs with advanced standards such as IEEE 802.11ac and 802.11ad are available which provides same performance as traditional ethernet based LANs.
- Wireless networks require careful radio frequency planning at the beginning of the installation.
- Wireless communication is subject to interference. There are various receiver techniques and modulation techniques which make wireless system robust against any kind of interference.

Que.2) What do you mean by spread spectrum? Explain its advantages.

Ans.) Spread Spectrum:-

Spread spectrum is a form of wireless communications in which the frequency of the transmitted signal is deliberately varied. This results in a much greater bandwidth than the signal would have if its frequency were not varied.

It is an important encoding method for wireless communications to spread data over wide bandwidth and makes jamming and interception harder.

Advantages of Spread Spectrum:-

1. Robustness against narrowband interference

2. Relatively high security

3. Coexistence of several signals – the receiver can separate each user based on code

4.No need for frequency planning as all user uses same bandwidth

5.Wideband signals – less prone to interference, less prone to fading

Que.3) . What is Multiplexing? Explain various types of multiplexing of wireless network.

Ans.) **Multiplexing:-** Multiplexing can be defined as; it is a way of transmitting various signals over a media or single line. A common kind of multiplexing merges a number of low-speed signals to send over an only high-speed link, or it is used to transmit a medium as well as its link with the number of devices. It provides both privacy & Efficiency. The entire process can be done using a device namely **MUX or multiplexer**, and the main function of this device is to unite n-input lines for generating a single output line. Thus MUX has many inputs & single output. A device is called DEMUX or demultiplexer is used at the receiving end which divides the signal into its component signals. So It has single input and number of outputs.

Multiplexing techniques are mainly used in communication, and these are classified into four types.

- Space Division Multiplexing (SDM)
- Frequency Division Multiplexing (FDM)
- Time Division Multiplexing (TDM)
- Code Division Multiplexing (CDM)

1.) Space Division Multiplexing (SDM):-

In wireless transmission, SDM implies a separate sender for each communication channel with a wide enough distance between senders. This multiplexing scheme is used, for example, at FM radio stations where the transmission range is limited to a certain region many radio stations around the world can use the same frequency without interference.

2.) Frequency Division Multiplexing (FDM):-

Frequency division multiplexing (FDM) describes schemes to subdivide the frequency dimension in to several non-overlapping frequency bands. Th is scheme is used for radio stations with in the same region, where each radio station has its own frequency. This very simple multiplexing scheme does not need complex coordination between sender and receiver: the receiver only has to tune into the specific sender.

3.) Time Division Multiplexing (TDM):-

A more flexible multiplexing scheme for typical mobile communications is time division multiplexing (TDM). Here a channel ki is given the whole bandwidth for a certain amount of time, i.e., all senders use the same frequency but at different points in time. Again, guard spaces, which now represent time gaps, have to separate the different periods when the senders use the medium.

4.) Code Division Multiplexing (DM):-

While SDM and FDM are well known from the early days of radio transmission and TDM is used in connection with many applications, code division multiplexing (CDM) is a relatively new scheme in commercial communication systems. Separation is now achieved by assigning each channel its own ‘code’, guard spaces are realized by using codes with the necessary ‘distance’ in code space, e.g., orthogonal codes.

Que.4) What is Multipath Propagation? How does it affect communication? Explain.

Ans.) Multipath Propagation:-

A radio signal spreads out in different directions as it radiates away from the broadcast antenna. Parts of the spreading wave will encounter reflecting surfaces, and the wave will scatter off these objects. In an urban environment, the wave might reflect off buildings, moving trains, or airplanes. Multipath occurs when a signal takes two or more paths from the transmitting antenna to the receiving antenna. We'll assume that one signal, the direct ray, travels directly from the transmitter to the receiver. The direct ray is usually (but not always) the strongest signal present in the receiving antenna. The other signals (or rays) arrive at the receiving antenna via more roundabout paths. These reflected signals eventually find their way to the receiving antenna. In our analysis, we'll assume these indirect rays arrive after the direct ray and that the indirect rays are weaker in power than the direct rays**.**

How does it affect communication:-

1 - Assuming multipath beams are coming from the antenna face , with traces of multiple attenuation by reflection or refraction , but logically is the same frequency with different phases . In this case you should not skip the radii of Fresnel . such as residual power of neighboring signals.

. 2 - Assuming the antenna is directional and is installed on the same tower with other antennas in the same frequency band, in this case it is necessary to consider the pattern of radiation and analyze the effects against the back of the side lobes - see data sheets. This is because the multipath interference can manifest itself in two ways:

- To a greater degree, when the polarization is the same in all the antennas and the separation between frequencies is minimal.

- Low grade, when the polarization is different also the separation between frequencies is greater, which implies a good distribution of frequencies from the design of the links. As in the microwave radios cellular telephone base station.

3 -. Multipath links in line of sight, it becomes saved with high performance antennas, because the main lobe of minimum opening.

Que.5) Explain Channel fading.

Ans.) Channel Fading:- Fading channel manifestations can be broadly divided into two categories: large-scale fading and small-scale fading. Large–scale fading represents the average signal power attenuation or path loss due to multipath signal propagation over large areas. Large-scale fading is affected by prominent terrain contours (such as hills, mountains, forests, billboards, clumps of buildings, etc.) between the transmitter and the receiver. The receiver is often represented as being "shadowed" by such prominences. The statistics of large-scale fading provide a way of computing an estimate of path loss as a function of distance. This is described as a mean-path loss and a log-normally distributed variation about the mean.

Small-scale fading refers to the random changes in signal amplitude and phase that are experienced by a signal as a result of small changes (as small as a half wavelength) in the spatial positioning between a receiver and a transmitter. Small-scale fading manifests itself in two mechanisms,

namely, time-spreading of the signal (or signal dispersion) and time-variance behavior of the channel. For mobile radio applications, the channel is time-variant because motion between the transmitter and the receiver results in propagation path changes. The rate of change of these propagation conditions accounts for the fading rapidity (rate of change of the fading impairments).