UNIT -1

MOBILE COMPUTING

Net Works : Network is the inter communication of computers and devices. It is a communication system which shares the computer equipments, S/W, data/informative voice and video transmission.

Network transmit information by wired or wireless communication media.

Wired Media means : Coaxial cable, twisted pair cable and fiber-optical cable.

Wireless Media means : Use spread spectrum technology and data transmitted by high frequency radio signal.

Wire less Network : It is a network of devices that are connected logically without wires. It is a telecommunication network. The wireless term is sued for mobile IT equipment. Like cellular telephones, personal Digital Assistants (PDAs) and wireless Networking. In the following cases can use the wireless technology.

1. To avoid physical structure.
2. To link portable or temporary structure.
3. To span a distance beyond the capabilities of cabling.
4. To provide a back up communication link in case of normal network failure.
5. To remotely connect mobile servers or network wireless communication uses.
    1. Radio frequency communication.
    2. Microwave communication -> Ex long range line – of – sight via antennas or short range.
    3. Infrared (IR) short – range communication Ex-> Remote controls .

    In wireless communication electromagnetic waves the date singles.

Wireless equipments are :

1. Satellite television: Alones viewers in almost any location to select from hundreds of channels.
2. Cordless telephone sets : These are limit – range devices.
3. Cordless computer peripherals: Cordless mouse, key boards ad printers can also be linked to a computer via wireless.
4. Global positioning system (GPS) : Allows pilots of aircraft, captain of boats and ships, Drivers of cars and trucks to ascertain their location anywhere in earth .
5. Cellular phones and page gens : It provide connectivity for protable and mobile applications .

Mobile computing : It is a computing environment over physical mobility. Mobile computing system alones the user to perform a task from anywhere using a computing device .

Dimension of mobile computing : Dimensions which make a system mobile .

1. Location Awareness: A mobiles device is not always at the same place.
2. Quality of service (Quos).
3. Limited storage capabilities.
4. Limited power supply: Batteries are the main resources of paver for mobile devices.
5. Support for a wide variety of user interface: Mobile application can also be handed from the stationary devices like Pecs, keyboard, mouse and monitor.

Mobile computing characteristics.

1. User mobility: User should be able to move from one physical location to another by using the same service without any interruption.
2. Network Mobility: User should be able to move from one network to another and use the same service. For ex: user moves from us to Delhi and uses the same GSM (Global system for mobile communication) phone to access his application through WAP (Wireless application Protocol).
3. Bearer Mobility: User should be able to move from one bearer to another and use the same service.
4. Device mobility: User should be able to move from one device to another and use the same service. User could be use desktop at his office, after same time uses lap top to access the same application.
5. Session mobility: Users session should be moved from one environment to other user using the service through CDMA (Code division Multiplexing access) network.

Applications of Mobile computing :

- Flight, directions and traffic information.
- Movie, News, Weather.
- Reading email.
- Retail.
- Health care.
- Real estate.
- Field service.
- Hospitality.
- Rivaling.

UNIT -2

MOBILE COMPUTING

Introduction to mobile Development Frame work .

2.1 **Client – Server Architecture** : Cs Architecture is the first computing Architecture commercially available, In Cs model two different programme residing on separate M/c . One programme said to be client and other is server. Client generates the request and server serves the client's request. In Cs architecture one server and more than one client.

The main aim of cs architecture is client do more work then server but no computing power, client give the information to the user about server.

Modern Client-Server architecture includes databases on the server side .

2.2 **N-TIER ARCHITECTURE:**

N-tier architecture is breaking down of an application into logical check that one called **tier.** Times can exist the same computer and be connected logically on different M/cs.

1. **Tier Architecture** : It is the simplest tier architecture single tier on single user and is equivalent & personal computer. It is not a part of network.
2. **Tier Architecture** : It is the basis network between a client and server. Ex-web model is a 2-tier architecture. A web browser makes a request from a web server, which then processes the request and returns the desired response.
3. **Tier Architecture** : This architecture is commonly used to build web application. In this case (1) browser acts like a chlient presentation layer. (2) Middle wave contain the business logic layer (3) Data base server handle data functions Database layer. Usually N-tier architecture begins as a 3-tier model and is expanded. It provides finer granularity. Granularity is the ability of a system. The finer granularity is the greater flexibility of a system.

N-TIER ARCHITECTURE AND THE WWW

www is a client – Server mechanism, where the client and server communicate through HTTP. The clients are the browsers which interpret the user interface in HTML. The servers are the web servers which serve the client request coming from HTTP with HTML response. Examples of N-tier architecture in web application is the shopping-cant web application .

In a shopping can't web application the presentation tier displays information related to bromine, purchasing and shopping can't content. It communicates with other tiers by outsprinting the result. In N-tier architecture the business logic tier is pulled out from the

presentation tier and, as its own layer. It controls applications functionality by performing detailed processing.

Peer to Peer architecture: In this network workstations has equivalent capabilities and responsibilities. This architecture is popular with home user and small business.

Advantages :

1. No need for a network administrator.
2. Network is fast.
3. Network is not expensive to set up and maintain.
4. Each Pc can make backup copies of its data to other Pcs for security.

Mobile Agent Architecture : Mobile agent have the following properties.

1. They are the programs which hide data and code which are transported from client M/c to remote server for execution.
2. They execute asynchronously: Mobile agents are software components which move from server to server in a network.

UNIT -3

MOBILE COMPUTING

Wireless Transmission :

Signal : Signals are the physical representation of data.Signal is two types (1) Analog (2) digital .

Analog signal : Analog signals one continuous electrical signals that vary in time. Analog is a sine wave. The completion of one full Pattern is called cycle. Analog signal require much less board width, about 4.5 MHZ and speed is 143.2 bps. **Telephone voice signal is analog signal.**

Digital signal: Digital signals are transmission signals that carry information in a discontinuous stream of on/off pulses. This signal consists of pulses or digits with discrete values. The value of each value is same. Digital signal have two amplitude level called nodes. Such as 1 or 0 high or low, true or false. It requires high band width as much as 74.25 MHZ and 1485 Mbps. Cost may be higher.

Period and frequency:

Period : Period is the amount of time (in seconds) a signal needs to complete one cycle.

Frequency: Frequency is the measurement of the number of occurrences of a repeated event per unit of time. Unit of frequency is HZ .

Bond width : The range f frequencies that a medium can pass is called bond width .

ANTENNAS : Antenna is a device is designed to transmit or receive radio waves. Antennas are used in system such as radio, TV, Radar, wireless LAN etc.

Antennas are two types :

1. Omni – directional (radiates-equally in all direction).
2. Directional (radiates more in one direction.)
3. LANs and WANs use omini directional antenna wireless MANs use directional antenna.

Selective cells: The selective cells are located at the entrance of a tunnel. The area of a cell need not to be of 360 degree coverage. Selective cell with Coverage are of 120 degree is used.

Umbrella cells : An umbrella cell covers several micro cells. The power level inside an umbrella cell is increased comparing to the paver level used in the micro cells that form the umbrella cells. It covers several micro cells.

Cellular system:

A cellular mobile communication system uses a large number of low power wireless transmit tens to create cell. Cell is the basic geographic unit of a cellular system.

A cellular net work is a radio network made up of a number of radio cells. Each cell served by a fixed transmitter, known as **cell site or base station**.

Advantages of cellular network:

- **Increased capacity.**
- **Reduced power usage.**
- **Better coverage.**

The true shape of cells is not a perfect hexagon . Different cells are

- **Micro cells.**
- **Macro cells.**
- **Selective cells.**
- **Umbrella cells.**

Cell structure consist by macro and micro cells and at least one mobile station. The cell has a predetermined size and to cover a service area.

Macro cells : They are large cells for remote and sparsely populated areas.

Micro cells: They are used for densely populated area. The existing area is splitted into smaller cell. So the cell capacity and available channel capacity is increased.

The frequency of such signals are transmitted is called the ISM **(Industrial, Scientific and medical)** bond. In this technique, the PRN are applied directly to carrier modulator .

FHSS: In this technique the frequency of a carrier is attend many times within a fixed time period. The signal jumps from one frequency to another within a given frequency range. The transmitter device"Listens" to a channel, if it detects no signal is transmitted; it transmits the data using the fuel channel bond width. If the channel is full, it "hops" to another channel and repeats the process.

Total bond width is split into many channels of smaller band width and guard spaces. Transmitter and receiver stay on one of these channels for a certain time and then hop to another channel. It implements FDM and TDM.

Spread Spectrum :

Spread spectrum is a Radio frequency communication system in which the baseband signal is spread over a larger bond width by high frequency signal.

The ratio(dB) between the spread base bond and the original signal is called Processing gain. Processing gain speed is from 10dB to bodes. In spread spectrum, the transmission signal

bond width is much higher than the information bond width . In different SS technique PRN (**Pseudo Random Number**) is indented in the communication channel.

(Spread spectrum (ss) Communication)

Various spread spectrum methods are

- Direct sequence spread spectrum (DSSS)
- Frequency Hopping spread spectrum (FHSS) .

DSSS: Generally DSSS transmit digital information DSSS uses CDMA (Code division Multiple Access)Signals from different units are transmitted at a given frequency range. A code is transmitted with each signal so that the receiver can identify the appropriate signal transmitted by the sender unit.

The frequency of such signals are transmitted is called the ISM (**Industrial, Scientific and medical) bond.** In this technique, the PRN are applied directly to carrier modulator.

FHSS: In this technique the frequency of a carrier is attend many times within a fixed time period. The signal jumps from one frequency to another within a given frequency range. The transmitter device “listens” to a channel, if it detects no signal is transmitted, it transmits the date using the full channel bond width. If the channel is full, it “hops” to another channel and repeats the process.

Total bond width is split into may channels of smaller band width and guard spaces. Transmitter and receiver stay on one of these channels for a certain time and then hop to another channel. It implements FDM and TDM.

Spread spectrum:

Spread spectrum is a Radio frequency communication system in which the base band signal is spread over a larger bond width by high frequency signal.

The ratio(dB) between the spread base bond and the original signal is called **processing gain.** Processing gain speed is from 10dB to 60 dB. In spread spectrum, the transmission signal bond width is much higher than the information bond width is much higher than the information bond width. In different ss technique PRN(Pseudo-Random Number) is incented in the communication channel.

Various spread spectrum methods are

- Direct sequence spread spectrum (DSSS)
- Frequency Hopping spread spectrum (FHSS)

DSSS: Generally DSSS transmit digital information. DSSS uses CDMA(Code division multiple Access.) Signals from different units are transmitted at a given frequency range. A code is

transmitted with each signal so that the receiver can identify the appropriate signal transmitted by the sender unit.

The frequency of such signals are transmitted is called the ISM (Industrial, Scientific and Medical) bond. In this technique, the PRN are applied directly to carrier modulator.

FHSS: In this technique the frequency of a carrier is attend many times within a fixed time period. The signal jumps from one frequency to another within a given frequency range. The transmitter device "listens" to a channel, if it defects no signal is transmitted, it transmits the date using the fuel channel bond width. If the channel is full, it "hops" to another channel and repeats the process.

Total bond width is split into many channels of smaller bond width and guard spaces Transmitter and receiver stay on one of these channels for a certain time and then hop to another channel. It implements FDM and TDM.

Cellular system: A cellular mobile communication system uses a large number of low power wireless transmitters to create cell. Cell in the basic geographic unit of a cellular system.

A cellular network is a radio network made up of a number of radio cells. Each cell served by a fixed transmitter, known as **cell site or base station**.

Advantages of cellular network:

- Increased capacity.
- Reduced power usage.
- Better coverage.
  The true shape of cells is not a perfect hexagon. Different cells one.
- Micro cells.
- Macro cells.
- Selective cells.
- Umbrella cells.
  Cell structure consist by macro and micro cells and at least one mobile station. The cell has a predetermined size and to cover a service area .

Macro Cells: They are large cells for remote and sparely populated areas .

Micro Cells: They are used for densely populated area. The existing area is splinted into smaller cell. So the cell capacity and available channel capacity is increased.

Selective cells: The selective cells are located at the entrance of a tunnel. The area of a cell needs not to be of 360 degree coverage. Selective cell with coverage area of 120 degree is used.

Umbrella cells: An umbrella cell covers several micro cells. The power level inside an umbrella cell is increased comparing to the power level used in the micro cells that form the umbrella cells. It covers several Micro cells.

UNIT -4

Medium Access Control

Basic Access Method like CSMA,CSMA/CA,CGMA/cb follow-CAN note.

When no. of signal access a wireless medium simultaneously, signals interfere each other. To overcome these problem, communication system receives extract distinct signals from various temirab in presence of signals divided into different cells, time slots, frequencies and codes.

Hidden/Exposed Terminals:

Example-> Consider three mobile phone scenario, The transmission range of 'A' reaches 'B', but not 'C'. 'A' con not detect 'C'. 'C' can not detect 'A'. A start sending to 'B','C' does not receives this transmission'C' also wants to send same data to 'B' and séances the Medium'C' starts sending causing a collision at 'B','A' can not delete this collision and continuous with its transmission. 'A' is hidden for 'C' and vice versa. The effect of collision in unnecessary delay.

Near/Far Terminals :

Consider this example : Hence A and B both are sending signals with some transmission power. The signal strength decreases due to distance. 'C' nearer to 'B' compare to 'A' . As a result 'C' cannot receive A's transmission.

Flow Control :

Flow control is a set of procedures that tells the sender how much data it can transmit before it must wait for an acknowledgement from the receiver .

There are two categories of flow control.

>Stop-and-wait (send one frame at a time).

> sliding window(send several frames at a time).

Stop and wait .

In this mechanism the sender waits for an Ack which it expects after sending of every data frame. Only when an ACk message received two next frame is then sent. At the end of the message the sender transmit an EOT signal which tells the receiver there s no more message has to be received. (Each frame is checked and acknowledged before the next frame is sent).

1. It is quite simple to realize.
2. There is no chance of any data missing at the receiver end .

Disadvantages:

1. It is very slow.
2. If the link is long then the entire time required for transmission increase.
3. At any instant at time unless it carries one data frame.
4. When a link is up during transmission it carries one data frame at any instant of time.

Sliding window :

The sliding window mechanism operates at the octet level . In this technique the sender can transmit several frames before receiving an Ack. The link can be used efficiently. Moreover the received acknowledges only same of the frames using a single Ack to conformed the receipted of multiple data frame .

Window

Sliding window

As shown in the figure the sliding window is an imaginary box available at both sender end and receiver end. In this technique frames can be acknowledge at any point without waiting for the window to fill up . Also frames can be transmitted although the window is not filled. The frames are numbered obeying modulo-n, which means they are numbered from 0 to n-1. This means the size of the window is from 0 to 7 when n=8. The acknowledgement messages generated by the receiver carries a number. This number tells the sender about the next frame that the receiver interested to receive.

Sender window

At the beginning of the transmission the sender windows contain n-1 frames. When the frames are transmitted then the left boundary of the window moves inward. Once an acknowledgement arrives the window expands. This expansion takes new frames into the window which is equal to the number of frames acknowledged by the Ack.

Receiver window:

This window shrinks from left when data frames are received where as it expends to the right when Ack message are sent .

In sliding window the size of the window is always one less than the modulo range. This is done, in order to avoid any confusion which receiving ack messages.

Multiplexing :

In telecommunications and computer networks, **multiplexing** (also known as **muxing)** is a method by which multiple analog message signals or digital data streams are combined into one signal over a shared medium. The aim is to share an expensive resource. For example, in telecommunications, several telephone calls may be carried using one wire. Multiplexing originated in telegraphy, and is now widely applied in communications.

Type of Multiplexing

Multiplexing technologies may be divided into several types, all of which have significant variations. (1)space-division multiplexing (SDM), frequency-division multiplexing(FDM), time-division multiplexing (TDM), and code division multiplexing (CDM) . Variable bit rate digital bit streams may be transferred efficiently over a fixed band width channel by means of statistical multiplexing, for example packet mode communication. Packet mode communication is an asynchronous mode time-domain multiplexing which resembles time-division multiplexing.

Digital bit streams can be transferred over an analog channel by means of cod-division multiplexing (CDM) technique such as frequency-hopping spread spectrum (FHSS) and direct-sequence spread spectrum (DSSS).

In wireless communications, multiplexing can also be accomplished through alternation polarization (horizontal/vertical or clockwise/counter clock wise) on each

adjacent channel and satellite, or through phased multianternna array combined with a Multiple-input multiple-output communications (MIMO) scheme.

Space-division multiplexing :

In wired communication, space-division multiplexing simply implies different point-to-point wires for different channels. Examples include an analogue stereo audio cable, with one pair of wires for the left channel and another for the right channel, and a multipair telephone cable. Another example is a switched star network such as the analog telephone access network (although inside the telephone exchange or between the exchanges, other multiplexing techniques are typically employed) or a switched Ethernet network. A third example is a mesh network. Wired space-division multiplexing is typically not considered as multiplexing .

In wireless communication, space-division multiplexing is achieved by multiple antenna elements forming a phased array antenna. Examples are multiple-input and multiple-output (MIMO), single-input and multiple-output (SIMO) and multiple-input and single-output(MISO) multiplexing. For example, a IEEE802.1 In wireless router with N antennas makes it possible to communicate with N multiplexed channels, each with a peak bit rate of 54 Mbit/s, thus increasing the total peak bit rate with a factor N. Different antennas would give different multi-path propagation (echo) signatures, making it possible for digital signal processing techniques to separate different signals from each other. These techniques may also be utilized for space diversity (improved robustness to fading) or beam forming (improved selectivity) rather than multiplexing.

UNIT -5

MOBILE COMPUTING

Wireless LAN and communication :

Wireless communication allows information exchange between two devices without use of wires and cables. A WLAN is uses radio waves as its carrier to give a network connection to all users in the surrounding areas .

WLANs transmit information by three main ways.

- Micro wave
- Spread spectrum.
- Infrared .

The source electromagnetic radiation's is sun. The electromagnetic spectrum classifies electromagnetic energy according to **frequency and wave length**.

The figure shows vertical axis represents **amplitude or strength** and horizontal axis represent time.

Wireless communication include transmitter, receiver and transceiver, Transmitter is a device and receiver is also a device and transceiver is through which we send some data.

infrared:

Infrared is a electromagnetic radiation with wavelengths shorter than radio waves. In infrared communication, an LED transmits the infrared signal. At the receiving end, a photodiode detect and computers the light pulses, then processed and retrieve the information.

Applications of infrared technology.

- Computers- mouse, keyboards, Floppy drives, Printers.
- Head Phones.
- Home security systems.
- Telephones
- TVS,VCRs, Cd players, stereos
- Toys
- Etc

IR Advantages :

1. Low power requirements : Ideal for Laptop, telephones personal digital assistants.
2. Circuitry cast ins low
3. No special hardware is required, can be incorporated into the IC of a product.
4. Portable
5. High noise immunity .

IR Disadvantages :

- Line of sight is required i.e transmitters and receivers must be almost directly aligned to communicate .
- Blocked by common materials: People, walls, Plants etc. can block transmission.
- **Short range** : Performance drops off with longer distance.
- **Light and weather sensitive**: direct sunlight rain, fog, dust, pollution can effect the transmission.
- **Speed**: data rate transmission is lower than wired transmission.

Radio frequency (RF) :

Radio frequency refers to the portion of the electromagnetic spectrum in which electromagnetic waves can be generated by alternating current, which is fed to an antenna.

RF advantages:

- Line of sight is not required.
- Not blocked by common materials: It can penetrate most solids and pass through walls.
- Longer range
- Not light sensitive.
- Not as sensitive to weather/environmental condition .

RF disadvantages:

- Interference: Communication devices using similar frequencies – wireless phones, scanners, can interfere with transmission.
- Lack of security : due to signals are spread out in space rather than wire.
- Higher cost than infrared.
- Lower speed than wire media .

Logical Architecture of wireless network:

Logical architecture defines the network's protocol by which two entities communicate.

The most popular logical architecture is OSI (Open System Interconnection) Model. It is a layer architecture but the wireless network concerned with Network layer, Data link layer and physical layer.

(Logical Architecture of wireless Network).

Types of WLAN.

WLANS are two types (1) Ad-hoc made . (2) Infrastructure mode .

Ad-hoc mode : In ad-hoc mode WLANs modes are connecting each other without wire .

- There is no fixed infrastructure.
- There is no administrator.
- There is no setup.
- This network operate in a stand-alone fashion.
- Each mode is equipped with a wireless transmitter and receiver with appropriate antenna.
- It is a peer to peer mode of transmission.
- Each mode communicate directly another mode within the radio range .
- (Ad-hoc Net work).

Infrastructure mode: In this mode WLAN cells are interconnected to a fixed net through access point.

Communication takes place between nodes through access point. **Cellular phone and Satellite based cellular phone** are the example of the Infrastructure Network.

Access point :

1. A computer with wireless canal and wired connection to internet is known as access point.
2. Boxes are available looks like a hub or router with antenna is also known as Access Point.

Access point is two types .

1. Hard ware Access point (HAP) .
2. Software Access point : It runs on a computer, equipped with a wireless network Interface card like ad-hoc wireless network.

IEEE 802.11 : IEE802.11 standard is known as Wi-Fi . This stand allow ad-hoc and infrastructure network. For this protocol various components are required . (IEEE: Institute of Electrical and Electronics Engineers) .

1. **Station** : Station is the component that connects to the wireless medium.
2. **BSS –(Basic service set):** BSS is a set of stations that communicate with one another. BSS are mobile stations and there is no connection to the wired network, that **BSS called Independent BSS (IBSS)** and it is temporary network. When BSS includes access points (AP), the BSS called Infrastructure BSS And in this case the communication occur through AP .

3. **ESS(Extended Service set):** ESS is a set of infrastructure BSSs . Where the APs communicate from one BSS to another. APs communicate via Distribution system (DS).
4. DS is the mechanism by which one AP communicates with another to exchange frames from one BSS to another.

Roaming : Roaming is the process of moving from one cell to another cell without loosing connection. A client can switch between access points. Client is not restricted to being stationary.

A user can move from area 1 to area 2 transparently. As client physically gets closer to another access point, the signal strength from the first will drop while the signal strength from the other will increase.

At one point, the signal strengths of the two will be equal but then the other will have the strongest signal ad the client should room to the next access point.

Blue tooth : It is a wireless technology for exchanging data over short distances. It connects mobile phones, computers, and other electronic devices. It uses radio waves instead of wire to connect phone or computer. Blue tooth technology based on Ad-hoc technology also known as Ad-hoc .

Pico net: It is a net work of devices connected using Blue tooth technology. The network ranges two to eight connected devices. When a network is established one device takes the role of the master, while other devices act as slaver.

A piconet is a network that is created using a wireless Bluetooth connection. Some examples of piconets include a cell phone connecter, a laptop and conneted to Blueooth-enabled digital camera, or several PDAs that are connected to each other.

A piconet computer network linking a wireless user group of devices using Blue tooth technology protocol. It allows one master device to interconnect with up to seven active slave devices. Up to 255 further slave devices can be inactive, or parked, which the master device can bring into active status at any time.

Piconets : A piconet is formed when two or more devices discover each other and begin to communicate. A piconet can have up to eight devices, with one device acting as a master and the rest acting as slaves. The first device to intimate transmission becomes the master, although the specification provides for a master and salve unit to exchange roles. A specific frequency- hopping sequence is used by all devices within each piconet. Figure 22.2 shows the simplest example of a piconet: A cell phone is downloading address-book and telephone-number information to the user’s laptop.

In this example, the laptop acts as a master. The application software running on the laptop contracts the cell phone when it is within range, and requests that it synchronies its database with the one stored on the laptop .

As stated earlier, a single piconet can have up to eight devices. The reason for this limit is simple: The address is only 3 bits long. This means that in binary, only he values of 07 can be stored in the address field. The master has no address, but 0 is reserved for broad cast messages; so the only addresses remaining for use by slaves are 17. However, a device can participate in two different piconets (called a scatternet),which is covered in the next section. Figure 22.3 shows an example of a larger piconet, in which one master controls multiple slaves in a piconet.

You can see that it's possible to link various devices in a piconet. You can download digital images from your digital camera to the laptop, use more than one Bluetooth-enabled cell phone to place voice calls, and even connect a personal digital assistant (PDA) to the laptop to exchange information. Another interesting thing to note in this figure is that you also can use a single connection to the Internet without having to have a direct cable connection to the moderm or broadband connection.

The master devce in Figure 22.3 is the laptop computer. It controls the other devices, which are called slaves.

Scatter nets:

A device can be a master of only one piconet. The device can at the same time, also be a slave in another piconet that is within range. A slave can also participate in two different piconets that are within its range. However, because the master device determines the hopping pattern used for apiconet, a device cannot be a master of more than one piconet. An example of a simple scatternet.

In this example, a laptop computer communicates with devices in both piconets. It is possible, however, for the laptop to be a master in one piconet and a slave in another.

When a device is a member of two piconets, it keeps track of both fr equency-hopping patterns and occasionally listens in on the correct frequency on each of the two picnets so that it can stay in touch with both piconets. A master device transmits a packet to its slaves occasionally to maintain the link,based on negotiations between the master and its slave devices. Thus, a device that is a member of two piconets must listen for these transmissions (or make them if it's the master in one piconet) .

MAC layer-What is MAC layer protocols?

The Media Access Control (MAC) data communication Networks protocol sub-layer, also known as the Medium Access Control, is a sub-layer of the data link layer specified in the

seven-layer OSI model. The medium access layer was made necessary by systems that share a common communications medium. Typically these are local area networks.

In LAN nodes uses the same communication channel for transmission. The MAC sub-layer has two primary responsibilities:

Data encapsulation, including frame assembly before transmission, and frame parsing/error detection during and after reception. Media access control, including initiation of frame transmission and recovery from transmission failure.

Following Protocols are used by medium Access layer:

ALOHA ; ALOHA is a system for coordinating and arbitrating access to a shared communication channel. It was developed in the 1970s at the University of Hawaii. The Original system used terrestrial radio broadcasting, but the system has been implemented in satellite communication systems. A shared communication system like ALOHA requires a method of handling collisions that occur when two or more systems attempt to transmit on the channel at the same time. (ALOHA- Advocates of Lyon Open source Hawaii association).

In the ALOHA system, a node transmits whenever data is available to send. If another node transmits at the same time, a collision occurs, and the frames that were transmitted are lost. However, a node can listen to broadcasts on the medium, even its own, and determine whether the frames were transmitted.

Carrier Sensed Multiple Access (CSMA): CSMA is a network access method used on shared network topologies such as Ethernet to control access to the network. Devices attached to the network cable listen (carrier sense) before transmitting. If the channel is in use, devices wait before transmitting. MA (Multiple Access) indicates that many devices can connect to and share the same network. All devices have equal access to use the network when it is clear.

Even though devices attempt to sense whether the network is in use, there is a good chance that two stations will attempt to access it at the same time. On large networks, the transmission time between one end of the cable and another is enough that one station may access the cable even though another has already just accessed it. There are two methods for avoiding these so-called collisions, listed here:

CSMACD(Carrier Sense Multiple Access/Collision Detection): CD (Collision detection) defines what happens when two devices sense a clear channel, then attempt to transmit at the same time. A collision occurs, and both devices stop transmission, wait for a random amount of time, and then retransmit. This is the technique used to access the 802.3 Ethernet network channel.

This method handles collisions as they occur, but if the bus is constantly busy, collisions can occur so often that performance drops drastically. It is estimated that network traffic must

be less than 40 percent of the bus capacity for the network to operate efficiently. If distances are long, time lags occur that may result in inappropriate carrier sensing, and hence collisions.

CSMA/CA (Carrier sense Multiple Access/Collision Advoidance): In CA collision avoidance), collisions areavoided becauses each node singnals its intent to transmit before actually doing so. This method is not popular because it requires excessive over head that reduces performance.

Ethernet: IEEE 802.3 Local Area Network (LAN) Protocols: Ethernet Protocols refer to the family of local-area network (LAN) covered by the IEEE 802.3. In the Ethernet standard, there are two modes of operation: half-duplex and full-duplex modes. In the halfduplex mode, data are transmitted using the popular Carrier-Sense Multiple AccessCollision Detection (CSMA/CD) Protocol on a shared medium.

The main disadvantages of the half-duplex are the efficiency and distance limitation, in which the link distance is limited by the minimum MAC frame size. This restriction reduces the efficiency drastically for high-rate transmission. Therefore, the carrier extension technique is used to ensure the minimum frame size of 512 bytes in Gigabit Ethernet to achieve a reasonable link distance. Four data rates are currently defined for operation over optical fiber and twisted-pair cables :

10 Mbps- 10Base-T Ethernet (IEEE 802.3) 100 Mbps- Fast Ehernet (IEEE 802.3u).

1000 Mbps – Gigabit Ethernet (IEEE 802.3z) 10-Gigabit-10 Gbps Ethernet (IEEE 802.3ae).

The Ethernet System consists of three basic elements:

(1) The physical medium used to carry Ethernet signals between computers,
(2) A set of medium access control rules embedded in each Ethernet interface that allow multiple computers to fairly arbitrate access to the shared Ethernt channel, and
(3) An Ethernet frame that consists of a standardized set of bits used to carry data over the system.
(4) As with all IEEE 802 protocols, the ISO data link layer is divided into two IEEE 802 sub-layers, the Media Access Control (MAC) Sub-layer and the MAC-client sub-layer. The IEEE 802.3 Physical layer corresponds to the ISO physical layer.

Each Ethernet-equipped computer operates independently of all other stations on the netwok: there is no central controller. All stations attached to an Ethernet are connected to a shared signaling system, also called the medium. To send data a station first listens to the channel, and when the channel is idle the station transmits its data in the form of an Ethernet frame, or packet.

After each frame transmission, all stations on the network must contend equally for the next frame transmission opportunity. Access to the shared channel is determined by the medium access control (MAC) mechanism embedded in the Ethernet interface

located in each station. The medium access control mechanism is based on a system called carrier sense Multiple Access with collision Detection (CSMA/CD).

As each Ethernet frame is sent on to the shared signal channel, all Ethernet interfaces look at the destination address. If the destination address of the frame matches with the interface address, the frame will be read entirely and be delivered to the networking software running on that computer. All other network interfaces will stop reading the frame when they discover that the destination address does not match their own address.

Security : Three basic security services defined by IEEE for WLAN. This is based on cryptography.

1. **Authentication** : This provides access control to the network by denying access to client stations that can not authenticate properly . The service addresses the question," Are only authorized persons allowed to gain access to my network".
2. **Confidentiality: OR Privacy :** It is provide " Privacy achived by a wired network . This service address the question" are only authorized persons allowed to view my data".
3. **Intigrity :** In this service, ensure that messages are not modified in transit between the wireless clients and the access point. This service addresses the question" Is the data coming into or existing the network trustworthy has it been tempered with"?

UNIT -6

MOBILE COMPUTING

UBIQUITOUS WIRELESS: The idea of anywhere, anytime, by anything and any one networking is at the core of a new emerging networking is known as ubiquitous Networking .The main objective of this networking is

- Freed from networking constraints concerning capacity, location and different link ups.
- Freed from the constraints of terminal limitation.
- Freed from constraints of limited service and contents.
- Freed from constraints of network risk.

SCENARIO OF MOBILE COMMUNICATION :

The mobile industry growth is very high means the number of subscriber increased rapidly . The price per minute of mobile service is decreases . This means the Average Revenue per User(ARRU) is shrinking. There are two primary ecosystems in the wireless industry.

- Global system for mobile communication (GSM)
- Code division Multiple Acess (CDMA) .

Mobile communication Generation : 1G to 3 G:

Development of next generation wireless system is due to GSM Network and CDMA network. Its objective is to create high-speed broad band and IP based Mobile system inter connection. Its feature is transparency, global roaming and seamless services independent of location .

3G Mobile communication Network :

- Cellular communication service initiated with 1 G.
- 1G provide only voice delivery from one mobile phone to another.
- Next is 2G, it provides voice delivery as well as data transfer facility .
- Next is 3G, it provide bunch of services like Audio/video conferencing, internet, chatting and much more services.
- With 3G and broad band we can access vision telephony, clip down load, and television on mobile phone.

Universal mobile Telecommunication system (UMTS):

The UMTS is a 3 G Mobile communication system. It provide (1) broad band service to the wireless and mobile communication.(2) It provides low cost mobile communication and data rates upto 2 mbps.(3) It provides pictures, graphics and video communication, multimedia information, as well as voice, data to mobile wireless subscribers.

UMTS Services :

The UMTS provide both voice and data. The following data rates are required for

- 144 kbps- Satelite are rural outdoor.
- 384 kbps- Urban outdoor.
- 2048 kbps- Indoor and low range outdoor.

It also provide quality of service (QOS) parameters for date transfer. The OMTS network services accommodate four types of traffic.

- Conversational class- Voice, video telephony, video gaming.
- Streaming class- Multi media, video on demand we beast .
- Interactive class- Web browsing, network gaming .
- Back ground class- E-mail, Sms, (short message services) file down loading.
  The UMTS supports the following service .
- Internet access: Messaging, video /music download, voice/video I/P, travel and information service.

Multimedia messaging: SMS extension for images, video and music.

UNIT -8

MOBILE COMPUTING

Mobile Transport payer :

TCP ad implication on mobility: Mobility can give performance degradation due to the loss of TCP segment during transmission. Last segment cases congestion central at the transmitting hast and the congestion recovery may after network layer. TCP software on the mobile hosts solves only part of the problem because the transmitting host still performs a slow stent.

Congestion Control : Typically TCP is designed for fixed network. Data transmission occur using cables, routines and other hardwires. Loss of packet is neither for TCP software nor for TCP Hardware. Loss of packet due to over load of Net work comports or over load in transmission.

Congestion may occur in carefully designed network. Router has to discard packets as soon as the buffers are full because the input rate of packets is more than the o/p rate.

TCP recognition only via missing Ack, have retransmission in unwise because retransmission is slow down the transmission rate.

In wireless transmission packet drop or loss is congestion due to transmission error .

Mobility can cause packet loss. Ex- A mobile mode rooms from one access point to another while there one still packets in transit to the wrong access point and forwarding is not responsible.

MOBILE IP:

- Anycast: It is a communication between a single sender and a list of addresses. These addresses, are also assigned to more than one interface, belonging to different nodes. However, a packet sent to an anycast address is delivered to just one of the member interfaces, typically the nearest according to the routing protocol's idea of distance. Any cast addresses cannot be identified easily; they have the structure of normal uncast addressee and differ only by being injected into the routing protocol at multiple points in the network.

MOBILE IPV6 ADDRESS SCOPE :

- **Link**-Local: Used on a single link. Packets with link-local source or destination addresses are not forwarded to other links. In other words, it can only be used between nodes of the same link. It cannot be routed.
- **Site**-Local: used for a single site. Packets with site-local source or destination addresses are not forwarded to other sites. In other words, it can only be used between nodes of the same site. It cannot be routed outside the site.
- **Global**: A globally unique address. Packets with global addresses can be forwarded to any part of the global network.

MOBILE IP OPERATION :

A MN listens for agent advertisement and then initiates registration. If responding agent is the HA, then mobile IP is not necessary. After receiving the registration request from a MN, the HA acknowledges and registration is complete. Registration happens as often as MN changes networks. HA intercepts all packets destined for MN. This is simple unless sending application is on or near the same network as the MN. There is a specific lifetime for service before a MN must

There is four congestion control algorithms.

- Slow start and congestion avoidance.
- Fast retransmit and fast recovery.

Slow start:

Missing Ack is the congestion. After detecting congestion, TCP behaves is called Slow start.

The first phase is known as slow start then te sender calculates the congestion window for receiver. The sender starts with a congestion window having size equal to one segment. If the Ack comes, the sender increases the congestion window (cw) by one and after that sending two packets.

Receive ACK> cw=2, sends 2 pkt. After its Ack comes, the sender again adds 2 to the congestion window, one for each of the Ack. Now the congestion widow is 4 .

Receive 2 Ack -> = 4, send 4 pkt. Every time after receiving the Ack the congestion window gets doubled till the congestion three hold is reached. After achieving the threshold value the linear growth starts. This is the second phase and this is called congestion avoidance phase.

Fast retransmit and Fast recovery : TCP sends an Ack only after receiving a packet. If a sender receives several Ack for the same packet, this is due to a gap in received packet at the receiver. Sender can retransmit missing packets. This is called fast retransmit. And TCP generate an immediate Ack, which is known as duplicate Ack. If three or more duplicate Acks are received in a row, it is the indication of segment loss. TCP then performs retransmission of missing segment.

The receiver got all packets up to gap and is still receiving packets. Therefore, packet loss is not due to congestion, continue with current congestion window, This is called fast recovery.

ITCP utilizes the resources of Monility support Routers (MSRs) to provide transport layer communication between Mobile host and fixed host. The problem related mobility and

unreliability of wireless links are handeled by ITCP. ITCP improve the through put between fixed host and mobile host.

When a mobile host (MH) wishes to communicate with same fixed host (FH) using I-TCP, a request is sent to the current MSR (which is also attached to the fixed network) to open a TCP connection with the FH on behalf of the MH.

Advantages :

- Transmission errors on the wireless link do not propagate into the fixed network.
- Simple to control, mobile TCP is used only for one hop between foreign agent and mobile host.
- Therefore, a very fast retransmission of packets is possible.

Disadvantages :

- Loss of end-to-end semantics, Receiver really got a packet.
- Higher latency possible due to buffering of data within the foreign agents and forwarding to a new foreign agent.
- Security mechanism must be adopted.

Selective retransmission :

TCP acknowledgements are often cumulative.

ACK n acknowledges correct and insequence receipt of packets up to n

If single packets are missing quite often a whole packewt sequence beginning at the gap has to be retransmitted (goback-n) thus wasting bandwidth Selective retransmission as one solution q RFC2018 allows for acknowledgements of signle packets, not only acknowledgements of in-sequence packet streams without gaps qsender can now retransmit only the missing packets.

Advantage-much higher efficiency.

Disadvantage- more complex software in a receiver, more buffer needed at the receiver.

Mobile TCP.

MTCP operates over a single hop wireless link.

MTCP achieves the elimination of 21 processing on the wireless segment of the TCP connection. MTCP improves the efficiency. MTCP splits the connection as I-TCP does. Un modified TCP is used for fixed network to supervisory host(SH). Supervisory host monitors all packets during transmission, if connection is disconnected, set sender winow size to o and sender automatically goes into constant mode.

Advantages:

1. End to End semantics.
2. When mobile host is disconnected, it avoids retransmission and slow start.
3. No buffering.

Disadvantages:

1. Packet loss at the wireless link propagates back to sender.
2. Not a good idea for heavy traffic.

Snooping TCP :

- The access point snoops into the traffic and buffers packets for fast re-transmission.
- Transparent extension of TCP within the foreign agent.
- Changes of TCP only within the foreign agent.
- Buffering of packets sent to the mobile host
- Lost packets on the wireless link (both directions) will be retransmitted immediately by the mobile host or foreign agent, respectively (so called"local" retransmission).
- The foreign agent therefore"snoops" the packet flow and recognizes acknowledgements in both directions, it also filters ACKs .
- Data transfer to the mobile host.
- FA buffers data until it receives ACK of the MH,FA detects packet loss via duplicated ACKs or time-out.
- Fast retransmission possible, transparent for the fixed network.
- Data transfer from the modile host.
- FA detects packet loss on the wireless link via sequence numbers, FA answers directly with a NACK to the MH.
- MH can now retransmit data with only a very short delay .

Advantages :

- End-to-end semantics is preserved.
- Handover is easy. I-TCP requires a careful handover of the system state. Here it falls back to the standard solution if no enhancements.

Problems:

- Snooping TCP does not isolate the wireless link as good as I-TCP
- Snooping might be useless depending on encryption schemes
- Data s transmitted twice in case of a packet loss. Once from the FA to the MH and the second time when the ACK finally reaches the CN.

WTCP (Mobile TCP)

WTCP ("Wireless Transmission Control Protocol") is a proxy based modification of TCP that preserves the end-to-end semantics of TCP. As its name suggfests, it is used in wireless networks to improve the performance of TCP .

Where it works :

WTCP does not replace the TCP on the hosts, but is placed on a proxy in between a source host and a mobile (wirelesss) host. The base station is a wireless transmitter and receiver for the mobile host, and acts as a gateway to the internet for the host.

The following is a highly simplified example of what happens whenb the mobile host and source host have a TCP connection with each other. When the mobile host uses its TCP to send a segment, the WTCP at the base station receives it and sends it on through the nework, where it eventually reaches the awaiting host. The awaiting host might send an acknowledgement back through the network, to the base station, which transmits it to the mobile host, . Despite handing som,e wireless-related errors, WTCP effectively does exactly what regular TCP does. The two edge hosts aren't even aware that the WTCP exists.

Performance enhancements :

Instead of replacing TCP completely, WTCP works with it to enhance TCP's performance over wireless. It accomplishes this by handing the negative effects of the wireless channel, incluyding high bit error rates that are known to occur in bursts over the wireless medium.

It detects wireless-related problems (such as lost of corrupted segments due to multipath fading or high BER) with the use of timeouts and duplicate acknowledgments. WTCP then attempts to mitigate the problem by retransmitting a lost segment only once, until it receives an acknowledgement back from the mobile host that it was received. Any other lost segments will have to wait in the WTCP's buffer until the first one is confirmed to have been received.

There are times when packets will sit in WTCP's buffer for many milliseconds. In order to avoid having either TCP end host go into its congestion avoidance mode, (due to TCP looking at a segment's timestamp and determining that it took a long time to arrive, therefore wrongly assuming it's due to congestion) WTCP uniquely hides the time spent by the packets at the WTCP proxy, so that the RTT estimation is not affected.

In one study on WTCP's performance in Wireless WANs, WTCP showed an improvement of 20 Selective retransmission.

TCP acknowledgements are often cumulative

Transaction oriented TCP (T/TCP):

Transaction refers to the convension between client and server. It was designed to address the need for a transaction based transport protocol. Popular implementation of Transport layer or TCP which is connection oriented protocol and UDP (User datagram protocol)

which is connection less protocol. TCP is reliable protocol and slower than unreliable UD/%/TCP is a possible successor to both TCP and CDP.

Transaction oriented communication has the following features.

- The fundamental interaction is a request followed by a response.
- At- most-once semantics is required.
- Connection setup, data transmission, connection release.
- Using 3-way hand shoke needs 3 packets for setup and release, respectively.
- Even short messages need a minimum of 7 packets .

Advantage :

- Requires changed TCP.
- Mobility not longer transparent.

UNIT -9

MOBILE COMPUTING

World wide web architecture for mobile computing:

www architecture provides a very flexible and powerfull programming model. The web browser is a networked application i.e it sends requests to a network server .

(www architecture)

The www standard specifies :

- Standard naming model : All servers and content on the www are named with an Internet-standard Uniform Resource Lector (URL).
- Content typing : All content on the www is given a specific type.
- Standard content formats: All web browsers seep point a set of standard content formats. These includes Hyper text Mark up language (HTML) , Java script etc.
- Standard protocols : Standard network protocols allow any web browser to communicate with any web server . The most commonly used protocol on the www is the hype text transport protocol (HTTP) , operating on top of the TCP/IP protocol suit.

Wireless Application protocol (WAP):

WAP is an International standard for application that uses wireless communication. It consists of network architecture, a protocol stack and wireless Mark up language (WML) .

WAP is published by the WAP forum founded in 1997 by Eriesson, motorala, Nokia and unwired planet. Now days WAP is used for the majority of the world's mobile internet site.

The client server approach is used for the application layer. The WAP client software component is called WAP browser. WAP client is a program executed on a wireless communication device. This device is called wireless terminal . For small wireless terminal , WAP uses a micro Browser. The screen of a device can be lagially devided into two parts (1) indicative (2) Informational.

Need of WAP : Wireless networks have less bandwidth, more latercy, less connection stability than conventional wired network.

Benefits of WAP :

- It is device independent.
- WAP utilizes standard Internet Mark up language technology, XML.
- Optimizing the content and air link protocols.
- The WML, UI (user interface) components map onto existing mobile phone user interface.

Example of WAP use :

- Checking train time table information.
- Ticket purchase.
- Flight check in.
- Checking weather condition.
- Looking up stock values.

- Looking up address.
- Looking up sport results.

WAP Architecture :

WAP programming is the enhancement of www programming. The most significant enhancements WAP has added to the programming model are push and Telephony support (WTA) . The request-response mechanism is called as **pull** and the contrast is **push** mechanism.

(WAP Architecture)

The WAP architecture has three components.

- WAP client.
- WAP proxy or WAP Gateway.
- Application servers .

(WAP utilize the proxy technology to enhance the connection between wireless demain and www. WAP proxy provides various functions including.

- Protocol Gateway : Translates requests from wireless protocol stack to the www protocols.
- Content Encoders and decadens : Translate WAP content into a compact format due to slow under lying wireless link and vice veersa .
- User agent profile management.
- Coching proxy : Improves performance and network utilization.
- WAP client includes wireless phones, PDAs and pages. It contains micro browsers. It allows the user to manage user interface.
- Application server : It consist of three tires.
- - Web server: Responds to HTTP requests from the client.
- Application server: encades elements.
- Database server: used for persistence storage of application data.

Wireless Mark up language (WML) :

It s similar to the HTTP. It consist of many parts. WML used to creat WAP pages. WML based on XML and HTML. This language is designed for operation with small wireless devices, WML having the following characteristics.

- A small screen size with low resolution.
- Limited data entry capabilities.

WML has following features.

- Supports for Text and Images..

- Supports for user input.
- Task invocation controls.
- Task invocation controls.
- International support.
- State and context management.

Syntax of WML :

The WML inherits the systax construction of XML main part of syntax are

- Entities.
- Elements
- Tags
- Attributes
- Comments.
- Variable
- Dependency on latter case .

WAP PUSH ARCHITECTURE:

The WAP push frame work allows information to be sent to a client device without user action. In a client/server model, a client requests for a service or information from a server. The server then responds to this request by providing information back to the client. This is referred to as pull Technology. Here, the client pulls the information from the server,. In addition to this technology, WAP provides other technology called push Technology. It is also based on client/ server model, but there is no explicit request originated by the client. The server transmits its content before the client's request. In short, pull transactions are always intimated by client while push transactions are always initiated by server. Push technology is helpful to implement alerts and notifications. Push saves resources.

Push framework is explained as under :

The push content is originated in a server in the Internewt that needs to be delivered to a mobile phone. The push Initiator (PI) contacts the push proxy Gateway (PPG) from the Internet side and delivers content to the destination client. The PPG then forwards the content to the mobile network to be delivered to detination client over the air.

The Internet side PPG protocol is called the push Access Protocol. The WAP side protocol is called Over-The-Air.

PUSH-PULL BASED DATA ACQUISITION:

Three types of browsing content can be pushed to a WAP micro browser: Service Indication (SI) Service Loading(SL), and Cache Operation (CO), Push SI provides the ability to

push content to users to notify them about electronic mail messages awaiting retrieval, news headlines, commercial offers, and so on. It its simplest form, a push SI contains a short message along with an URI. Upon receipt of the push SI, the message is presented to the user who is given the possibility of starting the service (retrieve the content) to which the URI refers. The subscriber may decide to start the service immediately or to postpone it. In contrast to push SI, Push SL provides the ability to push some content to the WAP device without user explicit request. A push SL contains a URI that refers to the push content. Upon receipt of the push SL, the push content is automatically fetched by the WAP device and is presented to the user. Push CO provides a means for invalidating objects stored in the WAP device's cache memory. In addition to browsing specific push contents, information can also be pushed to other WAP-based applications such as the WTA agent and the provisioning agent. The MMS client embedded in a WAP device also receives application-specific push messages to notify the user about the availability of new messages and for the delivery of reports.

I-Mode:

I-Mode is the packet-based service for mobile phones offered by Japan's one of the wireless technology. I-Mode eschews the Wireless Application protocol (WAP) and uses a simplified version of HTML; Wireless Mark up Language (WML). First introduced in 1999, i-Mode was the world's first smart phone for web browsing. The i-Mode wireless data service offers color and video over many phones. Its mobile computing service enables users to do telephone banking, make airline reservations, conduct stock transactions, send and receive e-mail, and have access to the Internet . As of early 2000, i-Mode had an estimated 5.6 million users.

WAP 2.x

The WAP 1.x architecture consisted of the origin server, gateway, and user-terminal environment. The server could be a WAP or HTTP server; the gateway transiated the protocol layer and application information. By contract, the WAP 2.x architecture consists of four conceptual components, namely the application environment; protocol framework; security services; and service discovery.

WAP-Architecture :

WAP is designed in a layered fahion, so that it can be extensible, flexible, and scalable. As a result, the WAP protocol stack is divided into five layers.

- **Application Layer**.

  Wireless Application Environment (WAEW). This layer is of most interest to content developers because it contains among other things, device specifications, and the content development programming labguages, WML, and WML Script.

- **Session Layer** :

  Wireless Session protocol (WSP) Unlike HTTP,WSP has been designed by the WAP Forum to provide fast connection suspension and reconnection.

- **Transaction Layer** :

  Wireless Transaction Protocol (WTP) runs on top of a datagram service, such as User Datagram Protocol(UDP) and is part of the standard suite of TCP/IP Protocols used ot provide a simplified protocol suitable for low bandwidthg wireless stations.

- Security Layer :
  Wireless Transport Layer Security (WTLS). WTLS incorporates security features that are based upon the established Transport Layer Security (TLS) Protocol standard. It includes data integrity checks, Privacy, service denial, and authentication services.
- Transport Layer :
  Wireless Datagram protocol (WDP). The WDP allows WAP to be bearer-indipendent by adapting the transport layer of the underlying bearer. The WDP Presents a consistent data format to the higher layers of the WAP protocol stack, thereby offering the advantage of bearer independence to application developers.

Each of these layers provides a well-defined interface to the layer above it . this means that the internal workings of any layer are transparent or invisible to the layers above it . The layered architecture allows other applications and services to utilize the features provided by the WAP-stack as well. This makes it possible to use the WAP-stack for services and applications that currently are not specified by WAP.

The WAP Protocol architecture is shown below alongside a typical Internet Protocol stack.

Note that the mobile network bearers in the lower part of the fgure above are not part of the WAP protocol stack.

WAP Gateway/Proxy is the entity that connects the wireless domain with the Internet. You should make a note that the request that is sent from the wirelss client to the WAP Gateway/Proxy uses the Wireless Session Protocol(WSP), In its essence, WSP is a binary version of HTTP.

A mark up language-the Wireless Mark up Language (WML) has been adapted to develop optimized WAP applications. In order to save valuable band width in the wireless network, WML can be encoded into a compact binary format. Enco WML is one of the tasks performed by the WAP Gateway/Proxy.

How WAP Model Works ?

When it comes to actual use, WAP works like this :

- The user selects an option on their mobile device that has a URL with wireless Mark up language (WML) content assigned to it.
- The phone sends the URL request via the phone network to a WAP gateway using the binary encoded WAP protocol.
- The gateway translates this WAP request into a conventional HTTP request for the specified URL and sends it on to the Internet.
- The appropriate Web server picks up the HTTP request.
- The server processes the request just as it would any other request. If the URL refers o a static WML file, the server delivers it. If a CGI script is requested, it is processed and the content returned as usual.
- The Web server adds the HTTP header to the WML content and returns it to the gateway.
- The WAP gateway compiles the WML into binary form.
- The gateway then sends the WML response back to the phone.
- The phone receives the WML via the WAP protocol.
- The micro-browser processes the WML and displays the content on the screen .
- For WAP version 1.X, the primary language of the WAE is Wireless Markup Language (WML). In WA Browser.

Micro browser. Similar to existing web browsers

- Markup language
  - Similar to HTML, adapted to mobile devices.
- Script language.
  - Similar to Javascript, adapted to mobile devices.
- Gateway
  - Transition from wireless to wired world.
- Server
  - “WAP/Origin server”. Similar to existing web servers .
- Protocol layers
  - Transport layer, security layer, session layer etc.
- Telephony application interface
  - Access o telephone functions

- WAE(Wireless Application Environment).
  - Architecture: application model, browser, gateway, server
  - WML: XML-syntax, based on card stacks, variables,…
  - WTA: telephone servies, such as call control, phone book etc.

- WSP(Wireless Session Protocol):
  - Provides HTTP 1.1 functionality.
  - Supports session management, security, etc.
- WTP (Wireless Transport Layer Security):
  -Provides reliable message transfer mechanisms .
  Based on ideas from TCP/RPC.
- WTLS(Wireless Transport Layer Security):
  - Provides data integrity, Privacy, authentication functions.
  - Based on ideas from TLS(Transport Layer Security.)/SSL(Security Sockets layer)
- WDP (Wireless Datagram protocol):
  - Provides transport layer functions
  - Based on ideas from UDP

Content ecoding, optimized for low-band width channels, simple devices

WAP(Wireless Application Protocol) is a specification for a set of communication protocols to standardize the way that wireless devices, such as cellular telephones and radio transceivers, can be used for Internet access .

Wireless Application Protocol (WAP) is a technical standard for accessing information over a mobile wireless network. A WAP browser is a web browser for mobile devices such as mobile phones that uses the protocol.

Before the introduction of WAP, mobile service providers had limited opportunities to offer interactive date services, but needed interactivity to support Internet and Web applications such as:

- Email by mobile phone
- Tracking of stock-market prices
- Sports results
- News headlines
- Music downloads

The Japanese i-mode system offers another major competing wirelss data protocol. As of 2013, WAP use has largely disappeared in Europe and the United States: Most modern handset internet browsers now support full HTMIL. So do not need to use WAP markeup for webpage compatibility.

Technical specifications

The WAP standard described a protocol suite allowing the interoperability of WAP equipment, and software with different network technologies, such as GSM and IS-95(also known as CDMA).

Wireless Application Environment (WAE)

Wireless Session Protocol (WSP)

Wireless Transaction Protocol (WTP)

Wireless Transport Layer Security (WTLS)

Wireless Datagram protocol (WDP)

*** Any Wireless Data Network ***

The bottom-most protocol in the suite, the WAP Datagram protocol(WDP), functions as an adaptation layer that makes every data network look a bit like UDP to the upper layers by providing unreliable transport of data with two 16-bit port numbers (origin and destination). All the upper layers view WDP as one and the same protocol, which has several"technical realizations" on top of other"data bearers" such as SMS,USSD, etc. On native IP bearers such as GPRS, UMTS packet-radio service, or PPP on top of a circuit-switched data connection, WDP is in fact exactly UDP.

WTLS, an optional layer, provides a public-key cryptography-based security mechanism similar to TLS.

WTP provides transaction support (reliable request/response) adapted to the wireless world. WTP supports more effectively than TCP the problem of packet loss, which occurs commonly in 2G wireless technologies in most radio conditions, but is misinterpreted by TCP as network congestion.

Finally, one can thicnk of WSP initially as a compressed version of HTTP.

This protocol suite allows a terminal to transmit requests that have an HTTP or HTTPS equivalent to a WAP gateway, the gateway translates requests into plain HTTP .

Wireless Application Environment (WAE)

The WAE space defines application-specific markup languages.

UNIT-10

Wireless Telecomm Networks

Global system for mobile communication (GSM):

Definition: GSM is a digital mobile telephony system. GSM uses TDMA and mostly used of three digital wireless telephony technologies. (TDMA, GSM, and CDMA)

The Proposed GMS system had to meet certain business objectives:

- Support for international roaming.
- Good speech quality.
- Ability to support handheld devices.
- Low service cost.
- Use of spectrum efficiency.
- Support for a range of new services and facilities.
-

ISDN Compatibility

Wireless Telecom Networks

- MS: Mobile Station
- BTS: Base Transceiver Station
- BSC: Base Station Controller
- MSC: Mobile Service Switching Center
- GMSC: Gateway Mobile Service Switching Center
- EIR: Equipment Identity Register
- VLR: Visitor Location Register
- HLR: Home Location Register
- AuC: Authentication Center
- NSS: Network Sun System

- PSTN: Public Switched Telecomm Network
- ISDN: Integrated Services Digital Network
- OMC: Operations and Management Center

The GMS network is divided into four major systems: the mobile station (MS), the switching system (SS), the base station subsystem (BBS), and the operation and support System (OSS).

The MS is carried by the subscriber; the BSS controls the radio link with the mobile station. The NSS, the main part of which is the mobile service switching center, performs the switching off call between the mobile and other fixed or mobile network users, as well as management of mobile services, such as authentication. The MS and The BSS communicate across the um interface, also known as the air interface or radio link. The BSS communicates with the mobile service switching center across the A interface.

GSM Components

Mobile station (MS): The MS consists of the physical equipment or mobile equipment (ME) sources the radio transceiver display and digital signal processor and a smart card called the subscriber identity module the same provides personal mobility. A smart card usually is the size of a credit card. To use it just plug it into the instrument. SIM card and ME are collectively called mobile terminal (MT). By inserting the same card into another GSM cellular phone, the user is able to receive calls at that phone, make calls from that phone, or receive others subscribe services. The ME is uniquely identifying by the International Mobile Equipment Identity (IMEI). The SIM card contains he International Mobile Subscriber Identity (IMSI), identifying the subscriber, a secret key for authentication, and other user information. The IMEI and the IMSI are independent, thereby providing personal mobility. The IMSI is made up of three parts: Mobile Country code (MCC) consisting of three digits, Mobile network

code (MNC) consisting of two digits, and the mobile subscriber Identity number (MSIN) with up to 10 digits. The same is protected by personal identification number (PIN), which is between 4 to 8 digits in the length. The user is asked to enter the PIN. If the number is not correctly entered in the three connective attempts, the SIM is blocked and MS can't be used. To unblock the SIM, the user is asked to enter the 8-digit pin unblocking key (PUK).

Switching system (SS) or network and switching subsystem (NSS): The NSS consists of MSC, HLR, VLR. And AuC. NSS acts like a normal switching node for mobile subscribers of the same network. It acts like a normal switching node for ISDN.

HLR: It is the database, which stores the information of subscribers belonging to the covering area of MSC. The Current location of the mobile.

VLR: The VLR can be considered as a temporary copy of selected information stored in HLR of the mobile subscribers that are currently located in a given MSC serving area.

AuC: The AuC is responsible for the authentication of subscriber. The AuC may be co-located with the HLR.

EIR: The EIR is a database that contains a list of all valid mobile equipment within the network, where each mobile station is identified by its IMEI. The IMEI is a database that contains a list of all valid mobile equipment on the network.

Base Station Subsystem: All radio-related functions are performed in the BSS, which consists of Base station Controllers (BSC) and the Base Transceiver Station (BTS). BSC- The BSC provides all the control Functions and physical links between the MSC and BTS.

Operation and Support System (OSS): OSS controls and monitors the GSM system.

General Packet Radio Service (GPRS):

GPRS (General Packet Radio Service) is a packet-based communication service for mobile devices that allows data to be sent and received across a mobile telephone network. It uses the existing GSM network to transmit and receive data to and from GPRS mobile devices. Access point Names (APN's) provide a gateway route to other networks such as the internet. The two key benefits of GPRS are a better use of radio and network resources and completely transparent IP support.

GPRS allows improved quality of data services in terms of reliability, response time, and features supported. GPRS offers up to ~171.2 Kbps, depending on the network of the TDMA frame.

To use GPRS, users specifically need a mobile phone or terminal that supports GPRS.

SIM Subscriber Identity Module

MSC Mobile Services Switching Center

HLR Home Location Register

AuC Authentication Center

GPRS uses the GSM architecture. There are two types of support nodes i.e. Serving GSN (SGSN) and Gateway GPRS Support Node (GGSN).

The SGSN in responsible for routing the packet switched data to and from the mobile stations (MS) within its area of responbility. The main function of SGSN are packet routing and transfer, mobile attach and detach procedure (Mobility Management (MM)), location management, assigining channels and time slots (Logical Link Management (LLM)), authentication and charging for calls. The SGSN works out which BSC to "route" your connection through.

GGSN is similar to the GSM GMSC and provides a gateway between the GPRS network and the public Packet Data Network (PDN) or other GPRS networks. It converts the GPRS packet coming from the SGSN into proper Packet Data Protocol (PDP) format before sending to the outside data network. Similarly, It converts the external PDP address to the GSM address of the destination user. The GGSN also performs the authentication and charging function.

GPRS classes of GPRS devices:

Class A: MS can operate simultaneously packet switched and circuit switched services. MS can work both on GSM and GPRS networks at a

time. Basically this means that you can make voice calls while you are connected to the internet withous any interruption in the services.

Class B: MS can operate either one at a time. Class B MS can be registered on both GSM and GPRS network simultaneously but can have only one active call: you can have a voice call or a data connection at a time. Once the voice call has termnated, the data service can be resumed.

Class C: MS can only handle either voice or data. You need to switch manually between services. For eg. Expansion cards for laptops.

GPRS Application:

- Chat
- Textual and Visual infromation
- Still & moving images
- Web browsing
- Document sharing/Collaborate working
- Audio
- Email, File Transfer..

10.3 IS-95

Interim Standard 96 (IS-95) is the forst CDMA-based digital cellular standard. The brand name for IS-95 is cdmaOne. It is a 2G mobile Telecommunication Standard that user CDMA, a multiple access scheme for digital radio, to send voice, data and signaling data (such as a dialed telephone number) between mobile telephones and cell sites.

10.3.1 IS-95 Architecture:

IS-95 architecture is almost similar to GSM architecture.

The main components of IS-95 are as follws:

- **Mobile Station (MS):** This is the mobile phone instrument with the user. This mobile station can be a stand alone device or other devices like fax machines etc.
- **Base Station (BS):** It connects to the MSC. BS is a system between the MS and the MSC. The BS is devided into BTS and BSCC.
- **Mobile Switching Center (MSC):** It is equivalent to the telephone ex-change of a fixed network. The MSC is an automatic system that

interfaces the traffic from the wireless network with the wired network.

- **Home Location Register (HLR):** It is the functional unit which manages mobile subscriber by managing their detais. One HLR can also serve multiple MSCs.

- **Visited Location Register (VRL**): It is linked to one or more MSCs. It is the functional unit that dynamically stores subscriber information obtained from respective HLR.

- **Authentication Center (AU):** It manages the authentication process of subscribers. It may be located within an HLR or MSC or may be independent of it.

- **Equipement Identity Register (EIR**): It keeps the record of mobile devices and provides on need. It may be located with MSC or may be independent of both.

- **Operating Systems (OS):** It is responsible for overall management of wireless network.

- **Internetworking Function (IWF):** It enables to communicate the MSC with other networks.

- **External Network:** These are other communication networks. They can be PSTN, ISDN etc.

CDMA 2000:

CDMA 2000 is the 3G version of IS-95. It builds on the inherent advantages of CDMA techonologies and introduces other enhancements, such as Orthologonal Frequency Division Multiplexing (OFDM and OFDMA), advance control and signaling mechanisms, improved interface management techniques, end-to-end Quality of Service (QoS), and new antenna techniques such as Multiple Inputs Multiple Outputs (MiMo) and

Space Division Access (SDMA) to increase data throughput rates and quality of service, while significantly improving network capacity and reducing delivery cost.

Attributes of CDMA:

Soft handoff: Cell uses the same radio frequency band, the only difference between user channels is the spreading code sequences. Therefore, there is no jump from one frequency to another frequency when a user moves between cells. Two or more neighboring base stations can receive the signal of a particular user, because they all use the same channel. Moreover, two base statio can simultaneously transmit to the same user terminals. The mobile receiver can resolve the two signals separetly and combine them. This feature is call soft handof.

Soft capacity or graceful degradation: The spectrum is devided into frequencies, time slots, or codes, the capacity provided from these three multiple access schemes is the same. In CDMA all the users in all cells share one radio channel and are separated by codes.

Multipath Tolerance: When a signal is separated over a wide bandwidth, a frequency selective fade will corrupt only a small portion of the signal's power spectrum, while passing the remaining spectrum pure. As a result, upon despreading there is a better probability that the signal can be recovered corrrectly.

Leading performance: DCMA2000 performance in terms of data-speeds, voice capacity and latencis continue to outperform in commercial depolyments other comparable technologies.

Efficient use of spectrum: CDMA2000 techonologies offer the highest voice capacity and data throughput using the least amount of spectrum, lowering the cost of delivery for operates and delivering superior customor experience for the end users.

Support for advance mobile services: CDMA2000 enables the delivery of a board range of advance services, such as high-performance VoIP, push-to-talk, video telegraphy, multimedia messaging, multicasting and multiplaying online gaming with richly renderes 3D graphics.

Devices selection: CDMA2000 offers the broadset selection of devices and has a significant cos advantages compared to other 3G techonologies to meet the diverse market needs around the worls.

Flexibility: CDMA2000 systems have been designed for urban as well as remote rural areas for fixed wireless, wireless local loop (WLL).

WIDEBAND CODE DIVISION MULTIPE ACCESS (WCDMA):

WCDMA is a wideband spread-spectrum 3G mobile telecommunication air interface that utilizes code division multiple access (or CDMA the general multiplexing scheme, not to be confused with CDMA the standard).

The term WCDMA also refers to one of the International Telecommunications Union's IMT-2000 standards, a type of 3G cellular network. It provides new service capabilities, increased network capacity and reduced cost for voice and data services.

Wireless Sensor Network:

A wireless sensor network is a wireless network consisting of spatially distributed devices using sensors to monitor physical or environmental conditions such as temperature, sound, vibration, pressure, motion or pollutants, at different locations.

In addition to one or more sensors, each node in a sensor network is typically equipped with a radio transceiver or other wireless communication devices, a small microcontroller, and an energy source, usually a battery. The cost of sensor nodes is similarly variable, ranging

from hundreds of dollars to a few cents, depending on the size of the sensor network and the complexity required of individual sensor nodes.

A sensor network normally consists a wireless ad-hoc network, meaning that each sensor supports a multi-hop routing algorithm (Several nodes may forward data packets to the base station).

The below fig. depicts Typical Multihop Wireless Sensor Network Architecture.

UNIT -11

MESSAGING SERVICES

SHORT MESSAGE SERVICES (sms)

Introduction

SMS is the delivery of alphanumeric messages to mobile phones over wireless networks. It is not a wireless communication technology. It is a value-added service whih operates on long range wireless networks. SMS provides a connectionless transfer of messages with low capacity and low time performance. It is the most important form of data communication. It can be sent from any moble device to anyu destination as a message, an email or some other form of electronic message. The features which makes SMS functionally different from other data communication technologies is that it can be delivered to the destination whether or not the voice service is in user and it is asynchronous messaging service in its operation. In other words an active mobile handset is able to receive or submit a short message at any time, independent of whether or not a voice or data call is in progress. SMS also guarantees delivery of the short message by the network. Temporary failures are identified , and the short message is stored in the network until the destination becomes available.

SMS does not require usage of one type of wireless network over other. It can be implemented on the network which is available. Because of its pervasive nature it is used as a text-based application layer transport protocol.

SMS is a service for sending messages of up to 160 characters (224 characters if using a 5-bit mode) to mobile phones that use Global System for Mobile (GSM) communication. It can be sent to digital phones from a web site equipped with PClink or from one digital phone to another. Typical uses of SMS include:

- Notifying a mobile phone owner of a voicemail message
- Notifying a salesperson of an inquiry and contact to call
- Notifying a doctor of a patient with an emergency problem.
- Notifying a service person of the time and place of their next call
- Notifying a driver of the address of the next pickup

An SMS gateway is a Web site that lets you enter an SMS message to someone within the cell served by that gateway or that acts as an international gateway for users with roaming capability.

Two types of GSM SMS have been defined. They are:

- Cell Broadcast : It is a service which delivers short messages to all users in a given area at regular intervals.
- Point-to-point Service:> It is a service which sends short messages to a particular user.

SMS architecture

The basic network architecture is shown below:

Leged:

SMS GMSC: SMS Gateway MSC

IWMSC: Internetworking MSC

SMSC : Short Message Service Center.

MSC: Mobile Swoitching Center

BSS : Base Statoon System

MS: Mobile Station

In the above shown architecture, the short message is first sent to SMSC from the message sender. The message sender can be MS or paging input device. The SMSC is connected to the GSM network through a specific GSM MSC called the SMS Gateway MSC (SMS GMSC). The SMSC may connect to several GSM networks. The SMS GMSC locates the current MSC of the message receiver and forwards the message to that MSC. That MSC broadcasts the message to BSS and the BTS forwards to destination MS. The MS used for SMS should contain specific software to decode and store the messages. Messages can be stored either in Subscriber Identity Module (SIM) or in the memory of Mobile Equipm ent (ME).

The message is delivered to the IWMSC and then to the SMSC. This is explained in detail in next topic. SMS is store and forward service. It can not be passed from the sender to the receiver without passing through SMSC. An SMSC should be scalable with high availability and reliability.

SMS Protocol Hierarchy

The architecture for mobile terminated messaging is similar with the exception that the IWMSC is replaced by GMSC. The protocol hierarchy is consists of four layers. They are as follows:

- Short Message Application Layer (SM-AL)
- Short Message Transfer Layer (
- SM-TL)
- Short Message Relay Layer (SM-RL)
- Connection Management Sub layer (CM-Sub)

The Protocol hierarchy for Mobile Origination is as shown below .

The layers below CM-Sublayer are the Mobility Management (MM) Sublayer and Radio Resource(RR) management sublayer. The upper layers are described as under:

Short Message Transfer Layer (SM-TL):

This layer provide services to transfer SM-Al messages and the respective delivery reports as per GSM. Here a reference number called Short Message Identifier (SMI) is generated for every message. This SMI at MS is not carried ..

SMS also eliminates the need for separate devices for messaging since services can be itegrated into a sigle wireless device – the mobile terminal .

MULTIMEDIA MESSAGE SERVICWES(MMS)

If you've ever sent or received text messages you'll know how useful the so-called Short Messaging Service (SMS) can be. Because most current mobile phones use narrow band GSM channels, the amount of data you can send at any one time is very limited- up to 160 characters. To overcome some of the limitations, users resort to abbreviated 'SMS-speak'. "R U OK" (Are you OK?) and "C U L8ER"(See you later;) (see you later;) etc. Fun, but not very satisfactory for social communication. Imagine if, instead, you could write as much text as you liked, format it, add creative typefaces and drawings, drop in animated images, include full-color photos, a bit of music or a voice clip, even a short video of you and your mates on holiday.

MMS is a store and forward messaging service that allows mobile subscribers to exchange multimedia messages with other mobile subscribers. MMS uses GPRS, so you must have GPRS in your network and be allowed to use it . As such it can be seen as an evolution of SMS, with MMS supporting the transmission of additional media types :

- Text
- Picture
- Audio
- Video
- Combinations of the above

MMS is an important emerging service, which allows the sending of multiple media in a single message, and the ability to send a message to multiple recipients.

The orininator can easily create a Multimedia Message, either using a built in or accessory camera, or can use images and sounds stored previously in the phone (and possibly downloaded from a web site).

Even if the recipient phone is not switched on, the Multimedia Message will be stored and sent to the recipient as soon as they switch on their phone. In a non-roaming case, it is expected that the subscriber will allow a Multimedia Message to be downloaded automatically to their phone and then they would be notified and could see the Multimedia Message immediately.

A number of Multimedia Messages can be stored in the users handset and reviewed or forwarded at a later data. Each Multimedia Message contains a number of pages (think of

a power point slide show as an analogy). On each page, there can be one image and one set of text. An audio file can also be attached. The time that each"page" is displayed can be specified, so the user experience is some what like a slide show.

How does MMS work?

Depending upon the operator, a typical example of how an MMS message can be sent and received between two compatible MMS phones is detailed below:

STEP:1: Using an MMS compatible phone, take a photo.

STEP 2: Use your phone to personalize the message by adding text, sound lip or your own voice.

STEP 3: Send the MMS message.

On a compatible phone, the MMS message will appear with a new message alert. The picture message will open on the screen, the text will appear below the image and the sound will begin to play automatically.

If the message is sent to a non-compatible MMS phone the user will receive a SMS message along the lines of : " You have been sent a picture message" They may then be given a website address, and possibly and username and password on which they can view the message.

Again, this is a simple example and may differ from operator to operator.

MMS messages are delivered using a combination of SMS and WAPO technologies. When a mobile phone receives an MMS message, what it is actually receiving is an MMS notification message which it receives over MMS (WAP puch). This MMS notification message contains header information about the MMS message, and a URL pointer that the recipient must fetch in order to retrieve the content of the MMS message.

This URL pointer is a dynamically generated URL for the MMS message content which is stored on the MMSC. In a typical phone-to-Phone MMS transaction, the process of sending and receiving the MMS message works like this :

- The sending Phone intiates a data connection that provides TCP/IP network connectivity, usually over GPRS.,
- The sending phone performs an HTTP POST to an MMSC of the MMS message encoding in the MMS Encapulation Format, as defined by the Open Mobile Alliance (http:/www.openmobilealliance.org). The encoded MMS mnessage includes all of the content of the MMS message, as well as header information, including a list of intended recipients for the message. (Note: In most environments, the HTTP POST will be routed through a proxy server. Some devices will use wireless profiled HTTP

and TCP through a WAP 2.0 Proxy server, while other devices will use the Wireless Session protocol, WSP, through a conventional WAP proxy server/gateway.)

- * The MMSC receives the MMS message submission and validates the message sender.
- The MMSC stores the conent of the MMS message and makes it available as a dynamically generated URL link.
- The MMSC generates an MMS notification message, which is sent via WAP push over SMS to the message recipient(s). This MMS notification message contains a URL pointer to the dynamically generated MMS content.
- The recipient receives the MMS notification message. It then initiates a data connection that provides TCP/IP network connectivity(usually over GPRS).
- The recipient phone performs an HTTP (or WSP) get to retrieve the mms message content URL from the MMSC.

The Problem with Direct MMS delivery is that the MMS client on every mobile phone is configured with settings for how the phone sends and receives MMS messages. To send or receive an MMS message, the phone makes a GPRS connection. It then usually connects to the MMSC for sending/receiving messages through a WAP proxy/gateway. The pre-configured MMS settings on many mobile operator networks are set up to connect to a special MMS-only GPRS which connects to an MMS-only WAP gateway, and this gateway is configured only to allow connections to the operator MMSC. If the recipient mobile phone is subscribed to an operator that has this type of setup, and you attempt direct MMS delivery, you can send the MMS notification to the phone over SMS, but the phone cannot retrieve the MMS message from your server because the GPRS/WAP Gateway does not allow it .

The main components of MMS architecture :

MMS operates like SMS in the sense that it is a person-to-person service with a operator-controlled central message storage, management and relay centre which also provides the ender with confirmation that the message has been received. The MMS Centre (MMSC), however, needs to be a more flexible entity than the SMS Centre, in order to cope with the variety of different message types and the need to convert message formats according to the capabilities of the receiving terminals.

The industry has defined four key functional elements of an MMSC product:

- MMS Relay – the engine which trans codes and delivers messages to mobile subscribers.
- MMS server- which Provides he store in the store-and-forward MMS architecture.
- MMS User Agent – an application server giving users the ability to view, create, send, edit, delete and manage their multimedia messages.
- MMS User Databases – containing records of user profiles, subscription data etc.

Supported coding Formats

Supported formats are as under :

- Plain text.
  - Images
  - JPEG
  - GIF
  - Animated GIF
  - WBMP\
- Audio Clips
  - AMR
  - WAV
- PIM. Personal Information Management
  - vCalendar
  - vcard

    In early stage, size of MMS was 30kb and 100kb

The Nokia Multimedia Messaging Service Center :

Scope of the Technology

MMS enables person-to-person mobile messaging to incorporate a mix of different media types in addition to traditional voice and text:

- Rich text – with the ability to select and manipulate fonts and perform a range of formatting options
- Colour- from 16-colours to full-spectrum and including black & white and grayscale.
- Icons, logos and pictograms – selected from clip-art libraries or devised by the user.
- Sound Clips – voice clips, melodies and special effects.
- Full music file downloads – such as MP3
- Photographs – Such as JPEG
- Animated graphics – such as MP3
- Video clps – such as MPEG4

These capabilities extend well beyond the scope of mobile-to-mobile. They can involve combinations of mobile or fixed phone, PDA (Personal Digital Assistant),PC or fax device. The built-in intelligent transcending facility will ensure that the message format is optimized for the receiving device. MMS delivers all the utility of other messaging technologies with the addition of mobility and with the ability to express emotion and share experiences in a uniquely direct, instantaneous way.

MULTIMEDIA TRANSMISSION OVER WIRELESS

With the increase in number of wireless data networks, there is an increasing interest in carrying multimedia over wireless networks using portable devices such as laptops and personal digital assistants. Mobility gives rise to the need for hand off schemes between wireless access points. Here we are going to discuss the effectiveness of transport layer hand off schemes for multimedia transmission.

Mobile computers such as PDA and laptop computers with multiple networkinterfaces are becoming very common. Many of the applications that run on a mobile computer involve multimedia, such as video conferencing, audio conferencing, watching live movies, sports, etc. Here we will be concentrating on the effect of mobility on streaming multimedia in wireless networks.

Streaming multimedia over wireless networks is a challenging task. Extensive research has been carried out to ensure a smooth and uninterrupted multimedia transmission to a mobile host(MH) over4 wireless media. The current research propel is to ensure an uninterrupted multimedia transmission when the MH moves between networks. Ensuring uninterrupted multimedia transmission during hand off is challenging because the MH is already receiving multimedia from the network to which it is connected; When it moves into another network, it needs to break the connection with the old network and establish a connection with the new network. The below figure shows a MH connected to Wireless Network 1; when it moves , it has to make a connection with the new network, say wireless network 2 . The re-establishment of a new connection takes a considerable amount of time, resulting in the possibility of interruption and resulting loss of multimedia.

The current TCP/IP network infrastructure was not designed for mobility. It does not support hand off between IP networks. For example, a device running a real-time application, such as video conference, cannot play smoothly when the user hands off from one wireless IP network to another , resulting in unsatisfactory performance to the user. Mobile IP (MIP), from the Internet Engineering Task Force (IETF), addresses the mobility problem. MIP extends the existing IP protocol to support host mobility, including hand off, by introducing two network entities . Home Agent (HA) and Foreign Agent (FA) .The HA and FA work together to achieve host mobility. The Correspondent Node (CN) always communicates with the MN via its home network address, even though MH may not dwell in the home network. For CN to have seamless access to MN, the MH has to be able to hand off in a timely manner between networks.

Hand off latency is one of the most important indicators of hand off performance. Large hand off latency degrades performance of real-time applications. For example, large hand off latency will introduce Interruption in a video conference due to breaks in both audio and video data transmission. In addition to high hand off latency, MIP suffers from a number of other problems including triangle routing, high signaling traffic with the HA,etc.