MOBILE COMPUTING

SCHEME OF VALUATION

VI SEMESTER COMPUTER SCIENCE (MAR/APRIL-2022)

CODE:15CS63C **MAX MARKS:100**

SCHEME OF VALUATION

PART-A

1. **List any five components(1*5) = 5 Marks**
2. **List advantages 1Marks + Explanation 4Marks = 5 Marks**
3. **Definition 2Marks + Name any three 3Marks = 5 Marks**
4. **Compare any five points(1*5=5M) = 5 Marks**
5. **List features 1Mark + Explanation 4Marks = 5Marks**
6. **List any five characteristics (1*5=5M) = 5 Marks**
7. **List applications 1Mark + Explanation 4Marks = 5Marks**
8. **Definition 2Marks + Give any three reasons 3Marks = 5 Marks**
9. **Compare any five features(1*5=5M) = 5 Marks**

PART-B

10. **Figure 5Marks + Explanation 5Marks = 10 Marks**

11. **Figure 4Marks + Each tier explanation(3*2=6M) = 10 Marks**

12. **Explain Bearer service 4Marks +Teleservices 4Marks + supplementary services 2Marks = 10 Marks**

13. **Figure 5Marks + Explanation 5Marks = 10 Marks**

14. **Schematic diagram 1 M + Explain Each mechanism (3*3=9M) = 10 Marks**

15. **List issues of MANET 2Marks + Explain any 4 issues(4*2=8M) = 10 Marks**

16. **List 2Marks +Explain any 4 special constraints(4*2=8M) = 10 Marks**

17. **Fig 2Marks + Explain 4 layers(4*2=8M) = 10 Marks**

18. **Figure 4Marks + Explanation 6Marks = 10 Marks**

19. **List schemes 1Marks + Explain three schemes(3*3=9M) = 10 Marks PART—A**

1.The components of wireless communication system are

- Transmitter
- Receiver
- Antenna
- Filters
- Amplifiers
- Mixers

2.The advantages of WLAN are

- Mobility
- Low implementation costs
- Installation speed and simplicity
- Network expansion
- Reduced cost of ownership
- Higher user to install base radio
- Reliability
- Scalability
- Usage of ISM band

* **Mobility:** productivity increases when people have access to data and information from any location. Wireless LAN offers wire free access to information within the operating range of the WLAN.

***Low implementation costs:** WLANs are easy to setup, relocate, change and manage. Networks that frequently change both physically and logically, can benefit from WLANs ease of implementation

* **Installation speed and simplicity:** Installing a Wireless LAN system can be fast and easy and can eliminate the need to install cable through walls and ceilings.

* **Network expansion:** Wireless technology allows the network to reach where wires cannot.

* **Reduced cost of ownership:** While presently the initial investment required for wireless LAN hardware is higher than the cost of wired LAN hardware.

* **Higher user to install base radio:** Wireless environment offers a higher user to capacity ratio.

* **Reliability:** One of the common causes of failure in wired network is down time due to cable fault. WLAN is resistant to different types of cable failures.

* **Scalability:** Wireless LANs can be configured in a variety of topologies to meet the needs of specific applications and installations.

* **Usage of ISM band:** Wireless LAN operates in the unregulated ISM (Industrial scientific and medical) band (2.40 GHz to 2.484 GHz, 5.725 GHz to 5.850 GHz) available for use by anyone.

3.Mobile computing: It can be defined as a computing environment of physical mobility. A mobile computing system allows a user to perform a task from anywhere using a computing device in the public.

Applications

- Personal
- Corporate
- Entertainment
- News
- Weather
- Telebanking
- Internet TV shows etc.

4.COMPARISION OF 2G and 3G

Slno		2G	3G
1	Period	2000-2005	2005-2010
2	Main features	Used digital radio signals Voice encoded to digital signals.	Fast data transfer rate and greater network capacity
3	Data rate	15-7kbps	2.5Mbps
4	Technology	Packet data system	Digital broad band packet data
5	Offered services	Voice ,SMS	High quality audio and video

6	Switching	Circuit switching	Packet switching

5.Desirable features of mobile IP are

- Transparency
- Compatibility
- Security
- Efficiency and scalability
- **Transparency:** A mobile end-system should continue to keep its IP address and there should not be any disruption of communication after any movement.
- **Compatibility:** Mobile IP should be compatible with the existing internet protocols.
- **Security :**It provide users with secure communications over the Internet.
- **Efficiency and scalability:** In the event of world wide support, there can be a large number of mobile systems in the whole Internet. This should neither result in large number of messages nor should it incur too much computational overhead.
  It should also be scalable to support billions of moving hosts worldwide.

6. Characteristics of MANETs are

- Lack of fixed infrastructure
- Dynamic topologies
- Bandwidth constrained, variable capacity links
- Energy constrained operation
- Increased vulnerability

7.Applications of MANETs are

- Communication among portable computers
- Environmental monitoring

- Military
- Emergency applications

- **Communication among portable computers:** In this case using MANET the audience can exchange notes, and also can surf the web if at least one of the hand held devices has access to Internet for example through a data card`
- **Environmental monitoring:** A popular category of applications of MANETs is the collection of the various types of data about the environment in which they are deployed. Continuous data collection from remote locations is considered important for several applications such as environmental management, security monitoring, road traffic monitoring and management etc.
- **Military:** MANET of the military equipment can allow a military setup to take advantage of having an information network among the soldiers, vehicles and military information headquarters.
- **Emergency applications:** Ad hoc networks do not require any pre-existing infrastructure. These networks therefore can be deployed easily and rapidly in emergency situations such as a search and rescue operation after a natural disaster and for applications such as policing and fire fighting.

8.Definition of Microkernel OS:A multi-server design divides the OS functionality into several independent user-level processes. The ability of each single process is also tightly controlled. Kernel only maintains minimum set of basic functionality that cannot be done in user space. This type of design is called microkernel

Following are reasons to prefer microkernel for developing mobile OS

- Code management is much easier
- Better expansion of functionality.

- Microkernel is compact and modular.
- Microkernel is flexible.
- Improved reliability.
- Vertical access instead of horizontal.
- Message passing facilities.
- Leads to distributed computing model
- Subsystems of microkernel are –POSIX, database, file, Network server, etc.
- Microkernel is foundations for modular and portable extensions, etc.

9.

Sl.no	Feature	Android	Symbian OS	Windows Phone 7
1	License	Public, Free, and open source	Initially was private later became public	Proprietary
2	Footprint	250KB	200KB	300KB
3	Change of U1	Possible	No	No
4	Power Management	Yes	Yes	Yes
5	Kernel	Linux with minor change	Proprietary	Win CE
6	Multitasking	Yes	Yes	No
7	Preemptive scheduling	Yes	Yes	Yes
8	Demand paging	Yes	Yes	Yes
9	CPU architecture supported	ARM, MIPS, X86	ARM	ARM

PART-B

10.MOBILE TELECOMMUNICATION SYSTEM

The architecture of a mobile telecommunication system is shown in the fig. it includes three main components: **the core network, the radio access network, and the mobile phones.**

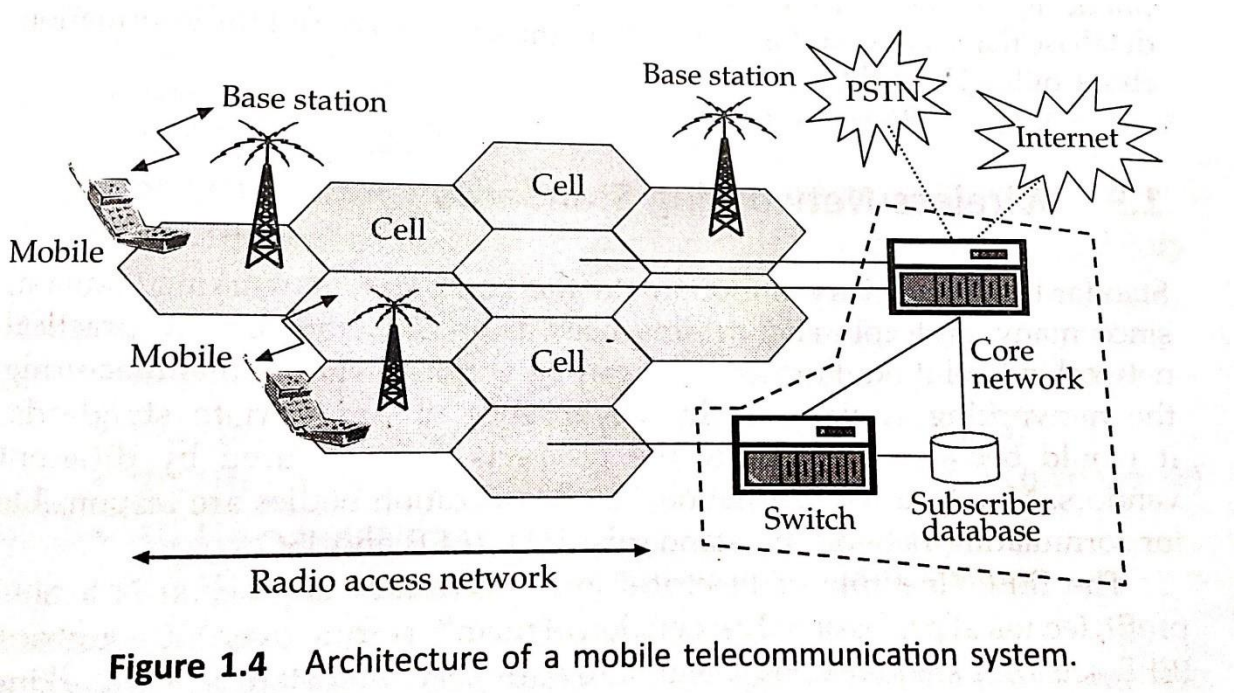


Figure 1.4 Architecture of a mobile telecommunication system.

Mobile handsets communicate over the radio access network. The radio access network is primarily composed of the base stations which communicate with the mobile phones using radio frequency electromagnetic waves. The coverage area is structured into hexagonal cells. In each hexagonal cell, one base station is located.

A base station typically has two antennas of different characteristics.one antenna is used for receiving and the other for transmitting.

Mobile handsets typically use the same antenna for both receiving and transmitting.

The core network interconnects the base stations, the mobile switching centre(MSC) and also provides an interface to other networks such as the traditional telephone network(PSTN) and the Internet.

The interconnect used in the core network is required to provide high speed connectivity. Therefore ,fibre optic cables are usually used as the backbone interconnect in the core network.

The core network is responsible for transmitting voice calls, SMS, etc. from one phone to another through switches.

The core network also maintains a database that contains information about the subscribers and the information about billing.

11. STRUCTURE OF MOBILE COMPUTING APPLICATION

The following fig shows a functionalities provided by each tier

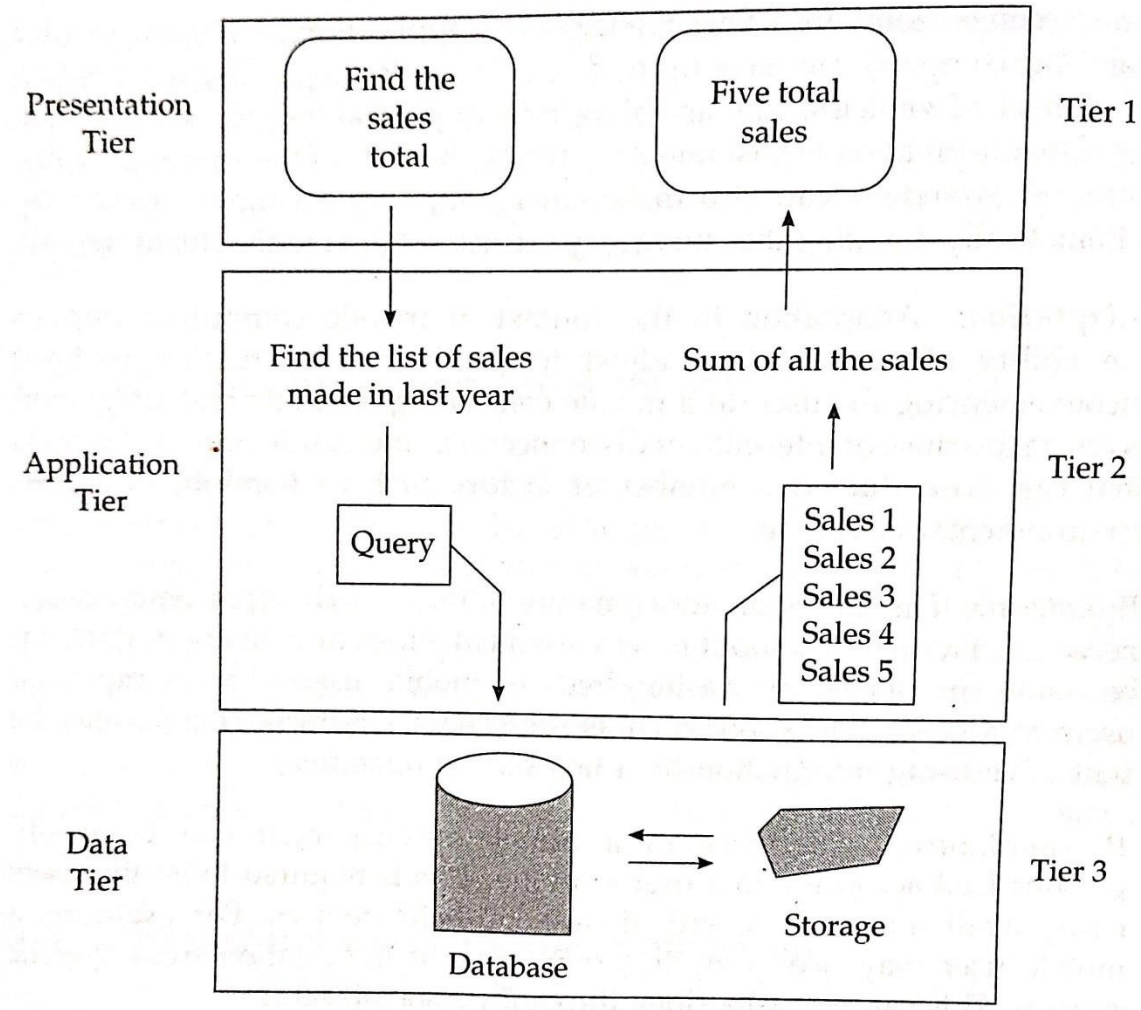


Figure 2.4 Functionalities provided by each tier structure of a mobile computing application.

Presentation tier : The topmost level of a mobile computing application concerns the user interface. A good user interface facilitates the users to issue requests and to present the results to them meaningfully. This layer usually includes web browsers and customized client programs for dissemination of information and for collection of data from the user.

Application tier: This layer has the vital responsibility of making logical decisions and performing calculations. It also moves and processes data between the presentation and data layers. We can consider the middle tier to be like “engine” of an automobile. It performs the processing of

user input, obtaining information and then making decisions. This layer is implemented using technology like Java, .NET services, cold fusion, etc.

Data tier: The data tier is responsible for providing the basic facilities of data storage, access, and manipulation.

12. GSM SERVICES

GSM provides three main categories of services. They are

1. Bearer services
2. Teleservices
3. Supplementary services

Bearer services : Bearer services give the subscribers the capability to send and receive data to/from remote computers or mobile phones. For this reason, bearer services are also known as data services. These services also enable the transparent transmission of data between GSM and other networks like PSTN, ISDN, etc. at rates from 300 bps to 9600 bps. These services are implemented on the lower three layers of the OSI reference model.

Teleservices :GSM provides both the voice – oriented teleservices and the non-voice teleservices. They are listed as

- Telephony.
- Emergency number.
- Short message services.
- Fax

Supplementary services: GSM provides certain supplementary services such as user identification, call redirection and forwarding of ongoing calls.

13. GPRS Architecture

GPRS architecture introduces two new network elements called Serving GPRS Support Node(SGSN) and the Gateway GPRS Support Node(GGSN)`

A SGSN is essentially a router. All SGSN are integrated into a standard GSM architecture and define many new interfaces as shown in fig.

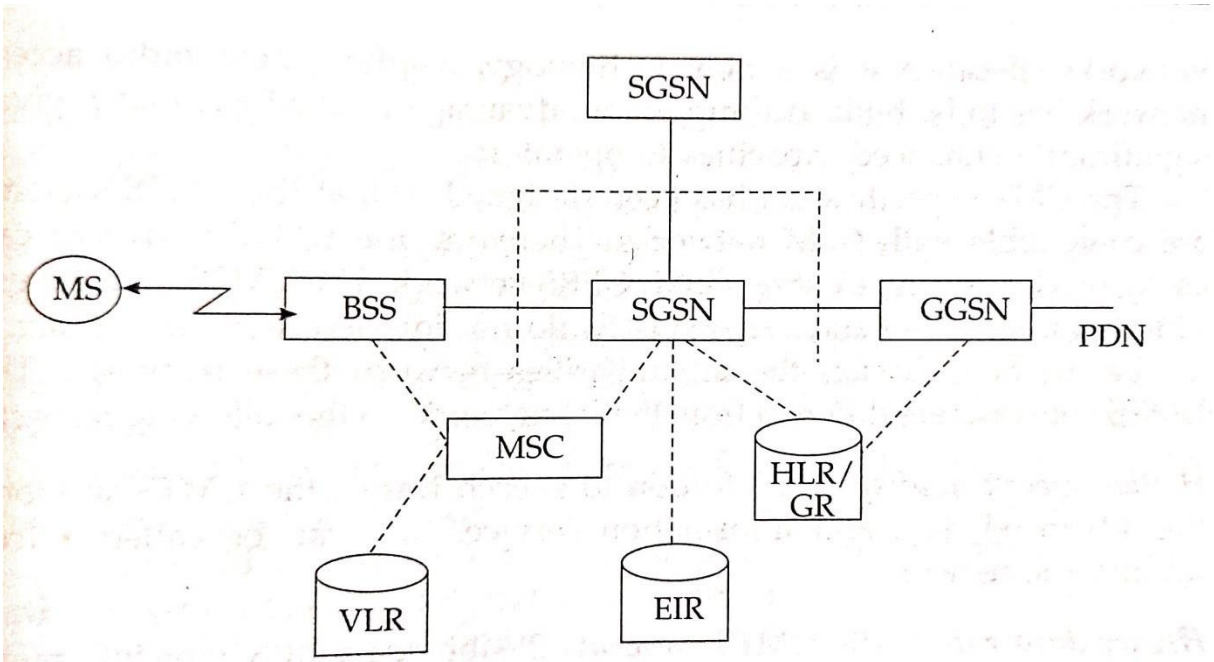


Figure 2.10 GPRS architecture reference model.

The GGSN is the interworking unit between the GPRS network and the external packet data network(PDN). The GGSN contains routing information for GPRS users. In fig the GGSN is connected to an external network and it transfers packets to the SGSN through an IP-based GPRS backbone network.

As shown in fig. SGSN helps support MS. The SGSN is connected to BSS through frame relay and it is at the same hierarchy level as the MSC. The GPRS Register(GR) is a part of HLR which stores all the relevant GPRS data. The data packets are transmitted to the BSS and finally to the MS through the GGSN and SGSN.

14.KEY MECHANISM USED IN MOBILE IP

Mobile IP is associated with the following three basic mechanisms.

- **Discovering the care-of-address**
- **Registering the care-of-address**
- **Tunneling the care-of-address**

A schematic diagram of Mobile IP is shown in fig.

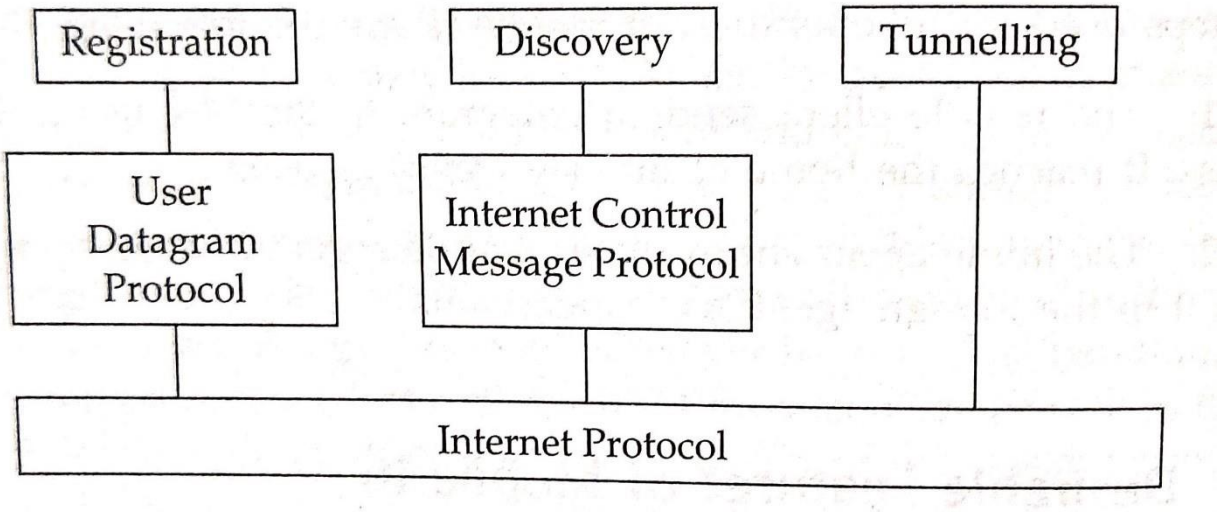


Figure 4.2 A schematic model of Mobile IP.

Discovering the care-of-address: It consists of the following important steps

1. Mobile agents advertise their presence by periodically broadcasting the agent advertisement messages`
2. The mobile node receiving the agent advertisement message observes whether the message is from its own home agent and determines whether it is on the home network.
3. If a mobile node does not wish to wait for the periodic advertisement, it can send out agent solicitation messages that will be responded to by a mobility agent.

Registering the care-of-address:

If a mobile node discovers that it is on the home network. It operates normally without using any mobility services. While a node has moved to a different network, if the mobile node obtains a care-of-address from a foreign agent, then this address should be registered with the home agent.

The mobile node sends a request for registeration to its home agent along with the care-of-address information whenever the home agent receives the registration request information.

The routing table is updated and it sends back the registration reply to the mobile node. The mobile node makes use of the registration procedure to intimate the care-of-address to a home agent.

Tunneling the care-of-address:

Tunneling take place to forward an IP datagram from the home agent to a care-ofaddress. This involves carrying out the following steps.

- When a home agent receives a packet addressed to a mobile host, it forwards the packet to the care-of-address using IP within IP.
- Using IP within IP, the home agent inserts a new IP header in front of the IP header of any datagram.
- Destination address is set to the care-of-address.
- Source address is set to the home agent's address
- After stripping out the first header, IP processes the packet again.

15. MANET DESIGN ISSUES

The important issues that are relevant to the design of a suitable MANET protocols are

- Network size and node density
- Connectivity
- Network topology
- User traffic
- Operational environment
- Energy constraint

Network size and node density : Network size and node density are the two important parameters of a MANET that need to be considered while designing an appropriate routing protocol for a network. Network size refers to the geographical coverage area of the network and network density refers to the number of nodes present per unit geographical area.

Connectivity : It refers to the number of neighbours it has. Here a neighbour of a node is one that is in its transmission range. The term connectivity between two nodes is also sometimes used to refer to a link between the two nodes. The term link capacity denotes the bandwidth of the link.

Network topology: The topology of a network denotes the connectivity among the various nodes of the network. Mobility of the nodes affects the network topology. Due to node mobility new links can form and some links may get dissolved. Other than mobility nodes can become

inoperative due to discharged batteries. The rate at which the topology changes needs to be appropriately considered in the design of an effective network.

User traffic: The design of a MANET is carried out primarily based on the anticipated node density, average rate of node movements, and the expected traffic. The traffic in a network can be of various types. The common traffic types are

- Bursty traffic
- Large packets sent periodically
- Combination of the above two types of traffic

Operational environment: The operational environment of a mobile network is usually either urban, rural and maritime. These operational environments support the Line of Sight(LOS) communication.

Energy constraint: No fixed infrastructure exists in a MANET, the mobile nodes themselves store and forward packets. This additional role of mobile nodes as routers leads to nodes incurring perennial routing related workload and this results in continual battery drainage.

16.Special constraints of mobile OS are

- Limited memory.
- Limited screen size.
- Miniature keyboard.
- Limited processing power.
- Limited battery power.
- Limited and fluctuating bandwidth of the wireless medium.
- Real time data streaming.

Limited memory: A mobile device usually has much less permanent and volatile storage compared to that of a contemporary desktop or laptop. The OS must be as small as possible and yet to provide a rich set of functionalities to meet user demands.

Limited screen size: The size of a mobile handset needs to be small to make it portable. This limits the size of the display screen. Consequently, new innovative user interfaces need to be supported by the mobile OS to overcome this constraint.

Miniature keyboard: Mobile handsets are either provided with a small keypad or the smallsized display screen is designed to be used as a keyboard in a touchscreen mode.

Limited processing power: A vast majority of modern mobile devices incorporate ARM-based processors. These processors are certainly energy efficient, powerful, and cheaper compared to the desktop or laptop processors.

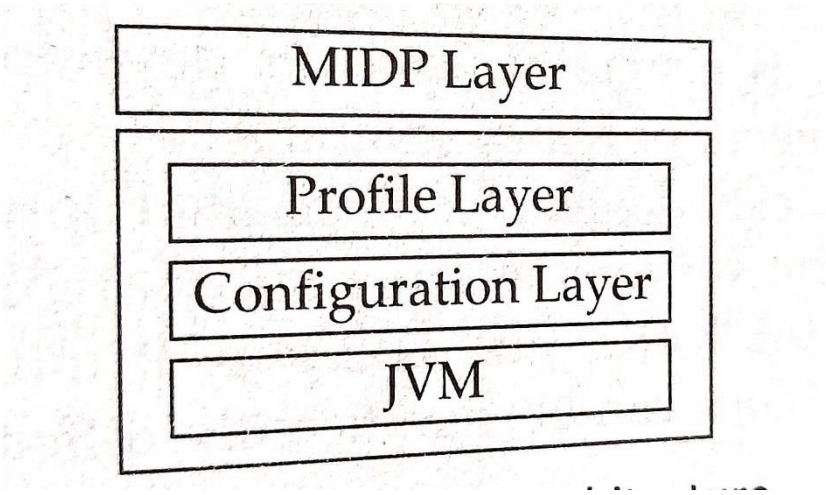
Limited battery power: Mobile devices need to be as lightweight as possible to increase their portability. Due to the severe restrictions that placed on their size and weight, a mobile device usually has a small battery and often recharging cannot be done as and when required.

Limited and fluctuating bandwidth of the wireless medium: The operating system of a mobile handset needs to run complex protocols due to the internal problems caused by mobility and the wireless medium.

Real time data streaming: Beyond the 3G operating systems, real time data streaming support is becoming important for applications such as mobile TV.

17. J2ME FUNCTIONAL ARCHITECTURE

J2ME is modular and scalable. J2ME consists of four layers of functionalities as shown in **fig.**



Java Virtual Machine (JVM) layer:JVM is implemented in this layer which is customized based on the capability of a particular device and a particular J2ME configurations.

Configuration layer: The features of JVM and the available Java class libraries for a specific category of devices and defined in this layer. For profile implementers this layer plays a vital role, but is less visible to the users.

Profile layer: The set of application programming interfaces(APIs) available on a particular family of devices is defined in this layer. Applications are written for a particular profile, and

applications are portable to any device. A device can support multiple profiles. This is the layer most visible to the users and application providers.

Mobile Information Device Profile (MIDP) layer: The Java APIs which are present in this layer provide reusable functionalities corresponding to user interface, persistence storage and networking.

18. WAP PROTOCOL STACK

The architecture of WAP protocol stack is shown in fig. The WAP protocol operates at several layers.

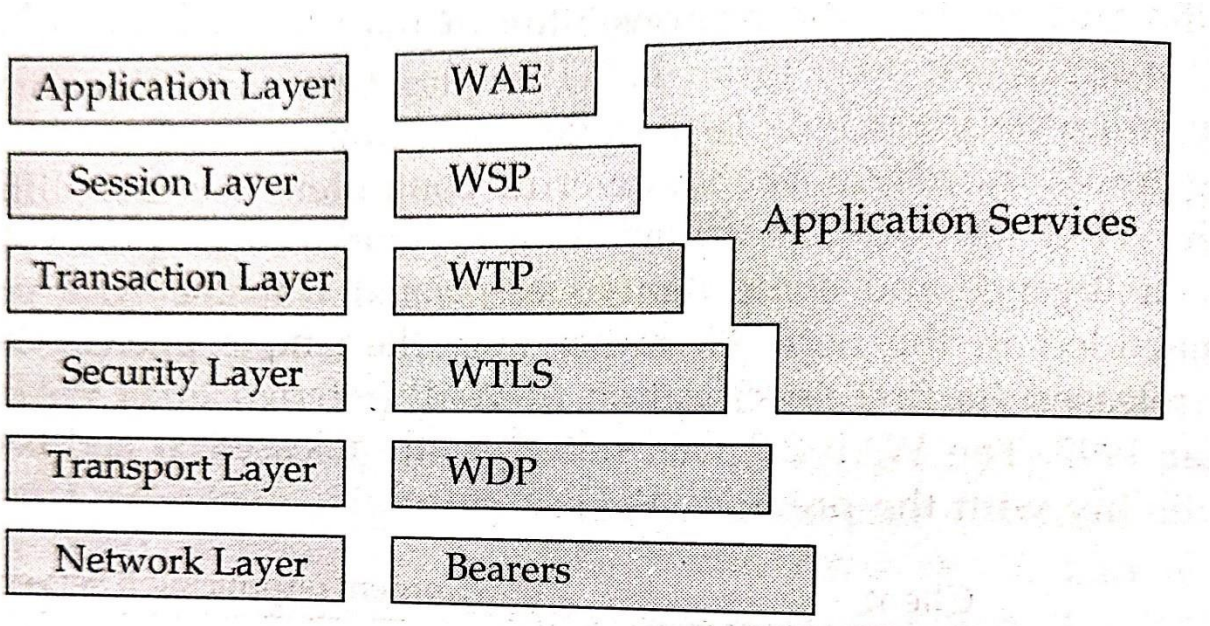


Figure 10.3 WAP protocol stack.

Wireless Application Environment (WAE)

WAE includes the micro-browser on the device. WML(the Wireless Markup Language), WMLS(A client side scripting language), telephony service and a set of formats for the commonly used data such as images, phone books and calendars.

Wireless Session Protocol (WSP)

WSP helps establish a web browsing session from a mobile handset. WSP is based on the HTTP protocol and provides the basic session state management, and facilities and unreliable data push (called WAP push).

Wireless Transaction Protocol (WTP)

The WTP layer in the WAP stack can be considered to be the equivalent of the TCP layer of the TCP/IP stack, but it takes into account the availability of low bandwidth by providing different classes of transaction services.

WTP handles the problem of packet loss more effectively than TCP Packet loss.

Wireless Transport Layer Security (WTLS)

WTLS is the security layer that is used to transfer data securely between a mobile device and a server. It provides support for data security and privacy, authentication, as well as protection against denial-of-service attacks.

Wireless Datagram Protocol (WDP)

WDP is the bottom-most protocol in the WAP protocol suite. It functions as an adaptation layer in a wireless communication environment that makes every data network look like UDP to the upper layers by providing services for transport of data in the unreliable wireless environment. WDP invokes services of one or more data bearers such as SMS, GPRS, CDMA, UMTS,etc.

Bearer Interfaces

A bearer is a low-level transport mechanism for messages. Considering the diversity of transport technologies, WAP is designed to operate with SMS to GPRS, UMTS and IP. GPRS is relatively faster and provides “always-on” connections for wireless devices.

19. MOBILE PAYMENT SCHEMES

Three popular types of M-payment schemes are

1.Bank account based

2.Credit card based

3. Micropayment

Bank account based M-payment

In this scheme, the bank account of the customer is linked to his mobile phone number. When the customer makes an m-payment to a vendor through Bluetooth or wireless LAN connectivity with the vendor’s machine, the bank account of the customer is debited and the value is credited to the vendor’s account.

Credit card based M-payment

In this scheme the credit card number is linked to the mobile phone number of the customer. When the customer makes an M-payment transaction with a merchant, the credit card is charged and the value is credited to the merchant's account. Credit card based solutions have a limitation especially in India.

Micro payment

Micropayment is intended for payment for small purchases such as items from vending machines. The mobile device can communicate with the vending machine directly using a Bluetooth or wireless LAN connection to negotiate the payment and then the micropayment is carried out. Otherwise the customer can make a call to the number of a service provider where the per call charge is equal to the cost of vending item.