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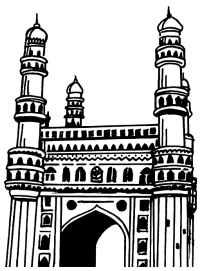

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# MOBILE COMMERCE

CONTENTS

## STUDY MANUAL



## SOLVED MODEL PAPERS

# SYLLABUS

## UNIT - I

### INTRODUCTION TO MOBILE COMMERCE

Definition, Scope of Mobile Commerce, Benefits & Limitations of M- Commerce, M-Commerce Framework, M-commerce business models, E-commerce Vs M-Commerce. Impact of MCommerce.

## UNIT - II

Types of Mobile clients (mobile phones, PDAs, laptop computers, vehicle-mounted devices, hybrid devices), Device limitations: considerations for user interface and application design Device location technology: GPS, triangulation. Mobile client software: Mobile device operating systems, Micro browsers, Mobile device communications protocols: WAP, i-Mode, Mobile device page description languages, Mobile device application software.

## UNIT - III

### WIRELESS COMMUNICATIONS TECHNOLOGY

**Wireless wide area network (WWAN) technology:** cellular systems 2G (CDMA, TDMA, GSM), 2.5G (GPRS, EDGE), 3G (WCDMA/UMTS, CDMA2000), 4G, 5G. Wireless local area network (WLAN) technology (wi-fi), Wireless metropolitan area network (WMAN) technology (WIMAX) Wireless personal area network (WPAN) technology (Bluetooth).

## UNIT - IV

### M-COMMERCE APPLICATIONS

Mobile financial services, Mobile advertising, Mobile Payment, Mobile Ticketing, Mobile product location and shopping, Mobile business services, Mobile auction, Mobile entertainment, Mobile office, Mobile distance education.

# Contents

## UNIT - III



## UNIT - IV

# Important Questions

## UNIT - I

**1. Explain the scope of Mobile Commerce.**

*Ans :*

Refer Unit-I, Q.No. 4

**2. What are the benefits of Mobile Commerce? Describe in detail.**

*Ans :*

Refer Unit-I, Q.No. 5

**3. Describe the Limitations of Mobile Commerce.**

*Ans :*

Refer Unit-I, Q.No. 6

**4. Describe the conceptual framework of mobile commerce.**

*Ans :*

Refer Unit-I, Q.No. 7

**5. What are the applications of mobile commerce ?**

*Ans :*

Refer Unit-I, Q.No. 14

## UNIT - II

**1. List and explain various types of Mobile Clients.**

*Ans :*

Refer Unit-II, Q.No. 2

**2. List out the major device limitations of mobile commerce technology.**

*Ans :*

Refer Unit-II, Q.No. 3

**3. How does Location Technology Track the Movements?**

*Ans :*

Refer Unit-II, Q.No. 7

**4. List out various most popular platforms of the mobile operating system.**

*Ans:*

Refer Unit-II, Q.No. 13

**5. What are the basic protocols used in Mobile communication.**

*Ans :*

Refer Unit-II, Q.No. 18

**6. Explain in detail Mobile Internet Protocol.**

*Ans :*

Refer Unit-II, Q.No. 19

**7. Explain in detail about Page description languages.**

*Ans :*

Refer Unit-II, Q.No. 30

**8. Discuss in detail about few of the application software's .**

*Ans :*

Refer Unit-II, Q.No. 33

## UNIT - III

**1. What is CDMA? Explain the features of CDMA.**

*Ans :*

Refer Unit-III, Q.No. 6

**2. List out various major applications and features of GSM Technology.**

*Ans :*

Refer Unit-III, Q.No. 12

**3. Discuss a brief overview of GPRS.**

*Ans :*

Refer Unit-III, Q.No. 15

**4. What is EDGE ? What are the key ele-ments of EDGE ?**

*Ans :*

Refer Unit-III, Q.No. 21

**5. Explain in detail about UMTS.**

*Ans :*

Refer Unit-III, Q.No. 25

**6. 'CDMA 2000 incorporated a number of advanced features that are crucial for enhancing the channel capacity as well as data speed'. Explain.**

*Ans :*

Refer Unit-III, Q.No. 28

**7. What is 4G ? List out the features of 4G wireless technology.**

*Ans :*

Refer Unit-III, Q.No. 29

**8. Explain WLAN in detail.**

*Ans ;*

Refer Unit-III, Q.No. 37

**9. What is WiFi ? What are its uses ?**

*Ans :*

Refer Unit-III, Q.No. 40

**10. Describe the concept of WiMAX?**

*Ans :*

Refer Unit-III, Q.No. 45

**11. Define Wireless Personal Area Network mean? List out the basic characteristics of WPAN.**

*Ans :*

Refer Unit-III, Q.No. 47

## UNIT - IV

**1. What is Mobile Banking? List out various mobile banking services.**

*Ans:*

Refer Unit-IV, Q.No. 2

**2. Explain the advantages of Mobile banking.**

*Ans:*

Refer Unit-IV, Q.No. 5

**3. Discuss the advantages of Mobile advertising.**

*Ans:*

Refer Unit-IV, Q.No. 13

**4. Discuss various major mobile payment models with examples.**

*Ans:*

Refer Unit-IV, Q.No. 17

**5. Describe various types of mobile payment service providers.**

*Ans:*

Refer Unit-IV, Q.No. 19

**6. Discuss the advantages of Mobile Payments.**

*Ans:*

Refer Unit-IV, Q.No. 20

**7. What is mean by Mobile Business Services? And Explain how mobile business services helps to increase more no of customers ?**

*Ans:*

Refer Unit-IV, Q.No. 32

**8. Discuss examples of open auction and closed auction.**

*Ans:*

Refer Unit-IV, Q.No. 36

UNIT I

## INTRODUCTION TO MOBILE COMMERCE

Definition, Scope of Mobile Commerce, Benefits & Limitations of M- Commerce, M-Commerce Framework, M-commerce business models, E-commerce Vs M-Commerce. Impact of MCommerce.

## 1.1 Introduction to Mobile Commerce

### 1.1.1 Definition

**Q1. Define Mobile Commerce.**

**(OR)**

**Give a brief note on M-commerce.**

*Ans :* **(Imp.)**

Mobile Commerce, also known as m-commerce, is defined as the process of performing business transactions using handheld mobile devices which are connected through wireless networks. The business transactions may range from buying and selling goods, making mobile payments, downloading audio/video contents, playing online games, using numerous software applications or getting mobile tickets. The mobile devices include cellular phones, handheld computers such as palmtops or laptops, pagers, smartphones and Personal Digital Assistants (PDA). The mobile users can access internet through these devices without any wired connection or a computer. Powered with the emerging technology based on Wireless Application Protocol (WAP), m-commerce employs web- ready micro browsers in these mobile devices to surf through the internet anytime, anywhere on earth.

WAP-enabled smartphones equipped with Bluetooth technology offer fax, e-mail and phone capabilities to the user to facilitate business transactions while in transit. Such smartphones are becoming so popular that most business houses have adopted m-commerce as the more efficient method of reaching to the customers or communicating with other business partners. The content delivery over wireless mobile devices has become much faster, safer as well as cheaper. The reservation of air/rail/bus tickets through mobile devices saves time and offers peace of mind to numerous passengers. Such services are gradually making m-commerce as the method of choice for performing digital business transactions.

**Q2. What do you mean by Wireless Communication Technology?**

*Ans :* **(Imp.)**

Mobile commerce is based on wireless communication technology. The wireless communication technology has emerged as the new choice of modern corporate world. The wireless networking has some distinct advantages over traditional wired networking that employs co-axial, twisted pair or fibre optic cables for physical connection between two or more computing devices. In wireless networking, the data transfer between computers are facilitated by microwaves, radio waves or infrared waves. It eliminates the cumbersome cabling process involving bulky cables with a significant reduction in labour and material cost as well as development time. The wireless networking technology together with wireless application protocol provides the backbone of mobile commerce applications. In various vertical markets, such as retail, healthcare, manufacturing and warehousing, mobile commerce gained acceptance and provided increased productivity through the usage of mobile devices. The mobile handheld devices are used to transmit data in real time to centralized hosts through wireless networks.

The mobile commerce that employs wireless technology, offers some extra advantage over the internet based e-commerce. In e-commerce, the internet provides information anytime of the day,

while in m-commerce, the information is available anytime, anywhere. In e-commerce, the information is available as long as the user is connected with the internet, i.e. connected with the wired network. If the user is involved with some other activities, i.e. travelling or doing some offline job, which forces him/her to become disconnected from the internet, the information becomes unavailable. M-commerce removes such uncertainties

**Q3. State the principles of mobile commerce.**

*Ans :*

- Mobile commerce is based on wireless mobile communication system, which utilizes digital cellular technology.
- The cellular network consists of a number of cell sites.
- Each cell site consists of a stationary base station (a radio frequency transceiver), an adjacent tower antenna (for transmission and reception of signals) and a surrounding cell (a hexagonal-shaped geographical area).
- Each cell is allotted a band of radio frequencies and provides coverage to any portable mobile device that comes within the geographical range of the cell. Whenever a mobile device such as a mobile phone or a pager, etc., comes inside a cell, it starts communicating with the base station using one of the cell frequencies.
- The base station receives the signal from the mobile device and transmits using the tower antenna to a distant base station for call delivery.
- To distinguish signals received from different mobile devices at the same base station, different access technologies such as Frequency Division Multiple Access (FDMA), Code Division Multiple Access (CDMA) or Time Division Multiple Access (TDMA) are used. Whenever a mobile user tends to move away from one cell to another adjacent cell, the cell frequency switching occurs, whereby the old cell frequency is dropped and the mobile device is automatically allotted a new frequency corresponding to the adjacent base station.
- The mobile device switches from previous base station frequency to current base station frequency and the communication with the new base station continues without interruption. This is known as cell handover.

### 1.1.2 Scope of Mobile Commerce

**Q4. Explain the scope of Mobile Commerce.**

*Ans :* **(Imp.)**

Mobile commerce provides instant connectivity between mobile users irrespective of their geographical location and time of the day. With enormous growth of wireless and mobile technology and rapid penetration of mobile phones in developing countries worldwide, the scope of m-commerce has increased manifold. With the advent of super fast 3G access technology that ensures high speed data transfer rates of the order of 20 Mbps, m-commerce is opening up new vistas of digital media applications. 3G technology, equipped with WiMax and UMTS standards for high speed mobile broadband internet connectivity, supports mobile multimedia application delivery at far greater bandwidths. So, it is now possible for mobile users to watch their favourite TV programmes or download and view famous movies in their mobile devices while travelling.

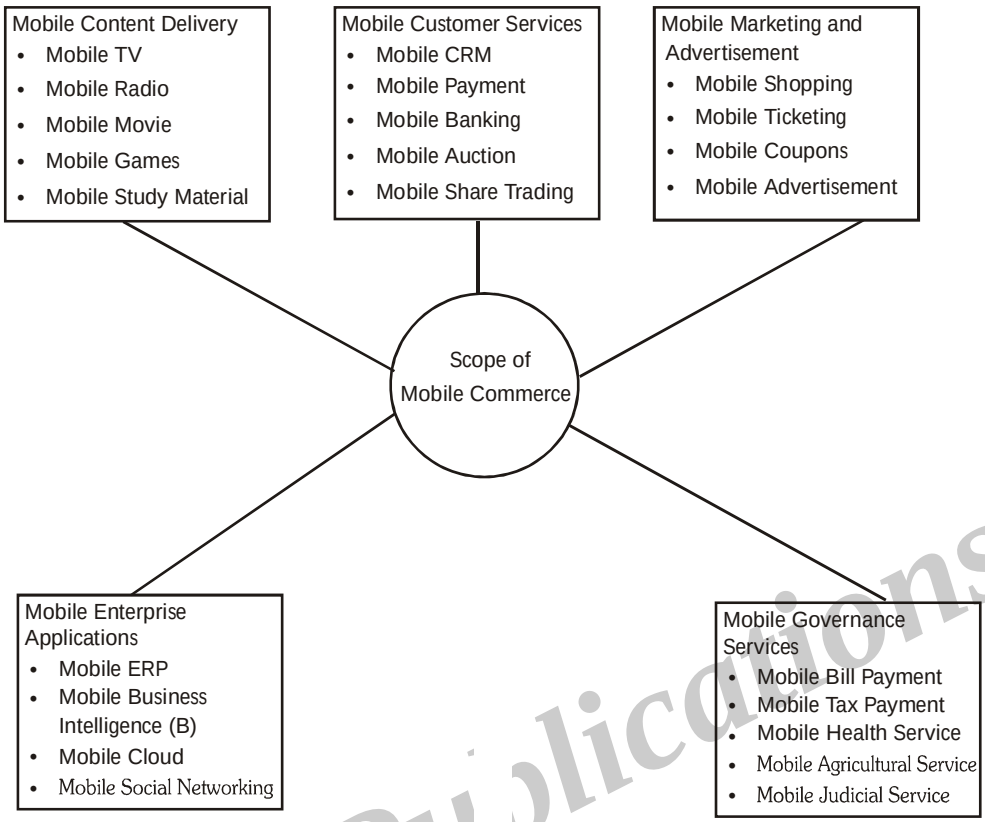



**Fig.: Scope of Mobile Commerce**

The scope of mobile commerce is all pervasive , and is gradually engulfing all aspects of lives of modern day citizens. Ranging from mobile banking , mobile browsing and mobile ticketing up to mobile marketing, mobile advertising and mobile computing, mobile commerce is gradually becoming an integral part corporate world and common people. With the prices of mobile phone decreasing exponentially and the number of different mobile applications increasing enormously, more and more people will indulge in m-commerce applications and soon it will become the preferred choice of the digital business world.

**7**

### Q5. What are the benefits of Mobile Commerce? Describe in detail.

*Ans :* **(Imp.)**

The main advantage of mobile commerce is that it provides instant connectivity to the Mobile user, irrespective of his/her geographical location and time of the day. The mobile user can stay connected with his/her business network and gather information even if he/she is in transit and remotely located away from the business installation. The same light weight mobile device can be used for making business transactions or making online payments round-the-clock in a cost-effective way. Highly personalized information can be delivered in the mobile device in an efficient manner to satisfy numerous needs of a large number of customers. The major benefits of mobile commerce are as follows:

#### (i) Anytime Anywhere

Mobile commerce together with wireless communication technology and wireless broadband internet access, keeps the mobile user connected with the internet while travelling across the globe. The

business information is available to the mobile user any time of the day and anywhere around the globe. This anytime/anywhere internet access makes business transactions more flexible and customer communications more efficient, which in turn improves the productivity of the company and increases customer satisfaction. The valuable market information, stock/share prices, inventory position, delivery schedule, etc. are instantly available at the fingertips. Handheld devices, such as Blackberry, etc. work on internet mode and allow users to continuously send/ receive electronic mail, download news alerts, stock prices and receive weather updates. The round the clock (24 x 7) internet availability benefits many users to conduct business transactions from their homes or from any other place while on the move and at any convenient time. Thus m-commerce offers greater mobility and flexibility to mobile users in performing business transactions using their handheld mobile devices.

**(ii) Cost-effective**

The costs of transactions using mobile devices are relatively low. The time-critical business data, such as reports, photographs, etc. can be captured and transmitted easily from the mobile devices without involving any bulky expensive equipment. The customer queries can be attended and support provided instantly from the mobile device, thus making customer support more comprehensive. The SMS-based micro payments facilitate bank account transfer within a few seconds and at the cost of an SMS. Contact less smartcard-based mobile payments provide a low cost alternative for toll tax payments in mass transit systems. In case of mobile billing, users can pay for electricity bills, telephone bills, petrol, grocery, etc. through their mobile phones. The payments made in the mobile phones for such items will appear as part of their mobile phone bills, thus eliminating the need for a third party payment mechanism such as, credit cards. This reduces the cost of payment to a large extent.

**(iii) Personalized Service**

Mobile commerce offers a number of personalized services to the mobile users depending on their various requirements and purposes. The digital cellular technology can monitor the location of user performing mobile transactions. Knowledge of the user's location may be used to deliver timely and useful contents such as product availability and discount information to the potential customer. Timely information, such as flight schedules and flight availability can be delivered to the user at the last minute. Delivery of time critical as well as emergency information, SMS-based notifications and alerts can be easily made if the location of the user is tracked. The location tracking is also utilized in offering customized services to the user, such as delivery of discount coupons that can be cashed in and around of the location of the customer. Delivery of regional maps, driving directions and online directories are also possible if the location of the mobile user is known. Another major advantage of location tracking is that, in criminal investigation, the location of the mobile user can be monitored and recorded as part of the investigation process.

**Q6. Describe the Limitations of Mobile Commerce.**

*Ans :* **(Imp.)**

Although mobile commerce has some distinctive advantages, such as instant connectivity and location and time independence over electronic commerce and offers low cost personalized Services to the mobile users, it suffers from some serious limitations which restrict its use in mainstream business world. The mobile device limitations, such as small screen size, small memory capacity and lower processor speed makes it unsuitable for high quality internet graphics applications. The limited availability of bandwidth to various mobile operators imposes a limitation on the speed of operation of different mobile commerce applications. The wireless networks used in mobile commerce are more vulnerable to external hacker attacks compared to wired networks and stringent security arrangements in the form of encryption and authentication should

be adopted to prevent unwanted intrusions. The main disadvantages of mobile commerce are explained in detail below.

### Mobile Device Limitations

#### 1. Small Screen Size

Mobile devices have smaller screen size (of the order of 2 by 3 inches) and poor resolution which makes them inconvenient for browsing applications. Data entry can be quite difficult using small combinational keypad that comes with most of the mobile handheld devices. The wide and high resolution screens in conventional desktops or laptops used in e-commerce applications offer ease of use in data entry operations as well as viewing web pages. These larger screens support 1920 × 1080 resolution and 3D graphics display. Although mobile devices offer greater mobility and flexibility in accessing information, the smaller screen size restricts the amount of information that could be presented and offers a less convenient user interface in the form of menu-based scroll- and click mode of data entry.

#### 2. Low speed processor

Most mobile devices come with low-powered processors with much lower processing speed compared to sophisticated processors (i.e. core 2 duo or i-core series) used in desktops or laptops. Such low speed processors restrict the download speed in most mobile commerce applications. The applications requiring too much processing power should be avoided as they may become irritably slow due to low speed processors. Also, keeping the low processor speed in mind, the mobile websites must be optimized to ensure customer satisfaction. Unnecessary plug-ins, flash images and animations should be removed to ensure speed of delivery.

#### 3. Small memory capacity

The mobile devices do not have large storage space. The memory capacity in mobile devices is in the order of 5 GB to 10 GB compared to 2 TB or higher used in desktops/ laptops. So, it is difficult to store large video files in mobile devices for future use. The mobile application developers must be concerned about the size of their applications during the development phase.

#### 4. Low power backup

Mobile devices use batteries as their power supply. Normally, power for a mobile device lasts up to 2-3 days, depending on the size of the device. After this period, the battery should be recharged again, and it adds an additional burden to the user who has to remember every now and then to recharge it.

#### (i) Wireless Network Limitations

Mobile commerce depends on wireless networks which are usually of lower speed compared to wired networks. In many cases, wireless networks offer one-fourth speed of standard wired network. Also, most wireless networks are more common in urban areas and some of the rural areas might not have wireless communication facilities. So online mobile services may become unavailable in some rural areas, and thus the popularity of mobile services may be suffered. Unless the mobile device is 2.5G or 3G technology compatible, the applications will become sluggish and unreliable compared to wired network applications. Atmospheric interference and fading of signals transmitted through wireless networks sometimes cause severe data errors and may even lead to disconnections.

#### (ii) Bandwidth Restrictions

A major disadvantage of mobile commerce is the bandwidth limitation, which imposes a limitation on speed of operation in various m-commerce applications. Wireless networks use frequency spectrum to transmit information across the network. Regulatory bodies control the use of available frequency spectrum and allocate the spectrum to various mobile operators. In India, the frequency spectrum were initially allocated and

regulated by Department of Telecommunication (DoT). Later, the Telecom Regulatory Authority of India (TRAI) was set up to control the usage of frequency spectrum. The limited availability of bandwidth to various mobile operators in turn restricts the data rate in mobile commerce applications. The GSM technology offers the data rate of the order of 10 Kbps and 3G technology can go up to 10 Mbps.

**(iii) Security Issues**

Another concern that is often raised in connection with mobile commerce is the security issue. Mobile devices are more vulnerable to theft, loss and mishandling. Special care must be taken to ensure that the security and privacy of the mobile customer are not compromised at the event of loss of a mobile device. This includes not storing sensitive information in the mobile devices and changing/locking of PIN/password fast and simple at the time of need.

Mobile commerce employs public wireless networks for transmission of signals which can be easily intercepted by hackers for capturing/altering stream of data travelling through the wireless medium. In wired networks, in order to gain access, the intruder has to gain physical access to the wired infrastructure. In wireless networks, anyone with the ability to receive signal in a mobile device can gain access to the network. In order to protect the wireless network from unwanted users, various encryption and authentication techniques should be employed. As the handheld devices have limited computing power and storage capacity, it is difficult to employ 256 bit encryption technique that requires enough computing power. However, the SIM cards inside a cell phone can include the digital signatures of PKI system. Thus, the PKI system of digital signatures can be integrated in a mobile device that adds to the security of the mobile application.

## 1.2 M-COMMERCE FRAMEWORK

**Q7. Describe the conceptual framework of mobile commerce.**

*Ans :* **(Imp.)**

The mobile commerce framework consists of the four basic building blocks as follows:

**(i) Content Management**

This component deals with the creation, distribution and management of diverse range of media rich digital contents that can be browsed through the small screens of the mobile devices. The digital contents are used in performing various business transactions such as buying and selling of goods, making online payments, product promos and providing on line customer support. An important part of content management is the ability to track different content providers and maintain and manage the relationships among them. The security and authenticity of the contents must be guaranteed and the access control mechanism must be provided to prevent unwanted users from misusing the document. The content distribution, rights management and clearing financial settlements, all come under the purview of content management module.

**(ii) Technology Infrastructure**

This component deals with the distribution of digital contents and transaction details over wireless communication networks to customer locations or other business installations. The wireless network infrastructure provides the very foundation of mobile commerce framework as it fulfils the basic requirements of data transmission between various business partners while performing any business transaction. The technology infrastructure includes wireless communication technology, Wireless Application Protocol (WAP) and mobile security technology. These technologies need to support digital content distribution, mobile application development and distribution and also provide a

secure technological platform for mobile billing and prepaid services through the use of mobile Virtual Private Networks (VPN). Figure 1.2 depicts the Mobile Commerce Framework.

### (iii) Application Development

The application development component of mobile commerce framework deals with the diverse range of mobile commerce applications. The main purpose of these mobile applications is to provide the product information to the end users, and also to enable them in performing the mobile business transactions. There are four major categories of mobile applications namely the information applications, communication applications, entertainment applications and commerce applications. Several mobile applications, such

<table>
<tr><td colspan="3">Content Management<br>[Creation, Distribution and Management of Digital Contents]</td></tr>
<tr><td>Business Service Infrastructure<br>• Payment Service<br>• Location Search Facility<br>• Security Arrangements<br>• Back End-support</td><td>Mobile Commerce</td><td>Mobile Application Development<br>• Java ME<br>• Android<br>• Apple iOS<br>• Objective C<br>• HTML5</td></tr>
<tr><td colspan="3">Technology Infrastructure<br>Wireless Networks, Wireless Application Protocol (WAP)<br>Security protocols, WML, Mobile Browsers</td></tr>
</table>

**Fig.: Mobile Commerce Framework**

### (iv) Business Service Infrastructure

The business service infrastructure provides the backbone to the mobile commerce framework. It supports the back office functionalities, such as payment services, location and search facilities and security arrangements of the mobile commerce systems. Production and fulfillment of these services are beyond the scope of traditional telecom service providers. These services are managed and delivered by some outside vendors, who have the ability and experience to provide such functionalities. They maintain the required infrastructure for supporting secured financial transactions in mobile commerce environments and also provide back-end support for searching and other facilities. Such back office systems are meant to be flexible enough and also are capable of rapid deployment of new services. They have a direct impact on end user experience, and have the greatest influence on the success or failure of the service provider. With the help of such back office infrastructures, mobile service providers can avoid upfront capital IT expenditure, and also these managed services offer the service providers the ability to quickly upgrade to the newer technological environment without any significant investment.

Above four components are the four pillars of mobile commerce framework and all m-commerce activities revolve around them. Whenever a mobile user tends to download MP3 music or a latest movie in his/her mobile device, sends an SMS requesting online payment to a bank, submits online order form requesting purchase in a mobile browser or books a mobile airline ticket, he/she is indulging in either or all four of the above mobile commerce framework components. In order to cope with the dynamic nature of the modern day lifestyle, people are demanding more mobility in accessing their business applications. A properly integrated and well-coordinated mobile commerce

framework needs to be developed in order to provide easy-to-use and secure mobile services to end customers. The main purpose of a structured and balanced mobile commerce framework is to enable the organizations to rapidly adapt to the latest mobile technologies and to ensure customer loyalty by providing them improved and enhanced services in sync with the growing market demands.

## 1.3 M-Commerce Business Models

**Q8. Describe the briefly about various mobile commerce business models.**

*Ans :*

A business model determines the path or process through which a business organization can realize some profit. It shows the way by which an organization can make some investment, add some value to the investment, get a finished product or service and generate some revenue through sales of the product or service. The revenue generated through sales must exceed the operating cost, so that the company gets some profit. Business models specify the mechanism for generating profit margins and to sustain in the value chain. Thus, business models help managers in strategic planning and formulating overall business strategy of the organization.

**(i) Payment Model**

In this model, mobile payment service providers offer mobile payment services that allow users to make cashless payment transactions including banking transactions, share trading, tax/bill payments and ticket or other retail purchases using credit/debit card or bank PIN. The payment service providers have collaboration with banks (or other financial institutions) and/or mobile network operators, and accordingly get bank-controlled mobile payment model or operator controlled mobile payment model. The payment service provider charges a certain percentage fee for each payment transaction made through the payment application. Alternatively, the user can pay a nominal monthly subscription fee to the payment service provider and can use the service as and when required.

**(ii) Advertiser Model**

This model is an extension of traditional e-commerce advertiser model and provides mobile websites which can be viewed by mobile users in their handheld mobile devices. Advertising companies can display their advertising messages in the website and pay a rental fee to the hosting website for displaying their messages. These mobile advertising websites usually offer some basic services such as email service, search engines, news service or social networking service to the users and post advertising messages in these sites to enjoy greater coverage. The advertisements often come with purchase buttons that allow users to purchase the product directly from their mobile devices. The mobile payment service is also provided to facilitate mobile purchase directly from the advertising websites. The advertiser companies pay a fixed fee to the advertising website for displaying their advertising messages. Additional revenue is generated for each purchase transaction made by the user through the website.

**(iii) Shopping Model**

This model is similar to e-commerce merchant model where retailers create mobile websites to display their range of products to the mobile devices of the customers. The mobile users can browse the mobile websites in their WAP enabled mobile screens and select and purchase any product of their choice.

**(iv) Content Provider Model**

In this model, mobile service providers offer a host of entertainment contents, such as breaking news, weather forecast, traffic updates, music, mobile games, TV shows, video content, movies, etc. that could be

downloaded to user mobile devices. Network operators have tie-ups with various content providers and offer both subscription-based services as well as pay-per-use services to mobile customers. Location-based services, such as map-based navigational services, discount coupons offered in local retail stores or restaurants, news of local events, etc. are also delivered in customer mobile devices.

## 1.4 E-COMMERCE VS M-COMMERCE

**Q9. Define E-Commerce? Explain the categories of E-Commerce.**

*Ans :*

- Electronic commerce, commonly known as E-commerce is trading in products or services using computer networks, such as the Internet.
- Electronic commerce draws on technologies such as mobile commerce, electronic funds transfer, supply chain management, Internet marketing, online transaction processing, electronic data interchange (EDI), inventory management systems, and automated data collection systems.
- Modern electronic commerce typically uses the World Wide Web for at least one part of the transaction's life cycle, although it may also use other technologies such as e-mail.

**Definition**

Sharing business information, maintaining business relationships and conducting business transactions using computers connected to telecommunication network is called E-Commerce.

**Categories**

**1. Electronic Markets**

Electronic Markets Present a range of offerings available in a market segment so that the purchaser can compare the prices of the offerings and make a purchase decision.

**Example:** Airline Booking System

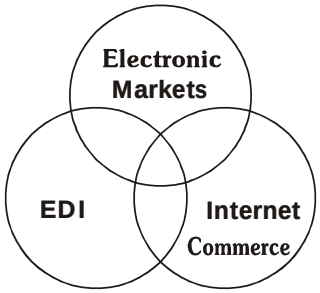



**Fig. The three categories of e - commerce**

**2. Electronic Data Interchange (EDI)**

- It provides a standardized system
- Coding trade transactions
- Communicated from one computer to another without the need for printed orders and invoices & delays & errors in paper handling
- It is used by organizations that a make a large no. of regular transactions

**Example:** EDI is used in the large market chains for transactions with their suppliers

**3. Internet Commerce**

- It is use to advertise & make sales of wide range of goods & services.
- This application is for both business to business & business to consumer transactions.

**Example:** The purchase of goods that are then delivered by post or the booking of tickets that can be picked up by the clients when they arrive at the event.

**Q10. State the features of E-Commerce.**

*Ans :*

**1. Ubiquity**

Internet/Web technology is the marketplace is extended beyond traditional available everywhere at work, at home, and boundaries and is removed from a temporal and elsewhere via mobile devices, anytime. geographic location. Marketspace is created; shopping can take place anywhere. Customer convenience is enhanced, and shopping costs are reduced.

**2. Global reach**

The technology reaches Commerce is enabled across cultural and across national boundaries, around the earth. National boundaries seamlessly and without modification. Marketspace includes potentially billions of consumers and millions of businesses worldwide.

**3. Universal standards**

There is one set of technical media standards technology standards, namely Internet across the globe.

**4. Interactivity**

The technology works Consumers are engaged in a dialog that through interaction with the user. Dynamically adjusts the experience to the individual, and makes the consumer a co-participant in the process of delivering goods to the market.

**5. Information density**

The technology Information processing, storage, and reduces information costs and raises quality. Communication costs drop dramatically, while currency, accuracy, and timeliness improve greatly. Information becomes plentiful, cheap, and accurate.

**6. Personalization/Customization**

The Personalization of marketing messages and technology allows personalized messages to customization of products and services are be delivered to individuals as well as groups. Based on individual characteristics.

**Q11. State the Advantages & Limitations of E-Commerce.**

*Ans :*

**Advantages of E-commerce**

E-Commerce advantages can be broadly classified in three major categories.

1. Advantages to Organizations
2. Advantages to Consumers
3. Advantages to Society

**1. Advantages to Organizations**

- Using e-commerce, organizations can expand their market to national and international markets with minimum capital investment. An organization can easily locate more customers, best suppliers, and suitable business partners across the globe.
- E-commerce helps organizations to reduce the cost to create process, distribute, retrieve and manage the paper based information by digitizing the information.
- E-commerce improves the brand image of the company.
- E-commerce helps organization to provide better customer services.
- E-commerce helps to simplify the business processes and makes them faster and efficient.
- E-commerce reduces the paper work.
- E-commerce increases the productivity of organizations. It supports "pull" type supply management. In "pull" type supply management, a business process starts when a request comes from a customer and it uses just-in-time manufacturing way.

**2. Advantages to Customers**

- It provides 24×7 support. Customers can enquire about a product or service and place orders anytime, anywhere from any location.
- E-commerce application provides users with more options and quicker delivery of products.
- E-commerce application provides users with more options to compare and select the cheaper and better options.
- A customer can put review comments about a product and can see what others are buying, or see the review comments of other customers before making a final purchase.
- E-commerce provides options of virtual auctions.

- It provides readily available information. A customer can see the relevant detailed information within seconds, rather than waiting for days or weeks.
- E-Commerce increases the competition among organizations and as a result, organizations provides substantial discounts to customers.

**3. Advantages to Society**

- Customers need not travel to shop a product, thus less traffic on road and low air pollution.
- E-commerce helps in reducing the cost of products, so less affluent people can also afford the products.
- E-commerce has enabled rural areas to access services and products, which are otherwise not available to them.
- E-commerce helps the government to deliver public services such as healthcare, education, social services at a reduced cost and in an improved manner.

**Limitations of E-Commerce**

**1. Security**

The biggest drawback of e-commerce is the issue of security. People fear to provide personal and financial information, even though several improvements have been made in relation to data encryption. Certain websites do not have capabilities to conduct authentic transactions. Fear of providing credit card information and risk of identity limit the growth of e-commerce.

**2. Lack of privacy**

Many websites do not have high encryption for secure online transaction or to protect online identity. Some websites illegally collect statistics on consumers without their permission. Lack of privacy discourages people to use internet for conducting commercial transactions,

**3. Tax issue**

Sales tax is another bigger issue when the buyer and seller are situated in different locations. Computation of sales tax poses problems when the buyer and seller are in different states. Another factor is that physical stores will lose business if web purchases are free from tax.

**4. Fear**

People fear to operate in a paperless and faceless electronic world. Some of the business organizations do not have physical existence, People do not know with whom they are conducting commercial transactions. This aspect makes people to opt physical stores for purchases.

**5. Product suitability**

People have to rely on electronic images to purchase products. Sometimes, when the products are delivered, the product may not match with electronic images. Finally, it may not suit the needs of the buyers. The lack of 'touch and feel' prevent people from online shopping.

**6. Cultural obstacles**

E-commerce attracts customers from all over the world. Habits and culture of the people differ from nation to nation. They also pose linguistic problems. Thus, differences in culture create obstacles to both the business and the consumers.

**7. High Labour cost**

Highly talented and technically qualified workforce are required to develop and manage the websites of the organization. Since internet provides a lot of job opportunities, business organizations have to incur a lot of expenses to retain a talented pool of employees,

**8. Legal issues**

The cyber laws that govern the e-commerce transactions are not very clear and vary from country to country. These legal issues prevent people from entering into electronic contracts.

**9. Technical limitations**

Some protocol is not standardized around the world. Certain software used by vendor to show electronic images may not be a common one. It may not be possible to browse through a particular page due to lack of standardized software. Insufficient telecommunication bandwidth may also pose technical problems.

**9. Huge technological cost**

It is difficult to merge electronic business with traditional business. Technological infra- structure may be expensive and huge cost has to be incurred to keep pace with ever changing technology. It is necessary to allocate more funds for technological advancement to remain competitive in the electronic world.

**Q12. Compare and contrast E-commerce and M-Commerce.**

*Ans :* **(Imp.)**

| S.No. | Factors | E-commerce | M-commerce |
|---|---|---|---|
| 1. | **Mobility** | E-commerce employs wired networks for internet connectivity and hence is restricted inside a building. It offers anytime connectivity. | M-commerce employs high frequency wireless networks for providing wireless internet and is completely ubiquitous in nature. It offers any time anywhere connectivity. |
| 2. | **Reliability** | Wired networks are more reliable and suffer less interference and noise. Quality of data transmitted is better as there is little or no cross -talk. | Wireless networks suffer from interference from adjacent channel frequencies or reflected waves that tend to reduce the intensity and quality of transmission. Special error detection techniques are employed to eliminate errors in transmission and improve signal quality. |
| 3. | **Speed** | The transmission speed of wired net works are much higher (of the order of 1000 Mbps) | The transmission speed of modern wireless networks are usually of the order of 100 Mbps. |
| 4. | **Security** | E-commerce transactions are more secured as the networks remain well-protected inside campus buildings. Firewalls and proxy servers are used to keep confidential business data secured in the central server. | M-commerce transactions through wireless networks are more vulnerable to hacker and other security attacks and require stringent security arrangements in the form of encryption and firewalls to prevent damage or misuse of private data during transmission. |
| 5. | **Cost** | The initial network set- up cost is high and periodic maintenance is mandatory | The initial set-up cost is much lower and maintenance cost is minimal. |
| 6. | **Usability** | E-commerce is performed through personal computers or laptops having larger screens, which are more conve-nient and user-friendly. | M-commerce is performed through handheld mobile devices having smaller screens and lower battery life. Also, the small devices have higher chance of getting lost or stolen, thus resulting to data loss. |

## 1.5 Impact of M-Commerce

**Q13. Describe the Impact of M-Commerce.**

*Ans :*

- Advent of wireless and mobile technology and rapid penetration of mobile devices in modern society have created new opportunities for the corporate world. In general, mobile commerce is considered as an extension of conventional internet based e-commerce.
- However, as the number of mobile device owners is far greater than that of internet users, mobile commerce creates a huge impact on day-to-day activities of both customers as well as business owners. By providing instant internet connectivity and greater mobility to billions of mobile users, m-commerce is redefining the relationship between customers and goods and service providers.
- It is predicted that in near future, mobile commerce will largely influence the marketing orientation of almost all the major industry sectors, and hence, will alter the general dynamics of the market. In addition to providing the users with mobility and location tracking, m-commerce applications are capable of achieving a high level of personalization and offer interactability with the individual customer.
- In a highly interactive environment, personal profiles, product preferences, home/ office locations, payment details, etc. can be collected directly from the customer from their mobile devices to generate an accurate and personalized database. Conversational advertising can be delivered directly to the mobile handset by a brand to describe the benefits of the product.
- This is an emerging concept whereby the mobile user can opt in to receive product information from a brand by giving the mobile number to the company. By utilizing the location tracking facility of m-commerce, special customer zones can be created which will be characterized by specific customers with different product preferences. The customers in a zone can be dynamically informed about various discounts and deals available in the local stores. Knowledge of customer numbers and preferences in a zone will help the suppliers to estimate the demand for a particular product, and also let the customers be informed instantly about any discounts/ price reduction offered in nearby stores.
- The popularity of mobile entertainment is growing rapidly. These include mobile phone gambling, mobile collaborative games, mobile sport video and mobile television. With rapid advancements of highly sophisticated mobile applications, mobile gaming business is expanding at a fast rate.
- Evolutions in technologies like mobile video sequencing, mobile video transcoding and mobile video communication are playing a key role in the success factor of mobile entertainment industry. Similarly, in healthcare industry, mobile medical imaging is made possible with the use of 3G wireless network. In education industry, mobile learning is introduced in the form of SMS or text messages.
- With the introduction of newer display technologies, such as electronic paper, liquid crystal display and digital paper, the mobile electronic readers or e-books have become commonplace. A large number of mobile users have started carrying e-readers to download online books or online newspapers while travelling.
- The impact of m-commerce is all-pervasive and ever-expanding. With the cost of mobile devices going down and introduction of newer and powerful technologies, more and more people are indulging in numerous mobile applications and eventually m-commerce will emerge as the most preferred tool for performing business transactions while in motion.

**Q14. What are the applications of mobile commerce ?**

*Ans :* **(Imp.)**

**(i) Mobile Banking**

Mobile banking is the process of performing banking transactions such as balance checking, account transfer, bill payments, credit card-based payments, etc. through a mobile device, such as a mobile phone or a Personal Digital Assistant (PDA). Such transactions could be performed from any remote locations and at any time of the day irrespective of the normal working hours of the bank. In order to avail the mobile banking facility, the customer must have an account in the bank, the mobile phone number must be pre-registered in the bank and also the network service provider (for the mobile device of the customer) must have a tie-up with the bank. When the customer wants to perform a mobile banking transaction, the transaction request from the customer first goes to the premises of the mobile service provider, and from there it is finally routed to the bank. Depending on the type of transaction, two types of mobile banking are available, namely SMS banking and WAP-based mobile banking. SMS banking is usually used for non-financial transactions, such as viewing of balance statement, requesting for a checkbook, status checking or stopping a check payment although some banks permit financial transactions also through SMS banking. In SMS banking, an SMS code requesting a transaction is sent to a particular number (as directed by the bank) from the mobile device of the customer. As soon as the bank receives the SMS, the required transaction is performed, the information is retrieved (in case of non-financial transaction) and sent back to the customer mobile phone in the form of another SMS. The entire transaction takes only a few seconds and the cost of the transaction is only that of an SMS. For different types of transactions different SMS codes are used.

**(ii) Mobile Payments**

Mobile payment is an alternative payment system where the mobile user makes payment using the mobile device for a wide range of services or goods.

**(iii) Mobile Phone Based Payments**

In this mode, the customer makes payment using the mobile device. In SMS-based payment, the payment is made by sending an SMS to the retailer. Both the customer and the retailer must have a regular credit/ debit account in a partner bank. After selecting an item for purchase, the customer sends an SMS from his/her mobile device to the retailer requesting the purchase.

**(iv) Card-based Mobile Payments**

In credit card based mobile payments, the mobile handset is used as a credit card for making payments. The credit card issuing bank gives a PIN number to the mobile handset user. At the time of making payments, the mobile user initiates the transaction by entering the PIN from his/her mobile handset. The issuing bank verifies the PIN and authorizes the payment. Next, the customer enters the amount to be paid and the transaction is completed. The amount is automatically deducted from the credit card account of the mobile user and credited to the bank account of the payee business partner, such as the shop owner.

**(v) Mobile Web Payments through WAP**

In this mode of mobile payment, the payment is made through the web pages displayed in the micro browser of the mobile phone. The web page is displayed following Wireless Application Protocol (WAP) and associated technology. At the time of making a purchase, the mobile user types the URL of the website of a merchant in the mobile device. The website containing various product information is displayed in the micro browser of the mobile handset. The user

selects a product that he/she intends to buy and places order for the product through the website. The merchant then sends an invoice to the user. If the user intends to pay through a credit card, he/she enters the credit card number, which is transmitted to the partner bank through a secured channel that employs encryption. The partner bank verifies the credit card number, and if found OK, informs the acquires bank for making the payment. Alternatively, if the user wants to pay directly from the partner bank in the form of account transfer, he/she enters the PIN number, which is sent to the partner bank for verification. After successful verification of the PIN, the partner bank debits the amount from the user's account and credits to the merchant's account. In either case, an SMS is sent to both the user and the merchant confirming the payment. The entire payment process is simple, quick and user-friendly as they have a similarity to the familiar online payment systems.

### (vi) Mobile Ticketing

Mobile ticketing is a special application of m-commerce which allows users to purchase tickets for air/rail/bus travel or for any sports/entertainment events from any location and at any time using mobile phones or any mobile device. The users can avoid tedious and time consuming process of getting paper tickets after waiting in a long line and the organizations can reduce production, distribution and infrastructural cost by providing simpler ways to purchase tickets anytime/anywhere. Mobile tickets are available for a number of cases, such as mass transit tickets, airline check-in, movie/theatre shows, sporting events, consumer voucher distribution, and so on. There are a variety of options by which a user can purchase mobile tickets, such as online purchase from merchant website, from WAP page in the mobile handset, purchase via SMS from the mobile handset, over the phone from a voice call or through a secure mobile ticketing application. Due to the convenience it offers to the customers and cost savings it offers to the companies, mobile ticketing is gaining momentum and more and more people are opting for mobile ticketing. Around 6 million mobile tickets were sold during 2012 worldwide, and the number is expected to increase manifold to cope with the ever - increasing demand of the mobile users.



### (vii) Mobile Computing

Mobile computing is a technology that allows users to perform normal computing operations, such as internet surfing, document preparation, spread sheeting, preparing PowerPoint presentations, send/receive e-mails or download MP3 audio files using portable computing devices while in transit. The portable computing devices include smart phones, personal digital assistants, laptops, ultra mobile PC or wearable computers. Some of these portable computers have bigger screens compared to mobile phones and hence overcome the small screen limitations. For example, Apple iPad comes with an 8" x 10'' screen, which is suitable for reading e-books as well as viewing websites.

In order to communicate with the external world, mobile computing employs wireless communication technology. For wireless internet access, Wi-Fi or Wi-Max technology is used that utilizes radio waves to broadcast internet signal from a wireless router to the surrounding area. Alternatively, digital cellular technology can be employed that utilizes cellular modem in the form of a data card that connects to nearby cell towers for high speed broadband internet access. The data card fits into the PC card slot of the laptop or the notebook computer. Broadband internet access is also provided to cell phones and PDAs using cellular broadband technology.

**Q15. What do you understand by M-Commerce Services ?**

*Ans :*

Mobile commerce allows users to conduct business transactions from their handheld mobile devices while travelling in remote areas. It offers instant connectivity to internet through wireless communication networks and offers greater mobility and ease of use to numerous mobile users worldwide. Apart from performing normal e-commerce trading transactions from internet-enabled mobile devices, mobile commerce offers some highly personalized and interactive services that became possible due to the unique capabilities of wireless environment and user mobility. Such specialized services can be broadly classified in following five categories :

- location-based services,
- mobile information delivery,
- mobile entertainment services,
- mobile banking and payment services,
- mobile marketing and advertising services.

**Q16. What are the different types of M-Commerce Services ?**

*Ans :*

There are two types of M-Commerce services. They are :

1. Location Based Services (LBS)
2. Information Services.

**Q17. Describe the features of location based services (LBS)? What are the positioning system available for LBS ?**

*Ans :*

Location Based Services utilize the geographic location information of the mobile device/ and offer a number of personalized information and entertainment services to the mobile customer. The location information of the mobile device can be retrieved either by using digital cellular network technology or by employing satellite positioning infrastructure.

Once the geographic location information of the mobile device is determined, a variety of useful information can be delivered to the customer location. These include local weather reports, local landmark information such as nearest ATM, banks or stores, delivery of discount coupons or location based games.

Parcel tracking or vehicle tracking in supply chain operations or people tracking in criminal investigation can be achieved with reasonable accuracy. In healthcare, the location of the nearest hospital can be identified and utilized for a mobile user in case of emergency.

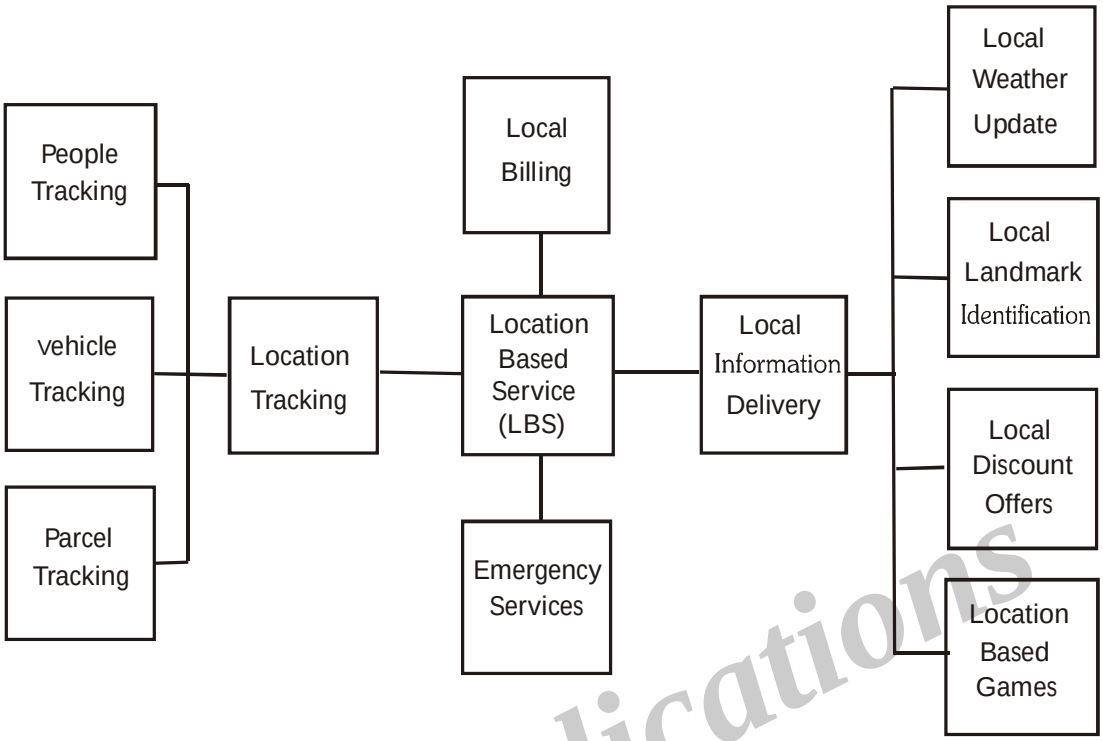



**Fig. : Location Based Services (LBS)**

All the above LBS services require accurate positioning of the mobile device. The positioning means determination of the location of the mobile device with reference to either a coordinate system or address system. In geocoding, the location of a mobile device is expressed in terms of geographic coordinates, i.e. latitude and longitude. Alternatively, the location can be expressed in terms of street address, block address or nearby landmark address derived from geographic coordinates.

The systems offering positioning of mobile devices are classified in two major categories, namely the satellite- based positioning system and cellular network-based positioning system. These two systems differ in technology and infrastructure and offer different levels of reliability and accuracy. In deep mines or in dense cities, satellite systems may not work well and cellular networks with dense coverage become more effective. On the other hand, in rural or remote areas, cellular networks become unavailable and satellite visibility becomes handy.

### (i) Satellite Positioning

Satellite positioning systems use a combination of a number of earth orbiting geostationary satellites and corresponding receiver terminals. The receivers are embedded in mobile handheld devices and receive radio signals sent from three or more satellites.

The information received from the radio signals are used to calculate the exact position of the mobile device. Such positional calculations are used in providing the location information about the mobile device in LBS applications. The satellite positioning systems can provide 10-40 meter accuracy and are widely used to provide reliable time and location information anywhere on earth whenever there is a unobstructed line of sight to three or more satellites.

**(ii) Cellular Network Positioning**

In cellular network-based positioning system, the coordinates of the cell towers of the base stations of each cell site is utilized in determining the location any mobile device that come in its vicinity. The signal received from a mobile device in three or more nearby cell towers are measured and the tower receiving the maximum signal strength is approximated as the position of the mobile device.

The location of the mobile device is calculated by the mobile network using the location coordinates of the corresponding cell tower. Such location calculations can give accuracy of the order of tens of meters. However in less populated areas having less number of cell towers, the accuracy can be of the order of several kilometers. In order to improve the accuracy of calculations, several implicit techniques are employed such as angle of arrival, time of arrival, observed time difference, and so on. Such techniques are supported by almost all major mobile access technologies such as GSM, GPRS, 2G or 3G systems.

**(iii) Local Information Delivery**

The knowledge of the position of a mobile user can be utilized to deliver a number of highly personalized information. Once the location of the mobile device is determined, Geographic Information System (GIS) is employed to get the basic map data of the nearby location, such as the information regarding the man made structures, i.e. streets, buildings as well as the geographic terrains, i.e. rivers or mountains.

- **Local weather update**

  Local weather information regarding snowfall, rainfall, max./min.temperature can be delivered to the user's mobile device. As the user moves from one region to another, the weather report gets updated and helps the user to be aware of the current weather condition. Also, local traffic situation can be summarized and delivered to the mobile user on request. In case of any nearby traffic congestions, an alert can be sent and an alternative (congestion free) route can be suggested.

- **Local landmark identification**

  Information regarding the locations of nearby banks, gas stations, ATM counters, hospitals, restaurants, etc. can be delivered to the mobile user. In addition to giving the location information about these utility centers, some step-by-step directional services are also provided to the customer to guide him to reach the desired landmark via an effective route. Such navigational services help a stranger in a locality to quickly locate some useful landmarks, such as gas stations or ATM counter. In some cases, local map showing important landmarks can be displayed to the WAP-enabled mobile device of the user.

- **Local discount offers**

  In yet another application of LSB, the discount coupons of any retail outlet can be delivered to the mobile devices of potential customers in nearby regions. Similarly, the night clubs can send the discount offers to some of their drinks or the information regarding some late night events to the mobile users staying in nearby localities. The news regarding the occurrence of any social events can be intimated to the mobile user in the form of an SMS.

- **Location-based games**

  Specialized location-specific video games can be delivered to the mobile device of the user which evolves and progresses along with the movements of the mobile players. Such location-based games utilize some kinds of localization technology like satellite positioning or GPS. Such games are usually urban multi-player street games played on city streets through the mobile handset of a number of players who change their

positions continuously while playing. These games also employ embedded technology as well as Near Field Communication (NFC) or bluetooth technology to improve their performances. Some of these games are available for a certain amount of time while others can be played anytime.

- **Local billing**

  This type of application provides the ability to generate preferential billing based on some personalized zones such as home zone, work zone, travel zone, etc. In one zone, the user can enjoy flat rate calling while in other zones special rates can be applied. Such services can be very helpful to customers who make a large number of calls from each zone at different hours of the day.

- **Emergency services**

  In cases of emergency, if the user dials a hospital/police/fire service emergency number from the mobile phone, the location information of the mobile phone is utilized and location-based emergency services are delivered. In such cases, the nearest appropriate authority (hospital/police station/fire brigade) is alerted and emergency service is sent from the centre to the user location in minimal time.

**Q18. Discuss the various products of LBS ?**

*Ans :*

**1. VZ Navigator**

This is a LBS application provided by Verizon Wireless to its mobile customers. It uses LBS technology to provide customers with maps, local search facility and directional service. The customer can download the VZ Navigator client application in the GPS-enabled mobile handset and can start viewing maps and other positional information. The maps provide colourful display of local landmarks, restaurants, ATM counters, hospitals and are accompanied with a voice step-by-step directional driving guidelines.

***2.*** **Google latitude**

It is a LBS application developed by Google. A mobile user having Google latitude application installed in his/her mobile device can allow a group of users to view his/her current location. The owner's cell phone account is automatically mapped to Google Maps application, whereby the location information of the owner can be displayed via Google Map.

**3. Loop**

It is a LBS application that offers location based messaging or geo messaging to mobile users. It provides a mobile GPS sharing system that allows users to visualize each other's location and thereby share information. It also delivers integrated information about the surrounding location to the mobile phone of the user to make them acquainted with the surrounding region.

**Q19. Explain briefly about information service.**

*Ans :*

Mobile devices such as mobile phones, Personal Digital Assistants (PDA), notebooks, laptops are often used for getting regular updates of a large variety of information. These include general news, traffic updates, financial news, stock updates, weather forecast, etc. For getting the information, the mobile user remotely connects to a central system from where the information is delivered either in the form of SMS alerts or in the form of regular websites.

Short Messaging Service (SMS) allows the exchange of short text messages (160 character max) using standard communication protocols between two mobile devices. This is the most widely used mobile application, which is used to receive information alerts by billions of mobile users across the world. SMS service is available in almost all major mobile protocols such as GSM, CDMA or 3G and it is also supported by satellite and landline networks.

A number of digital contents, such as news alerts, financial information, stock updates, logos, ringtones, etc. can be delivered through SMS.

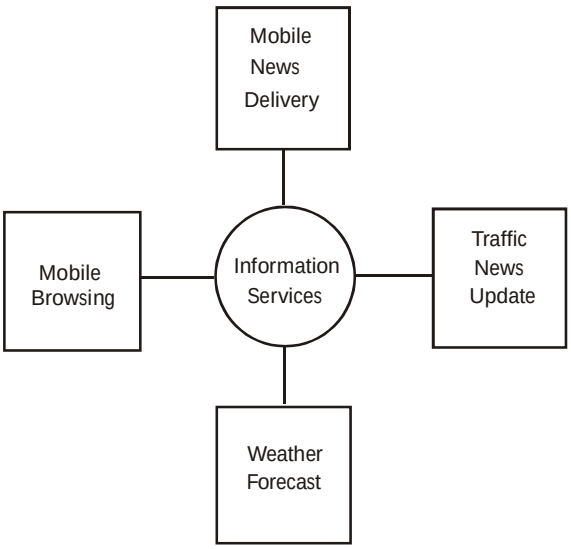



**Fig. : Information Services**

### 1. Mobile News Delivery

Mobile news delivery is the process of delivering current news to the mobile device of the subscriber either in the form of SMS news alerts, through specialized applications or using mobile versions of media websites. A recent study showed that a majority of mobile users prefer to access news through mobile devices rather than from television, radio, newspaper or other media.

### 2. Verve Wireless

California-based Verve Wireless in one of the pioneers in mobile news delivery. It maintains a proprietary Verve Gateway that allows local media and news companies to seamlessly extend their reach to mobile devices across the globe and across all mobile distribution channels.

### 3. AT & T Mobile News

AT&T, world's leading carrier of mobile and wireless services, has launched a specialized mobile news application meant for healthcare industry. The service, known as AT&T For Health (SM), supports delivery of healthcare solutions to the mobile devices of innumerable patients across the globe.

### 4. Jasmine Mobile News

Jasmine News is a leading mobile news provider in Sri Lanka that currently has more than 1,70,000 subscribers who pay $ 0.30 per month for getting the service. Jasmine sends brief news headlines on general topics including politics, law, sports, current events, business and entertainment, in the form of SMS to the mobile devices of the subscribers. Jasmine also has a website that displays news headlines and limited length contents on current topics that can be displayed on the micro-browsers of WAP-enabled mobile devices. Jasmine supports English, Tamil and Sinhala languages and wide popularity of Jasmine news among mobile users forced other prominent media houses of Sri Lanka, such as Derana (TV Channel) and Daily Mirror (Newspaper) to provide SMS news delivery to their subscribers.

### 5. Traffic News Update

Mobile traffic news update is an important mobile application which delivers live traffic update in the mobile devices of people on the move. Such traffic updates provide information regarding traffic congestions in busy intersections, available parking spaces, road blocks and diversions caused by any emergency situations and suggest alternative routes.

### 6. Google Maps for Mobile

Google Map is a web mapping application, which delivers maps of different categories, such as political maps of different countries, street maps for a selected area, highway route maps, satellite/aerial view of the world, etc. The maps are embedded in websites, which can be downloaded any time, totally free of cost. Google Maps for Mobile is a java application that can deliver Google Maps in any java-based mobile phone or mobile device. It supports GPS like location-based services that utilizes location information received from the nearest cell site.

**7. Tom Tom Navigator**

Tom Tom Navigator is an automotive navigation system and digital mapping service that can be installed in mobile devices, such as personal digital assistants, smartphones, mobile phones, palm devices or pocket PCs. It is manufactured by a well-known Dutch manufacturing company and is available in US, UK, Europe, Africa, Middle-East and South-East Asia. It can use GPS receivers built into the mobile device or can use external bluetooth receivers. The main screen can be personalized by the users to include frequently used functions and also users can report mapping corrections.

**8. Sygic**

This is an Australian company that provides real time traffic updates along with voice guided step-by-step navigation directions in mobile devices. It enables users to receive detailed and live traffic information via their smartphones. The company maintains a database to store real-time traffic information on traffic congestion, major road works, road closures, incidents and accidents. The information is assimilated in the application and is delivered to the mobile devices along with suggestions regarding alternative routes to avoid delay. It also delivers mobile maps to drivers to keep them dynamically informed about traffic conditions in nearby regions. This is Australia's first-ever national traffic and navigational service available to mobile devices of the drivers.

**9. Weather Forecast**

Weather forecasting is the science of predicting state of weather in a future time in a particular locality and plays an important role in planning of tours and events in numerous business and personal occasions. It collects quantitative data about current state of atmosphere such as humidity, barometric pressure, sky condition, temperature, etc. and analyses the data scientifically to project future state of atmosphere. Such weather forecasts can predict amount of rain, snowfall, temperature, wind chill, etc. at any time of the day and travellers and event organizers can plan accordingly to face those weather conditions. Weather updates are particularly important for users on the move so that they can prepare themselves for any type of weather hazards.

**10. Mobile Browsing**

Mobile browsing refers to internet surfing by mobile users through their mobile devices. Mobile commerce offers instant internet connectivity in the mobile devices using wireless digital cellular technology 24 x 7 and at any geographic location. Mobile users surf the internet in the micro browsers in their mobile devices and research has shown that a significant percentage of mobile users prefer to use their mobile device more for net surfing than for any other use, such as making phone calls or so.

Apart from net surfing, mobile browsers are also used for e-mailing, making online payments or booking online tickets. Whatever is the reason, mobile internet browsing has become an important aspect of m-commerce and more and more people have started spending a considerable amount of time in viewing web pages in their mobile devices while travelling. In spite of the smaller size and lower resolution of the mobile browsers, statistics has shown that a considerable number of people finds mobile browsers more comfortable than any other form of internet surfing. With a global increase in cell phone ownership and rapid growth of wireless mobile applications, experts predict that in near future, mobile devices will dominate the field of web browsing.

# Short Question and Answers

**1. Define Mobile Commerce.**

*Ans :*

Mobile Commerce, also known as m-commerce, is defined as the process of performing business transactions using handheld mobile devices which are connected through wireless networks. The business transactions may range from buying and selling goods, making mobile payments, downloading audio/ video contents, playing online games, using numerous software applications or getting mobile tickets. The mobile devices include cellular phones, handheld computers such as palmtops or laptops, pagers, smartphones and Personal Digital Assistants (PDA). The mobile users can access internet through these devices without any wired connection or a computer. Powered with the emerging technology based on Wireless Application Protocol (WAP), m-commerce employs web- ready micro browsers in these mobile devices to surf through the internet anytime, anywhere on earth.

**2. Wireless Communication Technology?**

*Ans :*

Mobile commerce is based on wireless communication technology. The wireless communication technology has emerged as the new choice of modern corporate world. The wireless networking has some distinct advantages over traditional wired networking that employs co-axial, twisted pair or fibre optic cables for physical connection between two or more computing devices. In wireless networking, the data transfer between computers are facilitated by microwaves, radio waves or infrared waves. It eliminates the cumbersome cabling process involving bulky cables with a significant reduction in labour and material cost as well as development time. The wireless networking technology together with wireless application protocol provides the backbone of mobile commerce applications. In various vertical markets, such as retail, healthcare, manufacturing and warehousing, mobile commerce gained acceptance and provided increased productivity through the usage of mobile devices. The mobile handheld devices are used to transmit data in real time to centralized hosts through wireless networks.



**3. Principles of Mobile Commerce.**

*Ans :*

- Mobile commerce is based on wireless mobile communication system, which utilizes digital cellular technology.
- The cellular network consists of a number of cell sites.
- Each cell site consists of a stationary base station (a radio frequency transceiver), an adjacent tower antenna (for transmission and reception of signals) and a surrounding cell (a hexagonal-shaped geographical area).
- Each cell is allotted a band of radio frequencies and provides coverage to any portable mobile device that comes within the geographical range of the cell. Whenever a mobile device such as a mobile phone or a pager, etc., comes inside a cell, it starts communicating with the base station using one of the cell frequencies.
- The base station receives the signal from the mobile device and transmits using the tower antenna to a distant base station for call delivery.

**4. What are the benefits of Mobile Commerce.**

*Ans :*

**(i) Anytime Anywhere**

Mobile commerce together with wireless communication technology and wireless broadband internet access, keeps the mobile user connected with the internet while travelling across the globe. The business information is available to the mobile user any time of the day and anywhere around the globe. This anytime/anywhere internet access makes business transactions more flexible and customer communications more efficient, which in turn improves the productivity of the company and increases customer satisfaction. The valuable market information, stock/share prices, inventory position, delivery schedule, etc. are instantly available at the fingertips. Handheld devices, such as Blackberry, etc. work on internet mode and allow users to continuously send/receive electronic mail, download news alerts, stock prices and receive weather updates. The round the clock (24 x 7) internet availability benefits many users to conduct business transactions from their homes or from any other place while on the move and at any convenient time. Thus m-commerce offers greater mobility and flexibility to mobile users in performing business transactions using their handheld mobile devices.

**(ii) Cost-effective**

The costs of transactions using mobile devices are relatively low. The time-critical business data, such as reports, photographs, etc. can be captured and transmitted easily from the mobile devices without involving any bulky expensive equipment. The customer queries can be attended and support provided instantly from the mobile device, thus making customer support more comprehensive. The SMS-based micro payments facilitate bank account transfer within a few seconds and at the cost of an SMS. Contact less smartcard-based mobile payments provide a low cost alternative for toll tax payments in mass transit systems. In case of mobile billing, users can pay for electricity bills, telephone bills, petrol, grocery, etc. through their mobile phones. The payments made in the mobile phones for such items will appear as part of their mobile phone bills, thus eliminating the need for a third party payment mechanism such as, credit cards. This reduces the cost of payment to a large extent.

**(iii) Personalized Service**

Mobile commerce offers a number of personalized services to the mobile users depending on their various requirements and purposes. The digital cellular technology can monitor the location of user performing mobile transactions. Knowledge of the user's location may be used to deliver timely and useful contents such as product availability and discount information to the potential customer. Timely information, such as flight schedules and flight availability can be delivered to the user at the last minute.

**5. Limitations of Mobile Commerce.**

*Ans :*

**1. Small Screen Size**

Mobile devices have smaller screen size (of the order of 2 by 3 inches) and poor resolution which makes them inconvenient for browsing applications. Data entry can be quite difficult using small combinational keypad that comes with most of the mobile handheld devices. The wide and high

resolution screens in conventional desktops or laptops used in e-commerce applications offer ease of use in data entry operations as well as viewing web pages. These larger screens support 1920 × 1080 resolution and 3D graphics display. Although mobile devices offer greater mobility and flexibility in accessing information, the smaller screen size restricts the amount of information that could be presented and offers a less convenient user interface in the form of menu-based scroll-and click mode of data entry.

**2. Low speed processor**

Most mobile devices come with low-powered processors with much lower processing speed compared to sophisticated processors (i.e. core 2 duo or i-core series) used in desktops or laptops. Such low speed processors restrict the download speed in most mobile commerce applications. The applications requiring too much processing power should be avoided as they may become irritably slow due to low speed processors. Also, keeping the low processor speed in mind, the mobile websites must be optimized to ensure customer satisfaction. Unnecessary plug-ins, flash images and animations should be removed to ensure speed of delivery.

**3. Small memory capacity**

The mobile devices do not have large storage space. The memory capacity in mobile devices is in the order of 5 GB to 10 GB compared to 2 TB or higher used in desktops/laptops. So, it is difficult to store large video files in mobile devices for future use. The mobile application developers must be concerned about the size of their applications during the development phase.

**6. Payment Model.**

*Ans :*

In this model, mobile payment service providers offer mobile payment services that allow users to make cashless payment transactions including banking transactions, share trading, tax/bill payments and ticket or other retail purchases using credit/debit card or bank PIN. The payment service providers have collaboration with banks (or other financial institutions) and/or mobile network operators, and accordingly get bank-controlled mobile payment model or operator controlled mobile payment model. The payment service provider charges a certain percentage fee for each payment transaction made through the payment application. Alternatively, the user can pay a nominal monthly subscription fee to the payment service provider and can use the service as and when required.

**7. Advertiser Model**

*Ans :*

This model is an extension of traditional e-commerce advertiser model and provides mobile websites which can be viewed by mobile users in their handheld mobile devices. Advertising companies can display their advertising messages in the website and pay a rental fee to the hosting website for displaying their messages. These mobile advertising websites usually offer some basic services such as email service, search engines, news service or social networking service to the users and post advertising messages in these sites to enjoy greater coverage. The advertisements often come with purchase buttons that allow users to purchase the product directly from their mobile devices. The mobile payment service is also provided to facilitate mobile purchase directly from the advertising websites. The advertiser companies pay a fixed fee

to the advertising website for displaying their advertising messages. Additional revenue is generated for each purchase transaction made by the user through the website.

**8. Content Provider Model**

*Ans :*

In this model, mobile service providers offer a host of entertainment contents, such as breaking news, weather forecast, traffic updates, music, mobile games, TV shows, video content, movies, etc. that could be downloaded to user mobile devices. Network operators have tie-ups with various content providers and offer both subscription-based services as well as pay-per-use services to mobile customers. Location-based services, such as map-based navigational services, discount coupons offered in local retail stores or restaurants, news of local events, etc. are also delivered in customer mobile devices.

**9. Define E-Commerce.**

*Ans :*

- Electronic commerce, commonly known as E-commerce is trading in products or services using computer networks, such as the Internet.
- Electronic commerce draws on technologies such as mobile commerce, electronic funds transfer, supply chain management, Internet marketing, online transaction processing, electronic data interchange (EDI), inventory management systems, and automated data collection systems.
- Modern electronic commerce typically uses the World Wide Web for at least one part of the transaction's life cycle, although it may also use other technologies such as e-mail.

**Definition**

Sharing business information, maintaining business relationships and conducting business transactions using computers connected to telecommunication network is called E-Commerce.

**10. Compare and contrast E-commerce and M-Commerce.**

*Ans :*

| S.No. | Factors | E-commerce | M-commerce |
|---|---|---|---|
| 1. | **Mobility** | E-commerce employs wired networks for internet connectivity and hence is restricted inside a building. It offers anytime connectivity. | M-commerce employs high frequency wireless networks for providing wireless internet and is completely ubiquitous in nature. It offers any time anywhere connectivity. |
| 2. | **Reliability** | Wired networks are more reliable and suffer less interference and noise. Quality of data transmitted is better as there is little or no cross -talk. | Wireless networks suffer from interference from adjacent channel frequencies or reflected waves that tend to reduce the intensity and quality of transmission. Special error detection techniques are employed to eliminate errors in transmission and improve signal quality. |

| | | | |
|---|---|---|---|
| 3. | **Speed** | The transmission speed of wired net works are much higher (of the order of 1000 Mbps) | The transmission speed of modern wireless networks are usually of the order of 100 Mbps. |
| 4. | **Security** | E-commerce transactions are more secured as the networks remain well-protected inside campus buildings. Firewalls and proxy servers are used to keep confidential business data secured in the central server. | M-commerce transactions through wireless networks are more vulnerable to hacker and other security attacks and require stringent security arrangements in the form of encryption and firewalls to prevent damage or misuse of private data during transmission. |

**11. Mobile Banking.**

*Ans :*

Mobile banking is the process of performing banking transactions such as balance checking, account transfer, bill payments, credit card-based payments, etc. through a mobile device, such as a mobile phone or a Personal Digital Assistant (PDA). Such transactions could be performed from any remote locations and at any time of the day irrespective of the normal working hours of the bank. In order to avail the mobile banking facility, the customer must have an account in the bank, the mobile phone number must be pre-registered in the bank and also the network service provider (for the mobile device of the customer) must have a tie-up with the bank. When the customer wants to perform a mobile banking transaction, the transaction request from the customer first goes to the premises of the mobile service provider, and from there it is finally routed to the bank. Depending on the type of transaction, two types of mobile banking are available, namely SMS banking and WAP-based mobile banking. SMS banking is usually used for non-financial transactions, such as viewing of balance statement, requesting for a checkbook, status checking or stopping a check payment although some banks permit financial transactions also through SMS banking. In SMS banking, an SMS code requesting a transaction is sent to a particular number (as directed by the bank) from the mobile device of the customer. As soon as the bank receives the SMS, the required transaction is performed, the information is retrieved (in case of non-financial transaction) and sent back to the customer mobile phone in the form of another SMS. The entire transaction takes only a few seconds and the cost of the transaction is only that of an SMS. For different types of transactions different SMS codes are used.

**12. Mobile Ticketing**

*Ans :*

Mobile ticketing is a special application of m-commerce which allows users to purchase tickets for air/rail/bus travel or for any sports/entertainment events from any location and at any time using mobile phones or any mobile device. The users can avoid tedious and time consuming process of getting paper tickets after waiting in a long line and the organizations can reduce production, distribution and infrastructural cost by providing simpler ways to purchase tickets anytime/anywhere. Mobile tickets are available for a number of cases, such as mass transit tickets, airline check-in, movie/theatre shows, sporting events, consumer voucher distribution, and so on. There are a variety of options by which a user can purchase

mobile tickets, such as online purchase from merchant website, from WAP page in the mobile handset, purchase via SMS from the mobile handset, over the phone from a voice call or through a secure mobile ticketing application. Due to the convenience it offers to the customers and cost savings it offers to the companies, mobile ticketing is gaining momentum and more and more people are opting for mobile ticketing.

**13. Mobile Computing.**

*Ans :*

Mobile computing is a technology that allows users to perform normal computing operations, such as internet surfing, document preparation, spread sheeting, preparing PowerPoint presentations, send/ receive e-mails or download MP3 audio files using portable computing devices while in transit. The portable computing devices include smart phones, personal digital assistants, laptops, ultra mobile PC or wearable computers. Some of these portable computers have bigger screens compared to mobile phones and hence overcome the small screen limitations. For example, Apple iPad comes with an 8" x 10'' screen, which is suitable for reading e-books as well as viewing websites.

# Choose the Correct Answers

1. Mobile commerce means _____. [ d ]
   (a) buying (b) selling
   (c) none (d) both
2. Mobile plays - giant role in _____ technology [ c ]
   (a) mobile (b) network
   (c) communication (d) none
3. Mobile money transfer is done through _____ by private sector banks [ a ]
   (a) mobile phones (b) ATM's
   (c) Banks (d) Online system
4. Purchasing & Selling of financial instruments in the same name of far others is known as _____. [ c ]
   (a) investment broking (b) portfolio management
   (c) contract broking (d) money transfer
5. Mobile wallets are known as _____ [ b ]
   (a) wallets (b) e-wallets
   (c) bank accounts (d) mobile account
6. Mobile devices send request through _____ protocol [ b ]
   (a) TCP/IP (b) HTTP
   (c) FTP (d) UDP
7. A _____ is a small multimedia enabled mobile device [ a ]
   (a) MID (b) UMPC
   (c) Smart phone (d) None
8. A mobile browser is also known as _____. [ a ]
   (a) Micro browser (b) Mobile web
   (c) www (d) None
9. The platform used by e-commerce and m-commerce is _____. [ b ]
   (a) One-time (b) Webstores
   (c) Websites (d) None
10. Mobile portals are referred as _____. [ a ]
    (a) Portable portals (b) Transferable portals
    (c) Moving portals (d) Wireless portals

# Fill in the blanks

1. Mobile commerce mean engaging user in _____ process.
2. _____ perctange of user use smart phone for buying and selling of products.
3. Mobile plays a giant role in _____ technology.
4. Mobile money transfer is done through _____
5. _____ mean using mobile browser to access internet
6. _____ is transaction based banking service.
7. Mobile or wireless wallets are known as _____
8. M-commerce business model and strategies are divided into _____ analysis.
9. A _____ is a small multimedia enabled mobile device.
10. A mobile browser is also known as _____

**ANSWERS**

1. Buy or sell
2. 89%
3. Communication
4. Mobile phones
5. Mobile browsing
6. Mobile accounting
7. C-wallets
8. Theoretical and empercial
9. MID
10. Micro browser

# One Mark Answers

**1. Mobile Commerce.**

*Ans :*

Mobile Commerce, also known as m-commerce, is defined as the process of performing business transactions using handheld mobile devices which are connected through wireless networks.

**2. Expand WAP.**

*Ans :*

Wireless Application Protocol.

**3. Expand CDMA.**

*Ans :*

Code Division Multiple Access

**4. Expand TDMA.**

*Ans :*

Time Division Multiple Access

**5. Define E-Commerce.**

*Ans :*

Electronic commerce, commonly known as E-commerce is trading in products or services using computer networks, such as the Internet.

**6. Define Mobile Payments.**

*Ans :*

Mobile payment is an alternative payment system where the mobile user makes payment using the mobile device for a wide range of services or goods.

UNIT II

Types of Mobile clients (mobile phones, PDAs, laptop computers, vehicle-mounted devices, hybrid devices), Device limitations: considerations for user interface and application design Device location technology: GPS, triangulation. Mobile client software: Mobile device operating systems, Micro browsers, Mobile device communications protocols: WAP, i-Mode, Mobile device page description languages, Mobile device application software.

## 2.1 Types of Mobile Clients (Mobile Phones, PDAs, Laptops, Vehicle Mounted Devices, Hybrid Devices)

**Q1. What is a mobile client? What are the features of a mobile client.**

*Ans :*

A mobile client is a technology designed to extend the features of a company's mobile telephone system. The technology makes it easier for employees to:

- Separate personal and business communications while using one smartphone
- Manage business calls while out of the office
- Transition smoothly from using a company desktop computer to a mobile device

A mobile client is designed to make it easier to integrate portable devices into a company's communication workflows.

A mobile client is invaluable if your company has a largely mobile workforce, or if has a team structure where people shift dynamically across mobile and desktop devices. Using this technology, your people can easily keep track of their communications, and your customers and clients will be presented with a unified and consistent corporate face.

**Features**

A mobile client allows your company to:

- Maintain a centralized list of contacts across desktop and computer devices.
- Easily route business calls to a mobile device from your corporate switchboard.
- See employee presence and availability in real-time.
- Blend instant messaging, voice mail (including visual voice mail), and phone channels into one dashboard that can be accessed from any device.

**A mobile client offers the following benefits**

- **Improved customization**

  Using a mobile client, your employees can perform detailed customization on how incoming calls work through a mobile device. These include but are not limited to selective silent mode, ring tone filtering, and switching easily between private and business phone profiles.

- **More ways to communicate**

  A mobile client makes it easier to bridge the divide between desktop and mobile communication. For example, a mobile client allows users to take voice messages from their computer, or receive mobile calls as though they were inside the corporate network.

**Q2. List and explain various types of Mobile Clients.**

*Ans :* **(Imp.)**

Following are the types of Mobile Clients :

1. Mobile Phones
2. PDA's
3. Laptop computers
4. Vehicle mounted devices
5. Hybrid devices

## 1. Mobile Phones

A mobile phone is a wireless handheld device that allows users to make and receive calls. While the earliest generation of mobile phones could only make and receive calls, today's mobile phones do a lot more, accommodating web browsers, games, cameras, video players and navigational systems.

Also, while mobile phones used to be mainly known as "cell phones" or cellular phones, today's mobile phones are more commonly called "smartphones" because of all of the extra voice and data services that they offer.

The first mobile phones, as mentioned, were only used to make and receive calls, and they were so bulky it was impossible to carry them in a pocket. These phones used primitive RFID and wireless systems to carry signals from a cabled PSTN endpoint.

Later, mobile phones belonging to the Global System for Mobile Communications (GSM) network became capable of sending and receiving text messages. As these devices evolved, they became smaller and more features were added, such as multimedia messaging service (MMS), which allowed users to send and receive images.

Most of these MMS-capable devices were also equipped with cameras, which allowed users to capture photos, add captions, and send them to friends and relatives who also had MMS-capable phones.

Along with the texting and camera features, cell phones started to be made with a limited capability to access the Internet, known as "data services." The earliest phone browsers were proprietary and only allowed for the use of a small subsection of the Internet, allowing users to access items like weather, news, and sports updates.

Eventually, phone makers started to engineer these phones to access the entire Internet, and webmasters for all sorts of businesses, government offices and other domain holders started to make web sites responsive to access by mobile phones. The trend, called "responsive design," changed the face of the Internet, with mobile phone transactions making up a larger share of ecommerce sales and other activities.

## 2. PDA's

Personal digital assistant is a term for a small, mobile, handheld device that provides computing and information storage and retrieval capabilities for personal or business use, often for keeping schedules, calendars and address book information handy.

Popular in the 1990s and early 2000s, personal digital assistants (PDAs) were the precursors to smartphones. Most PDAs had a small physical keyboard, and some had an electronically sensitive pad on which handwriting could be received. Original uses for a personal digital assistant included schedule and address book storage and retrieval and note-entering. However, many types of applications were written for PDAs.

### Features

- The ascent in the quantity of PDA clients has required the assembling of various frill just as opening of administration focuses that acknowledge PDAs for fix.
- These organizations' master fix faculty are talented in dealing with various issues and potential parts substitution.
- Convenient advanced aides, or PDAs, are perhaps the most recent bit of must-have innovation for a huge number of clients.
- PDAs are pocket-sized gadgets that may consolidate a mobile phone, camera, organizer, Web program and many other helpful highlights for business and individual use.
- In any case, there are a few significant focal points and weaknesses to possessing a PDA that forthcoming purchasers ought to weigh prior to choosing.

**Advantages**

- **Availability**

  One of the primary preferences of possessing a PDA is the capacity to stay in contact with individuals through email, text informing and telephone. Since PDAs are so convenient and networks so broad, clients can take them anyplace.

- **Association**

  Another advantage of possessing a PDA is expanded association. Schedule and rundown applications make it simple to monitor arrangements, make notes in a hurry and document past discussions or other information.

- **Status**

  For some PDA clients, the gadget has the additional advantage of meaning a specific status. Organization gave PDAs might be held for more significant level representatives and can come to connote a place of power or significance. For individual clients, having the most recent PDA might be an indication of riches or innovative information.

- **Broad Internet Connectivity**

  For occupied people, the primary preferred position of getting a PDA is being able to remain associated through email, calls, text informing and different courier applications. These are worked with broad organization network so clients can get to the Internet anyplace they are.

**Disadvantages**

- **Cost**

  One of the greatest hindrances of a PDA is the expense. Other than paying for the gadget itself, most PDAs require the purchaser to buy in to a utilization contract. This includes a month to month bill and the chance of overage charges if the client outperforms his designated free telephone minutes or information limits.

- **Interruption**

  PDAs may likewise turn into an interruption when they're not satisfying an authentic need. The capacity to be constantly associated can prompt sat around riding the Web, settling on telephone decisions or messing around. Some business clients whine of being "available to come in to work" when their colleagues and bosses can reach them whenever.

- **Restricted in Scope**

  PDAs are restricted in degree. They are neither PC substitutions nor would they be able to be successfully used to supplant mobile phones. PDAs are not furnished to manage miniature preparing capacities.

- **Time constraint**

  PDAs are not generally the best response to business arrangements. Paper-based coordinators are a more reasonable choice since PDAs are hard to utilize, information passage is abnormal, they are moderate and beginner clients discover them superfluously unpredictable.

### 3. Laptop Computers

A laptop may be a pc that will be easily carried to a variety of locations. It's also called a transportable pc. It can run an equivalent set of software and a set of files as that of a personal computer. A laptop features a built-in monitor, keyboard, touchpad, and speakers and may be powered by a chargeable battery. It had been first invented by British designer Bill Moggridge. A laptop is employed widely thanks to its portable nature.

**Advantages**

**(i) Mobility**

The main advantage of a laptop, as compared with a stationary computer, is its mobility. The lightweight, compact size, the built-in battery within the laptop

allowing it to simply move from one place to a different one. Many models are often worn in the least times, utilized in a park, cafe, or carted during a car.

**(ii) Finished product**

The laptop is straightforward to use with none additional devices. It's everything like its own keyboard, built-in mouse (touchpad), built-in speakers, built-in microphone, many laptops have a built-in camera.

**(iii) Internet access**

Internet access is the second advantage for the increase in demand for the laptop because it provides the power to access the web through wireless technology Wi-Fi.

**(iv) Offline operation**

The laptop is additionally convenient to use for all types of presentations. In this case, you are doing not dependent upon the technical equipment of the venue. As the laptop can work offline from its battery so no need to connect from the mains.

**(v) Instant**

Usually carrying a laptop means your ticket to instant access to information, be it personal or professional. It results in better collaboration between co-workers or students.

**Disadvantages**

**(i) Frequent Upgrades**

The laptops are difficult to upgrade thanks to their integrated design. The sole parts which will be upgraded are hard disc and memory as these are the sole parts that are accessible to the user. It's very difficult to repair it. As every laptop has its own proprietary design and construction, they're difficult to upgrade. Additionally, they need a high maintenance cost too.

**(ii) Higher price**

The laptops are costly as compared to PC, because the smaller components required by the laptop come costly.

**(iii) Difficulty in customization**

The laptop doesn't offer an option for personalization consistent with one's requirements. The laptop only gives access to the computer's memory and disk drive. The opposite components like processors, graphics cards, and cooling systems aren't easy to access and replace. So, when one among the laptop's non-customization components becomes obsolete then you'll need to buy a replacement laptop to stay up with the technology.

**(iv) Highly insecure**

The laptops are generally stolen thanks to their heavy cost. The thieves may misuse the stolen business data or personal data which will convince be very dangerous. Hence, both the physical protection of laptops and the safeguarding of knowledge are very important.

**(v) Health issues**

Prolonged use of laptops can cause RSI thanks to their flat keyboard and trackpad pointing devices. The integrated screen of the Laptop often causes the users to hunch for a far better view than can cause neck or spinal injuries.

**(vi) Durability**

Thanks to their high portability laptops are subject to more wear and tear. Laptop components like screen hinges, latches, and power jacks are susceptible to deteriorate gradually thanks to ordinary use.

**4. Vehicle mounted Devices**

Vehicle-mounted devices or Vehicle-mounted computers are digital devices that are designed to perform multiple business-specific

operations while being attached or mounted to vehicles. These vehicles can vary, from full-fledged trucks and logistics vehicles to forklifts used in complex warehouse environments, factory floors, and manufacturing units.

Vehicle-mounted devices are needed to perform accurate and quick operations, calculations and logging, making the job of frontline workers and field-forces more efficient and error-free.

Vehicle-mounted devices are rugged devices designed to perform in harsh weather and extreme environmental conditions including shocks and vibrations. Vehicle-mounted devices are deployed for heightened productivity, to ensure that the mobile workforce or field-force is always supplied with the latest data and information, can compute precise results leaving no room for human error and manage large-scale inventories with efficiency.

Industries that Make Use of Vehicle-Mounted Devices Include:

- Warehouse Management
- Transportation & Logistics
- Manufacturing
- Construction
- Distribution
- Oil & Gas
- Supply chain

**Characteristics of Vehicle-Mounted Devices:**

The Must-haves

- Durability
- Flexibility to connect to any additional peripherals & accessories
- Light weight
- Easy deployment
- Simple integration
- Variety of display sizes
- Shock and vibration resistance
- Programmable function keys
- Wide power input
- Wide operating temperature & humidity range
- Docking station or rugged vehicle cradle

**5. Hybrid Devices**

Hybrid devices refer to the computers manufactured with functionalities of multiple devices that have similar features. Hybrid devices are commonly available in the form of combination devices with the functionalities of laptop and tablet computers. They are accessible in both detachable and convertible forms. The convertible hybrid devices can be transformed onto a tablet by rotating, sliding or folding the keyboard within or behind the frame of the system. The detachable variants can disengage their keyboard and operate as lightweight tablet personal computers (PC). These devices also consist of additional accessories, processors, sensors and storage space for effective cloud management and orchestration, disaster recovery and hybrid hosting. As a result, they find extensive applications across various industries, including education, banking, financial services and insurance (BFSI), telecommunication, manufacturing and transportation.

## 2.2 DEVICE LIMITATIONS

**Q3. List out the major device limitations of mobile commerce technology.**

*Ans :* **(Imp.)**

Mobile technology devices come with strengths, but also limitations. These strengths and limitations play out in good mobile user experiences.

**(i) Small Screen**

In spite of the modern trend towards larger-screen phones, what makes mobile phones so convenient and portable is their small size. Compared with desktop and even laptop screens, phone screens accommodate a lot less content. As a result, screen size is a serious

limitation for mobile devices. The content displayed above the fold on a 30 inch monitor requires 5 screen fulls on a small 4-inch screen. Thus, mobile users must

(1) incur a higher interaction cost in order to access the same amount of information.

(2) rely on their short-term memory to refer to information that is not visible on the screen. It's thus not surprising that mobile content is twice as difficult.

Portable = Interruptible

**(ii) Mobile technology devices are portable**

Most fit easily in a pocket or purse and they tend to follow us everywhere. Because we use phones in a variety of contexts and situations, we are more likely to be interrupted when using such devices: an external event in the outside environment may demand our attention and require us to stop whatever we were doing on the small screen. As a result, attention on mobile is often fragmented and sessions on mobile devices are short. In fact, the average mobile session duration is 72 seconds. In comparison, our own studies show that on desktop, the average session is 150 seconds: more than twice as large.

**(iii) Single Window**

Although some device manufactures are trying to accommodate multiple windows on the screen at the same time, the limited size of the mobile screen makes that goal quite unpractical, even with today's larger-screen phones. The vast majority of users only see a single window (and thus a single application or website) at a time; they cannot split the screen (as on the desktop) and work with two different apps simultaneously.

**(iv) Touchscreen**

Touchscreens come with many blessings and sins. Gestures represent a hidden, alternate user interface (UI), that, when built with the right affordances, can make the interaction fluid and efficient and can save screen real estate. But they also suffer from low memorability and discoverability. On the other hand, it's hard to type proficiently on a tiny virtual keyboard and it's easy to accidentally touch the wrong target.

**(v) Variable Connectivity**

Even in the era of fast cellular networks and ubiquitous Wi-Fi, coverage is not universal or equally good. Phone users frequently complain about connectivity problems. Every new page load translates into a significant waiting time when the network does not cooperate.

If you want users to finish their tasks on your mobile site or in your app, mind the waiting time. Design pages that are light, yet contain as much information as possible, to avoid many back–and–forth trips from client to server. Minimize the number of steps and, ultimately, the number of page loads.

**(vi) No Hover State**

- **Visible**

  The content or feature is accessible from visual means. It may be nested in sub-sections or child pages, but the content is nonetheless accessed from visible navigational elements such as buttons or links.

- **Convention**

  By relying on mobile design conventions you may hide content and only display it when the user employ certain gestures such as swipe or shake, or when the user drags content around such as pull-to-refresh.

**(vii) Slow and Error-Prone Typing**

Typing on a touch keyboard is a slow and error-prone exercise so make sure to keep your form fields to an absolute minimum and pre-select clever defaults. Furthermore, you need to consider how you deal with errors in data.

### (viii) Inaccurate Clicks

On touch devices people use their fingers to click links and buttons on the screen, which significantly decrease the accuracy of clicks. This is also known as the "fat finger problem".

In practice, this means you must consider the size and proximity of all clickable elements, making sure they're large enough to reliably touch with a human finger and far enough apart that users won't accidentally touch the wrong element.

## 2.3 Considerations for User Interface and Application Design

**Q4. What is the need of user interface?**

*Ans :* **(Imp.)**

User interface is the front-end application view to which user interacts in order to use the software. The software becomes more popular if its user interface is:

- Attractive
- Simple to use
- Responsive in short time
- Clear to understand
- Consistent on all interface screens

**Types**

There are two types of User Interface:

**1. Command Line Interface**

Command Line Interface provides a command prompt, where the user types the command and feeds to the system. The user needs to remember the syntax of the command and its use.

**2. Graphical User Interface**

Graphical User Interface provides the simple interactive interface to interact with the system. GUI can be a combination of both hardware and software. Using GUI, user interprets the software.

The following are the golden rules stated by Theo Mandel that must be followed during the design of the interface.

**Place the user in control**

- **Define the interaction modes in such a way that does not force the user into unnecessary or undesired actions**

  The user should be able to easily enter and exit the mode with little or no effort.

- **Provide for flexible interaction**

  Different people will use different interaction mechanisms, some might use keyboard commands, some might use mouse, some might use touch screen, etc, Hence all interaction mechanisms should be provided.

- **Allow user interaction to be interruptable and undoable**

  When a user is doing a sequence of actions the user must be able to interrupt the sequence to do some other work without losing the work that had been done. The user should also be able to do undo operation.

- **Streamline interaction as skill level advances and allow the interaction to be customized**

  Advanced or highly skilled user should be provided a chance to customize the interface as user wants which allows different interaction mechanisms so that user doesn't feel bored while using the same interaction mechanism.

- **Hide technical internals from casual users**

  The user should not be aware of the internal technical details of the system. He should interact with the interface just to do his work.

- **Design for direct interaction with objects that appear on screen**

  The user should be able to use the objects and manipulate the objects that are present on the screen to perform a necessary task. By this, the user feels easy to control over the screen.

**Q5. Explain User Interface designing Process.**

*Ans :* **(Imp.)**

The analysis and design process of a user interface is iterative and can be represented by a spiral model. The analysis and design process of user interface consists of four framework activities.

**1. User, task, environmental analysis, and modeling**

Initially, the focus is based on the profile of users who will interact with the system, i.e. understanding, skill and knowledge, type of user, etc, based on the user's profile users are made into categories. From each category requirements are gathered. Based on the requirements developer understand how to develop the interface. Once all the requirements are gathered a detailed analysis is conducted. In the analysis part, the tasks that the user performs to establish the goals of the system are identified, described and elaborated.

**2. Interface Design**

The goal of this phase is to define the set of interface objects and actions i.e. Control mechanisms that enable the user to perform desired tasks. Indicate how these control mechanisms affect the system. Specify the action sequence of tasks and subtasks, also called a user scenario. Indicate the state of the system when the user performs a particular task. Always follow the three golden rules stated by Theo Mandel. Design issues such as response time, command and action structure, error handling, and help facilities are considered as the design model is refined. This phase serves as the foundation for the implementation phase.

**3. Interface construction and implementation**

The implementation activity begins with the creation of prototype (model) that enables usage scenarios to be evaluated. As iterative design process continues a User Interface toolkit that allows the creation of windows, menus, device interaction, error messages, commands, and many other elements of an interactive environment can be used for completing the construction of an interface.

**4. Interface Validation**

This phase focuses on testing the interface. The interface should be in such a way that it should be able to perform tasks correctly and it should be able to handle a variety of tasks. It should achieve all the user's requirements. It should be easy to use and easy to learn. Users should accept the interface as a useful one in their work.

## 2.4 Device Location Technology, GPS, Triangulation

**Q6. What is Location Tracking ?**

**(OR)**

**Explain the Concept of Location Tracking ?**

*Ans :*

Location tracking refers to technologies that physically locate and electronically record and track the movement of people or objects. Location tracking technology is in use every day with GPS navigation, locations located on digital pictures and searching for businesses nearby using common apps. While location tracking is often associated with smartphone use since smartphones have a GPS chip, there are other ways location tracking is done.

The Global Positioning System (GPS) is location tracking technology that uses data from 24 satellites orbiting the earth. A GPS satellite calculates location by timing how long it takes a radio signal traveling to reach either a fixed or mobile tracking device on earth such as a GPS navigation device built into your car or a smartphone with a GPS chip.

Using multiple satellites, a GPS device can identify it's longitude and latitude location and display the information to the person using the device or send the information to a software app or program. A common everyday example is a use of Internet and mobile map applications on

smartphones that can calculate your current position using your GPS location and show where you're located on a map. Because your location coordinates are sent to a map application, your location is now known by the application, which is location tracking.

Some GPS devices don't send your location anywhere, they just record your location and keep a record of where you are and where you've been. Car navigation systems are a commonly used location tracking systems that don't send your location to anyone, but do keep a record of your location history on the navigation system memory. Your "previous destinations" option is a list of locations you've traveled to that you used your navigation system for guidance. If you drove somewhere and didn't use the navigation system for directions, it likely doesn't have a record of your travel.

With certain smartphones, users have to allow any app permission to use location information captured by the smartphone. Sometimes it's necessary to allow an app to use your location for the app to function. For example, if you want an app to tell you the weather in your current location, you have to give the app permission to obtain your location from your smartphone GPS circuit. If you do allow the app permission, the app can obtain your location when it wants to and send your location back to the app computers that record information. You might not have a username and account with a weather app, but some apps want to use your location and know who you are.

Location tracking has many beneficial uses. Commercial businesses track expensive machinery, fleets of vehicles, and product shipments, seeking to prevent equipment inventory loss. Hospitals track patients to improve efficiency in busy ERs and to safeguard infants in maternity wards and allow only the parents to carry the infants using location tracking devices.

Additional uses for location tracking include wearable gadgets and apps for parents to track their kids and for law enforcement tracks offenders. The cameras you see at red lights, the cell phone app in your pocket, and activity monitors all have some location tracking capability, which makes the tracking of people's locations and every move a debated privacy issue as well.

**Q7. How does Location Technology Track the Movements?**

*Ans :* **(Imp.)**

There are several mechanisms inside a typical mobile device that can provide location information. The most common are GPS, RFID, Wi-Fi and cellular technology. We'll explain these in more detail in the next section, but they all operate on similar principles.

A mobile device communicates with other devices and hubs – such as satellites, routers and towers – to function. Because the mobile device is pinging off of multiple communication hubs, its precise location can be triangulated.

A few examples will clarify how these methods work. The most precise location-tracking services incorporate more than one of these technologies.

**(i) GPS**

The Global Positioning System is an array of satellites that exist solely to help find things across the planet. Any device with a GPS receiver (which includes most smartphones) can ping the satellites with that receiver. This will cause it to communicate with at least four satellites, and the satellites can compare the signal delay to pinpoint where the signal originated. This allows your phone to know exactly where you are and provide turn-by-turn navigation. A common business use case is GPS fleet tracking software, which businesses use to remotely keep tabs on their company vehicles and their drivers' performance.

**(ii) Wi-Fi**

Wi-Fi location tracking is a bit different from other methods. Typically, a device only connects to one Wi-Fi network at a time. This eliminates the possibility of triangulation. Instead, this form of location tracking uses IP

addresses. Every network has a physical IP address that allows the greater internet to know where it is. This is necessary for it to accurately send information across internet infrastructure. When your phone connects to a Wi-Fi network, it pairs with the physical IP of that network. That allows location services to know your current address.

**(iii) Cellular technology**

Cellular tracking works much like GPS. Instead of connecting to satellites, though, your device is connecting to cellular towers. Generally speaking, you will be in range of at least two towers, which is enough for the system to use triangulation to find your location.

**(iv) RFID**

RFID tracking is effectively a combination of these other methods. The RFID scanner typically has a static location. When it pings off of other networks, the location of the scanner can be logged. When the RFID scanner is activated, it can tag its location when it records the access. This can identify the location of the device accessing the scanner.

**Q8. What are the uses of Location based services.**

*Ans :*

Companies have found several ways to use a device's location.

- **Store Locators**

  Using location-based intelligence, retail customers can quickly find the nearest store location.

- **Proximity-Based Marketing**

  Local companies can push ads only to individuals within the same geographic location. Location-based mobile data can improve local marketing efforts to potential customers within that city who might actually act on the information.

- **Travel Information**

  An LBS can deliver real-time information, such as traffic updates or weather reports, to the smartphone so the user can plan accordingly.

- **Roadside Assistance**

  Many roadside assistance companies provide an app that allows them to track your exact location in the event of a blown tire or car accident without the need for you to give directions.

- **Mobile Workforce Management**

  For logistics-dependent companies that employ individuals out in the field or at multiple locations, an LBS allows employees to check in at a location using their mobile devices. Businesses with remote work forces often rely on geographic data to ensure workers are where they need to be.

- **Fraud Prevention**

  An LBS creates another level of security by matching a customer's location to a credit card transaction. Tying the smartphone's location to a credit card allows you to flag transactions made across several geographic locations over a short time.

**Q9. What is GPS? And how it is useful in tracking a location.**

*Ans :*

GPS Stands for "Global Positioning System." GPS is a satellite navigation system used to determine the ground position of an object. GPS technology was first used by the United States military in the 1960s and expanded into civilian use over the next few decades. Today, GPS receivers are included in many commercial products, such as automobiles, smartphones, exercise watches, and GIS devices.

GPS requires the use of many satellites orbiting the Earth. These satellites continually broadcast their locations and status above us. This is continually monitored by the GPS Master Control Station, as well as other tracking and monitoring stations here

on the ground, to ensure accuracy and proper function. The Master Control Station is also responsible for maintenance and correction, should anything go wrong.

A GPS device on Earth receives these signals, interpreting each one's unique data. By mapping the locations of four or more satellites in relation to the tracking device, it can triangulate its exact position in three-dimensional space. More satellites are often used to validate data and provide a more accurate location reading.

**Q10. What are the Major benefits of GPS Tracking?**

*Ans :*

Following are the major benefits if GPS tracking

**1. Improved Safety**

The safety of your drivers is no doubt a top priority for your organization. This starts with having well-maintained vehicles but should also focus on monitoring driver behavior and ensuring that safe driving practices are being followed.

Most GPS trackers also have built-in accelerometers and can alert drivers and managers to patterns of poor driving behaviors, such as harsh braking, harsh acceleration, harsh cornering and speeding. When equipped with AI-enabled dashcams, fleet managers can go even deeper with visibility into distracted driving, tailgating and red-light violations.

**2. Minimize Fuel Costs**

With GPS tracking, fleet owners can understand when and how their vehicles are being operated. Speeding and other poor driving behaviors, such as harsh acceleration, can decrease fuel efficiency increasing costs.

Unauthorized vehicle use can also significantly increase fuel costs. A GPS tracking system can alert management to unauthorized use via time-of-use restrictions and calendar templates.

**3. Lower Operational Costs**

By having access to the data that matters most to your business in real-time, organizations can make more informed business decisions, reducing operational costs.

Having instant access to data helps businesses identify problems quickly and ensures that resolutions can be put in place to mitigate costs that would have been incurred if the problem existed for a longer period.

GPS trackers can support the digitization of processes and simplify the collection of data, ensuring that the right information is collected and stored in a central location that is accessible by all team members. By digitizing processes like pre-trip inspections, job dispatch and proof of delivery fleets can streamline administrative processes so their team can focus on getting the job done.

**4. Increased Productivity**

Increasing productivity is a time and money saver. With a GPS fleet tracking system, businesses can monitor time spent at job sites or at loading bays and work to ensure drivers are more productive. Also, by ensuring the nearest vehicle is routed to a job, businesses can eliminate waste.

**5. Theft Recovery**

Vehicles and equipment are some of the most valuable assets your business owns. Therefore, it should come as no surprise theft recovery is one of the top benefits of GPS tracking.

When you have GPS tracking installed on your vehicles and other assets, your company can easily monitor the location and set calendar templates for expected use and quickly identify unusual or unauthorized use.

Get instant alerts when a vehicle or piece of equipment is operating outside its designated location or hours of operation. If a vehicle is stolen, location tracking can help authorities recover the asset, reducing expensive replacement and insurance costs.

**Q11. What is meant by Triangulation?**

*Ans:*

**Meaning**

Triangulation is the process of determining the exact location of a radio transmitter. This can be done using various techniques such as through radial distance, direction or receiving a signal from two to three different points and then assessing the exact location by overlapping of the three radial distances. Triangulation in cellular communication is commonly used to pinpoint the exact geographical location of a user.

Triangulation is a method for calculating a position that relies on a known distance between two measuring apparatuses and the measured angles from those two points to an object. This works using the angle-side-angle triangle congruency theorem to the find the location of an object.

Triangulation is widely used in wireless mobile communication to find the location of a cell phone user. Triangulation is utilized in cruise navigation, radar systems, GPS systems in vehicles and other such mobile devices. A triangulation mechanism can be affected by the presence of steel structures, water towers, communication posts and signal jammers. Using two or more points to determine the location of radio transmitter or cell phone user give much more reliable results than relying on just one.

## 2.5 Mobile Client Software- Mobile Device Operating Systems, Micro Browsers

**Q12. What is Mobile Operating System?**

*Ans :*

A mobile operating system allows the user to run other different application software on the mobile, tablets, etc. Moreover, we can say that it is a type of operating system which is specially designed for mobiles, tablets, smartwatches, etc. Furthermore, they are a mixture of computer OS with some additional features for mobiles. Also, they are comparatively light and simple.

An operating system (OS) is a program that acts as an interface between the system hardware and the user. Moreover, it handles all the interactions between the software and the hardware.

**Q13. List out various most popular platforms of the mobile operating system.**

*Ans:* **(Imp.)**

**1. Android OS**

The Android operating system is the most popular operating system today. It is a mobile OS based on the Linux Kernel and open-source software. The android operating system was developed by Google. The first Android device was launched in 2008.

**2. Bada (Samsung Electronics)**

Bada is a Samsung mobile operating system that was launched in 2010. The Samsung wave was the first mobile to use the bada operating system. The bada operating system offers many mobile features, such as 3-D graphics, application installation, and multipoint-touch.

**3. BlackBerry OS**

The BlackBerry operating system is a mobile operating system developed by Research In Motion (RIM). This operating system was designed specifically for BlackBerry handheld devices. This operating system is beneficial for the corporate users because it provides synchronization with Microsoft Exchange, Novell Group Wise email, Lotus Domino, and other business software when used with the BlackBerry Enterprise Server.

**4. iPhone OS / iOS**

The iOS was developed by the Apple in c for the use on its device. The iOS operating system is the most popular operating system today. It is a very secure operating system. The iOS operating system is not available for any other mobiles.

**5. Symbian OS**

Symbian operating system is a mobile operating system that provides a high-level

of integration with communication. The Symbian operating system is based on the java language. It combines middleware of wireless communications and personal information management (PIM) functionality. The Symbian operating system was developed by Symbian Ltd in 1998 for the use of mobile phones. Nokia was the first company to release Symbian OS on its mobile phone at that time.

**6. Windows Mobile OS**

The window mobile OS is a mobile operating system that was developed by Microsoft. It was designed for the pocket PCs and smart mobiles.

**7. Harmony OS**

The harmony operating system is the latest mobile operating system that was developed by Huawei for the use of its devices. It is designed primarily for IoT devices.

**8. Palm OS**

The palm operating system is a mobile operating system that was developed by Palm Ltd for use on personal digital assistants (PADs). It was introduced in 1996. Palm OS is also known as the Garnet OS.

**9. WebOS (Palm/HP)**

The WebOS is a mobile operating system that was developed by Palm. It based on the Linux Kernel. The HP uses this operating system in its mobile and touchpads.

**Q14. What are the functions of Operating System?**

*Ans :*

An operating system performs various tasks. Let us study them. Several functions of OS are:

**1. Memory Management**

It is the management of the main or primary memory. Furthermore, whatever program is executed, it has to be present in the main memory. Therefore, there can be more than one program present at a time. Hence, it is required to manage the memory.

**The operating system**

- Allocates and deallocates the memory.
- Keeps a record of which part of primary memory is used by whom and how much.
- Distributes the memory while multi processing.

**2. Processor Management/Scheduling**

When more than one process runs on the system the OS decides how and when a process will use the CPU. Hence, the name is also CPU Scheduling. The OS:

- Allocates and deallocates processor to the processes.
- Keeps record of CPU status.

**3. Device Management**

The processes may require devices for their use. This management is done by the OS. The OS:

- Allocates and deallocates devices to different processes.
- keep records of the devices.
- Decides which process can use which device for how much time.

**4. File Management**

The files on a system are stored in different directories. The OS:

- keeps records of the status and locations of files.
- Allocates and deallocates resources.

**5. Security**

The OS keeps the system and programs safe and secure through authentication. A user id and password decide the authenticity of the user.

**6. Other Functions**

Some other functions of the OS can be:

- Error detection.

- keeping a record of system performance.
- Communication between different software etc.

**Q15. What are the features of Mobile operating system.**

*Ans :* **(Imp.)**

**Features**

**1. Easy to use**

- The graphics should be attractive.
- The buttons and features should be easy to use. more over, the functionalities should not be very compilicated.
- Features should be powerful and useful.

**2. Good app store**

- An app is one of the basic part of an OS.
- Good and useful apps forms an important part of an OS.
- The apps should be simple and interactive.

**3. Good battery life**

- Power is one of the main requirement of a smartphone.
- They require power for processors sensors etc. Therefore, the battery holds a very important role.
- Smartphones power usage keeps on increasing therefore, a good battery backup is very essential.

**4. Data usage and organization**

- An operating system should focus on controlling the data and network usage. It should keep the limit and requirement in focus.
- Secondly, the organization of data related to to-do lists, calendars, alarms, reminders etc is very important. A good OS should keep this data in a very organized and safe manner. Moreover, the data should be readily and easily available.

**Q16. List out the components of a Mobile Operating System**

*Ans :*

The components of a mobile OS are same as a basic OS. The components are as follows:

**1. Kernel**

A kernel is the core/heart of an OS. It contains all the functions and operations to manage the working of OS.

**2. Process Execution**

The OS executes various process so that the statements will execute and connect the application program to the hardware. Whenever a process executes it uses memory, space and other resources as well.

**3. Interrupt**

Interrupts are basically used be the hardware devices to communicate with the CPU. It is basically a signal which the device generates to request the CPU. Moreover, whenever an interrupt occurs the CPU temporarily stops executing its current process.

**4. Memory Management**

It is the management of the main or primary memory. Furthermore, whatever program is executed, it has to be present in the main memory. Therefore, there can be more than one program present at a time. Hence, it is required to manage the memory.

**The operating system**

- Allocates and deallocates the memory.
- Keeps a record of which part of primary memory is used by whom and how much.
- Distributes the memory while multi-processing.

**5. Multitasking**

It is performing more than one tasks at a time. The OS allows the user to work wit more than one process at a time without any problem.

**6. Security**

The OS keeps the system and programs safe and secure through authentication. A user id and password decide the authenticity of the user.

**7. User Interface**

GUI stands for Graphical User Interface. As the name suggests, it provides a graphical interface for the user to interact with the computer. It uses icons, menus, etc. to interact with the user. Moreover, the user can easily interact by just clicking these items. Therefore, it is very user friendly and there is no need to remember any commands.

**Q17. Define Micro Browser. List out its advantages.**

*Ans :*

A microbrowser, also called a mobile browser or wireless Internet browser, is a web browser designed to be used on a mobile device like a smartphone or tablet. It functions like a traditional web browser, but is optimized for viewing pages on a small screen, and to operate efficiently with limited memory and processing power.

The first microbrowser was called PocketWeb, and it was created in 1994 for Apple's Newton PDA. The first commercial microbrowser, released in 1996, was called Net Hopper.

A microbrowser makes it possible to view a Web page on a mobile phone/gadget. Initially, Web browsers were used to access content and websites from a WAP protocol and supported basic HTML, XML and WDML Web page formats. Some websites also have a mobile version of their site that usually provides the same content, theme and functionality but might have a different layout. Generally, a microbrowser has limited Web page zooming capability, lacks the ability to view dynamic websites and restricts users to only one Web page at a time. Popular Web browsers have a mobile version of their browser such as Opera Mini or Internet Explorer ,Chrome, Firefox, Safari, UC Browser etc.

Following are the advantages of Micro Browsers.

- Speed
- Convenience
- Portability
- Ease in sharing content
- Improved user experience

Often more comfortable and ergonomic browsing experience.

## 2.6 Mobile Device Communication Protocols, WAP, I-Mode

**Q18. What are the basic protocols used in Mobile communication.**

*Ans :* **(Imp.)**

Device that does not need to remain at one place to carry out its functions is a mobile device. So laptops, smartphones and personal digital assistants are some examples of mobile devices. Due to their portable nature, mobile devices connect to networks wirelessly. Mobile devices typically use radio waves to communicate with other devices and networks. Here we will discuss the protocols used to carry out mobile communication.

Mobile communication protocols use multiplexing to send information. Multiplexing is a method to combine multiple digital or analog signals into one signal over the data channel. This ensures optimum utilization of expensive resource and time. At the destination these signals are de-multiplexed to recover individual signals.

These are the types of multiplexing options available to communication channels .

- **FDM (Frequency Division Multiplexing)**

  Here each user is assigned a different frequency from the complete spectrum. All the frequencies can then simultaneously travel on the data channel.

- **TDM (Time Division Multiplexing)**

  A single radio frequency is divided into multiple slots and each slot is assigned to a different user. So multiple users can be supported simultaneously.

- **CDMA (Code Division Multiplexing)**

  Here several users share the same frequency spectrum simultaneously. They are differentiated by assigning unique codes to them. The receiver has the unique key to identify the individual calls.

**(i) GSM**

GSM stands for Global System for Mobile communications. GSM is one of the most widely used digital wireless telephony system. It was developed in Europe in 1980s and is now international standard in Europe, Australia, Asia and Africa. Any GSM handset with a SIM (Subscriber Identity Module) card can be used in any country that uses this standard. Every SIM card has a unique identification number. It has memory to store applications and data like phone numbers, processor to carry out its functions and software to send and receive messages

GSM technology uses TDMA (Time Division Multiple Access) to support up to eight calls simultaneously. It also uses encryption to make the data more secure.

The frequencies used by the international standard is 900 MHz to 1800 MHz However, GSM phones used in the US use 1900 MHz frequency and hence are not compatible with the international system.

**(ii) CDMA**

CDMA stands for Code Division Multiple Access. It was first used by the British military during World War II. After the war its use spread to civilian areas due to high service quality. As each user gets the entire spectrum all the time, voice quality is very high. Also, it is automatically encrypted and hence provides high security against signal interception and eavesdropping.

**(iii) WLL**

WLL stands for Wireless in Local Loop. It is a wireless local telephone service that can be provided in homes or offices. The subscribers connect to their local exchange instead of the central exchange wirelessly. Using wireless link eliminates last mile or first mile construction of network connection, thereby reducing cost and set up time. As data is transferred over very short range, it is more secure than wired networks.

WLL system consists of user handsets and a base station. The base station is connected to the central exchange as well as an antenna. The antenna transmits to and receives calls from users through terrestrial microwave links. Each base station can support multiple handsets depending on its capacity.

**(iv) GPRS**

GPRS stands for General Packet Radio Services. It is a packet based wireless communication technology that charges users based on the volume of data they send rather than the time duration for which they are using the service. This is possible because GPRS sends data over the network in packets and its throughput depends on network traffic. As traffic increases, service quality may go down due to congestion, hence it is logical to charge the users as per data volume transmitted.

GPRS is the mobile communication protocol used by second (2G) and third generation (3G) of mobile telephony. It pledges a speed of 56 kbps to 114 kbps, however the actual speed may vary depending on network load.

**Q19. Explain in detail Mobile Internet Protocol.**

*Ans :* **(Imp.)**

Mobile IP is a communication protocol (created by extending Internet Protocol, IP) that allows the users to move from one network to another with the same IP address. It ensures that the communication will continue without user's sessions or connections being dropped.

**Terminologies**

- **Mobile Node (MN)**

  It is the hand-held communication device that the user caries e.g. Cell phone.

- **Home Network**

  It is a network to which the mobile node originally belongs to as per its assigned IP address (home address).

- **Home Agent (HA)**

  It is a router in home network to which the mobile node was originally connected

- **Home Address**

  It is the permanent IP address assigned to the mobile node (within its home network).

- **Foreign Network**

  It is the current network to which the mobile node is visiting (away from its home network).

- **Foreign Agent (FA)**

  It is a router in foreign network to which mobile node is currently connected. The packets from the home agent are sent to the foreign agent which delivers it to the mobile node.

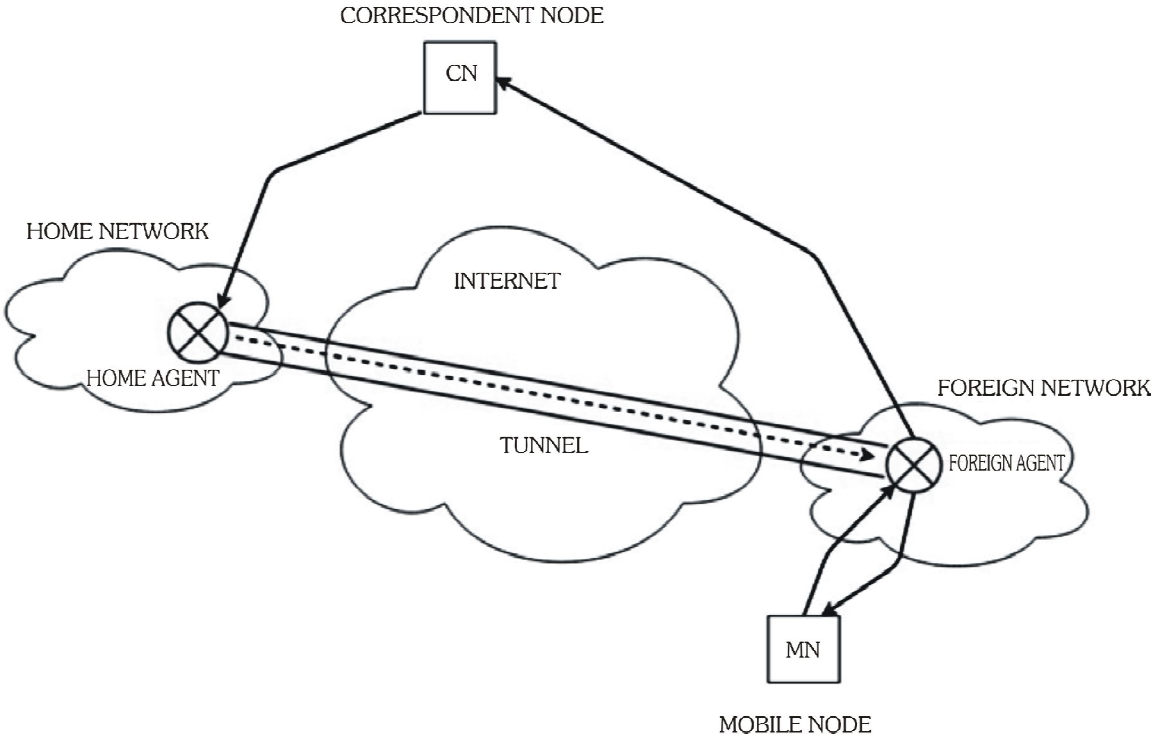
- **Correspondent Node (CN)**

  It is a device on the internet communicating to the mobile node.

- **Care of Address (COA)**

  It is the temporary address used by a mobile node while it is moving away from its home network.





Correspondent node sends the data to the mobile node. Data packets contains correspondent node's address (Source) and home address (Destination). Packets reaches to the home agent. But now mobile node is not in the home network, it has moved into the foreign network. Foreign agent sends the care-of-address to the home agent to which all the packets should be sent. Now, a tunnel will be established between the home agent and the foreign agent by the process of tunneling.

Tunneling establishes a virtual pipe for the packets available between a tunnel entry and an endpoint. It is the process of sending a packet via a tunnel and it is achieved by a mechanism called encapsulation.

Now, home agent encapsulates the data packets into new packets in which the source address is the home address and destination is the care-of-address and sends it through the tunnel to the foreign agent. Foreign agent, on other side of the tunnel receives the data packets, decapsulates them and sends them to the mobile node. Mobile node in response to the data packets received, sends a reply in response to foreign agent. Foreign agent directly sends the reply to the correspondent node.

**Q20. Explain working procedure of Mobile IP.**

*Ans:*

The working of Mobile IP can be described in 3 phases:

**1. Agent Discovery**

Agents advertise their presence by periodically broadcasting their agent advertisement messages. The mobile node receiving the agent advertisement messages observes whether the message is from its own home agent and determines whether it is in the home network or foreign network.

**2. Agent Registration:**

Mobile node after discovering the foreign agent, sends registration request (RREQ) to the foreign agent. Foreign agent in turn, sends the registration request to the home agent with the care-of-address. Home agent sends registration reply (RREP) to the foreign agent. Then it forwards the registration reply to the mobile node and completes the process of registration.

**3. Tunneling:**

It establishes a virtual pipe for the packets available between a tunnel entry and an endpoint. It is the process of sending a packet via a tunnel and it is achieved by a mechanism called encapsulation. It takes place to forward an IP datagram from the home agent to the care-of-address. Whenever home agent receives a packet from correspondent node, it encapsulates the packet with source address as home address and destination as care-of-address.

**Q21. What are the applications of Mobile IP.**

*Ans :*

The mobile IP technology is used in many applications where the sudden changes in network connectivity and IP address can cause problems. It was designed to support seamless and continuous Internet connectivity.

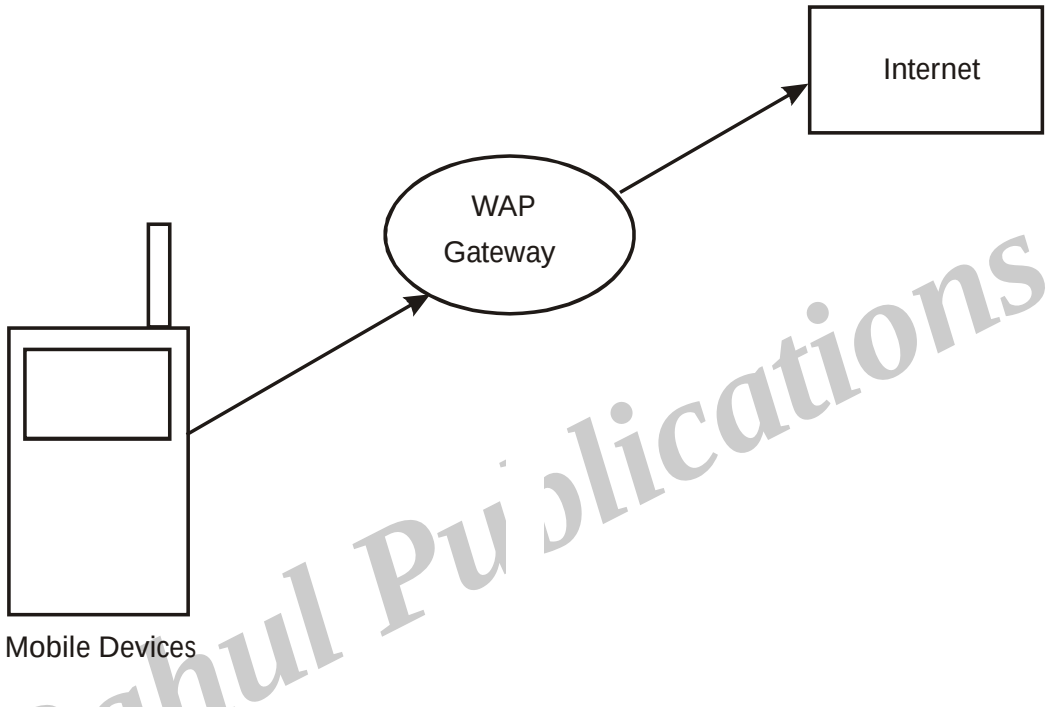
It is used in many wired and wireless environments where users have to carry their mobile devices across multiple LAN subnets.

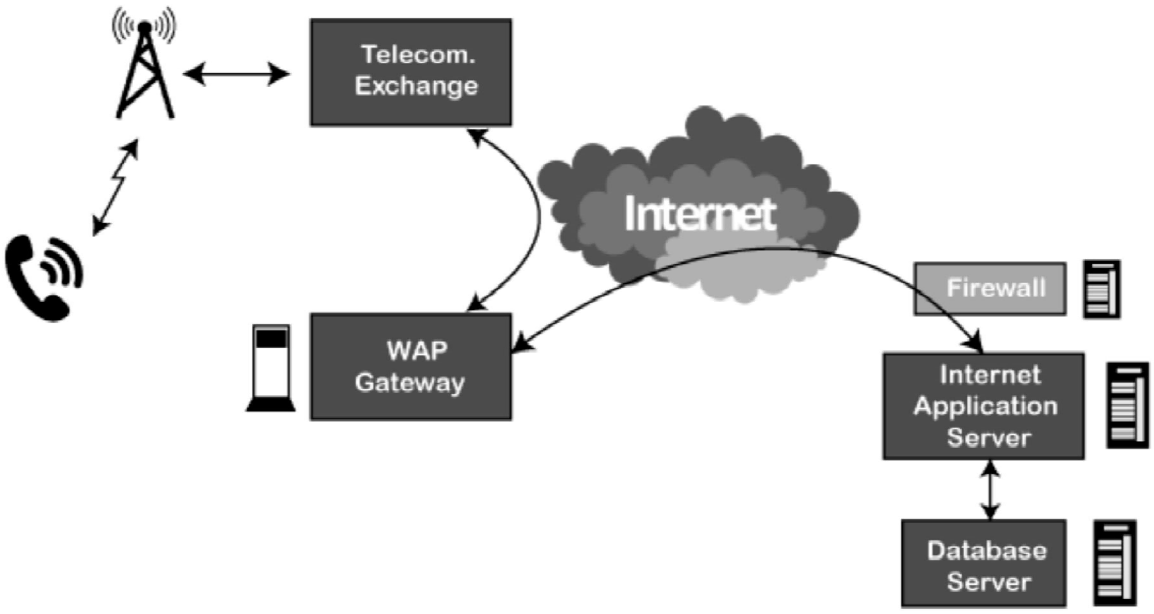
Although Mobile IP is not required within cellular systems such as 3G, it is often used in 3G systems to provide seamless IP mobility between different packet data serving node (PDSN) domains.

**Q22. What is meant by WAP ?**

*Ans :*

WAP stands for Wireless Application Protocol. It is a protocol designed for micro-browsers and it enables the access of internet in the mobile devices. It uses the mark-up language WML (Wireless Markup Language and not HTML). It enables creating web applications for mobile devices. In 1998, WAP Forum was founded by Ericson, Motorola, Nokia and Unwired Planet whose aim was to standardize the various wireless technologies via protocols.



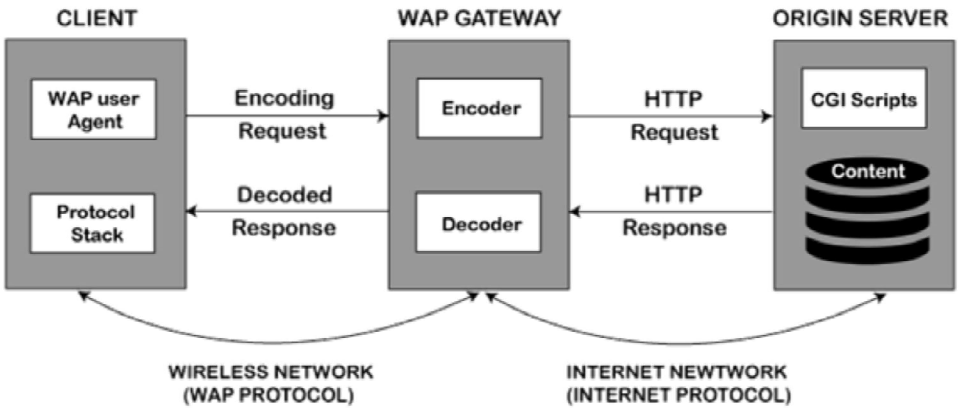



**Q23. Explain Working Procedure of WAP Model.**

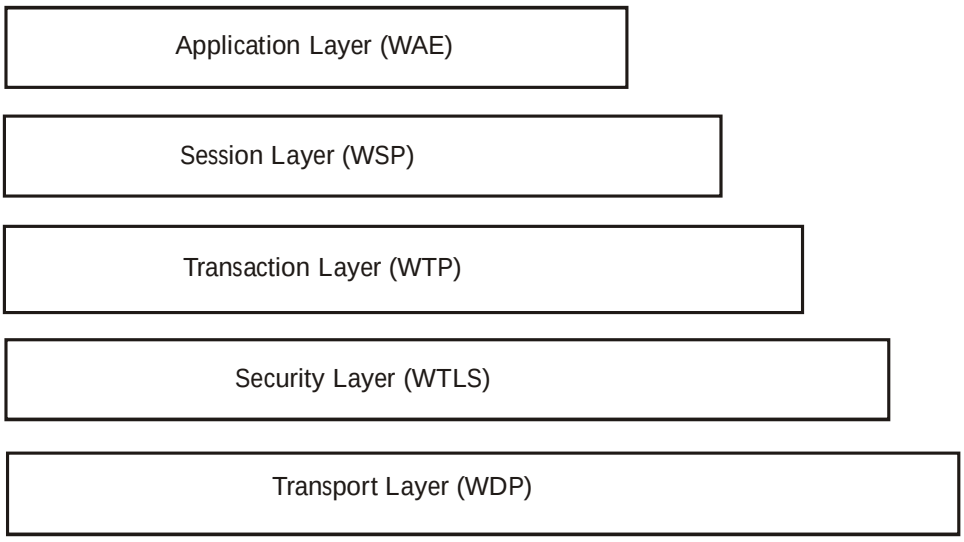
*Ans :* **(Imp.)**

The following steps define the working of Wireless Application Protocol or WAP Model:

- The WAP model consists of 3 levels known as Client, Gateway and Origin Server.
- When a user opens the browser in his/her mobile device and selects a website that he/she wants to view, the mobile device sends the URL encoded request via a network to a WAP gateway using WAP protocol.
- The request he/she sends via mobile to WAP gateway is called as encoding request.
- The sent encoding request is translated through WAP gateway and then forwarded in the form of a conventional HTTP URL request over the Internet.
- When the request reaches a specified Web server, the server processes the request just as it would handle any other request and sends the response back to the mobile device through WAP gateway.
- Now, the WML file's final response can be seen in the browser of the mobile users.




**WAP Protocol stack**



It specifies the different communications and data transmission layers used in the WAP model:

**(i) Application Layer**

This layer consists of the Wireless Application Environment (WAE), mobile device specifications, and content development programming languages, i.e., WML.

**(ii) Session Layer**

The session layer consists of the Wireless Session Protocol (WSP). It is responsible for fast connection suspension and reconnection.

**(iii) Transaction Layer**

The transaction layer consists of Wireless Transaction Protocol (WTP) and runs on top of UDP (User Datagram Protocol). This layer is a part of TCP/IP and offers transaction support.

**(iv) Security Layer**

It contains Wireless Transaction Layer Security (WTLS) and responsible for data integrity, privacy and authentication during data transmission.

**(v) Transport Layer**

This layer consists of Wireless Datagram Protocol (WDP). It provides a consistent data format to higher layers of the WAP protocol stack.

**Q24. List out the advantages of WAP.**

*Ans :*

Following is a list of some advantages of Wireless Application Protocol or WAP:

- WAP is a very fast-paced technology.
- It is an open-source technology and completely free of cost.
- It can be implemented on multiple platforms.
- It is independent of network standards.
- It provides higher controlling options.
- It is implemented near to Internet model.
- By using WAP, you can send/receive real-time data.
- Nowadays, most modern mobile phones and devices support WAP.

**Q25. List out the disadvantages of WAP.**

*Ans:*

Following is a list of some disadvantages of Wireless Application Protocol or WAP:

- The connection speed in WAP is slow, and there is limited availability also.
- In some areas, the ability to connect to the Internet is very sparse, and in some other areas, Internet access is entirely unavailable.
- It is less secured.
- WAP provides a small User interface (UI).

**Q26. What are the applications of WAP ?**

*Ans:*

The following are some most used applications of Wireless Application Protocol or WAP:

- WAP facilitates you to access the Internet from your mobile devices.
- You can play games on mobile devices over wireless devices.
- It facilitates you to access E-mails over the mobile Internet.
- Mobile hand-sets can be used to access timesheets and fill expenses claims.
- Online mobile banking is very popular nowadays.
- It can also be used in multiple Internet-based services such as geographical location, Weather forecasting, Flight information, Movie & cinema information, Traffic updates etc. All are possible due to WAP technology.

**Q27. What is the use of i-Mode ?**

*Ans :*

(i) i-Mode, stands for Internet Mode is a microbrowser technology that supports text, graphics, audio, and video for Web access over the cellular network.

(ii) i-Mode is one of the most successful services offering wireless web browsing and e-mail services from mobile phones in Japan.

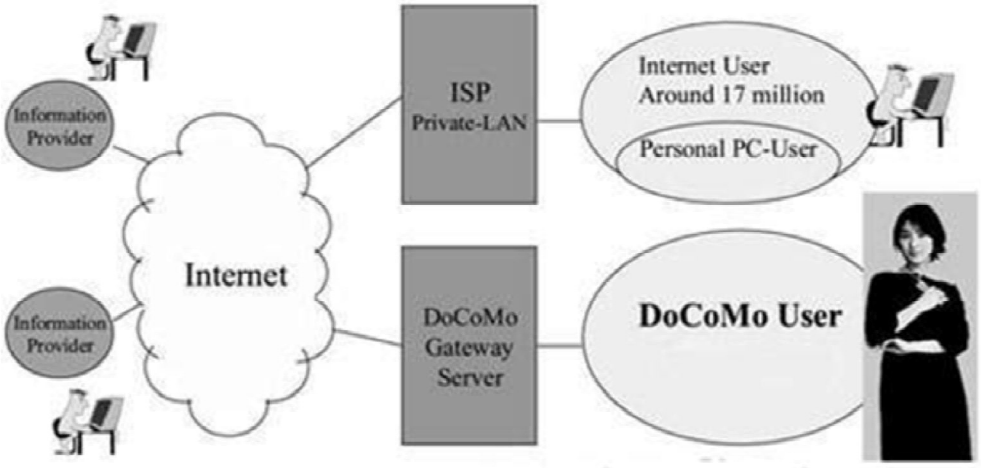
(iii) i-Mode provides packet-data transmission, which enables operators to charge their customers according to the volume of data transmitted and users do not pay for the time they are connected to a website or service.

(iv) Transmission between the handhelds and the i-Mode-enabled cell sites is via packet mode, using packets of 128 octets at high-speed data transmission rates.

There are essentially four main components that are required for the i-Mode service. They are as follows :

- A cellular phone capable of voice and packet communication and with a browser installed.
- A packet network.
- An i-mode server.
- Information providers.

The following picture depicts a very broad overview of i-mode concept



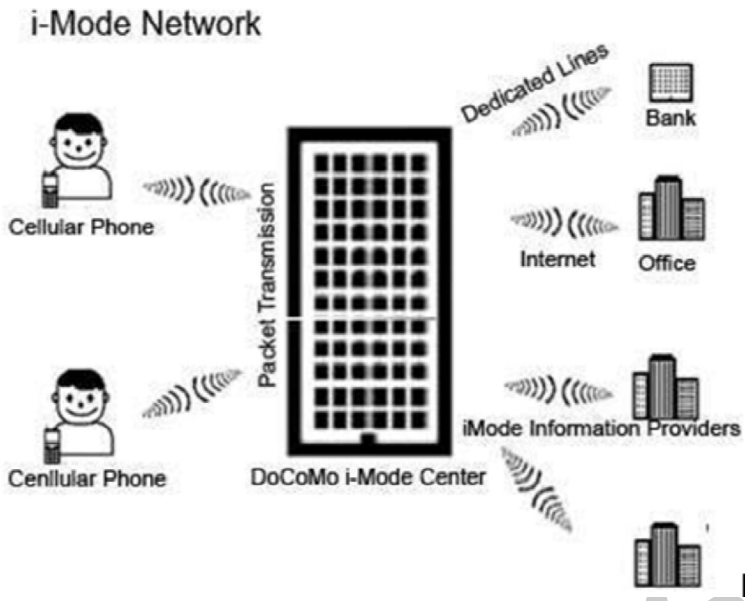

(source: MPT of Japan)

**Q28. Discuss in detail about i-Mode Network structure.**

*Ans :*

i-Mode Networks utilize two types of computers - servers and clients. Servers are the computers that hold information and they are called DoCoMo i-Mode Centers. Clients are the computers that we view the information and they are cellular i-Mode phone.

The following image shows the i-Mode Network structure diagram-




There are two other important components involved in connecting to a wireless network. In order to connect a cellular network to a server, a gateway must exist. Also, the web site must be in an i-Mode format.

**(i) i-Mode Gateway**

An i-Mode gateway translates wireless requests from a mobile phone to the server and sends information from a gateway back to the mobile phone.

NTT DoCoMo provides a gateway to their users and connects them to i-Mode enabled websites.

**(ii) i-Mode Enabled Sites**

An i-Mode enabled website utilizes pages that are written in C-HTML. The transmission between the handhelds and the i-Mode-enabled cell sites takes place via packet mode using packets of 128 octets at high speed data transmission rates.

An i-Mode phone utilizes a micro-browser to browse i-Mode enabled site. These phones usually have a title bar with icons at the top of an LCD screen. These icons then allow users to access various services such as weather forecasts, transportation schedules, data searches, news updates, etc.

**Q29. List out the services of i-Mode.**

*Ans :*

The highly convenient functions offered by i-mode are enriching our lifestyles by crossing the conventional boundaries of mobile phone functions.

Some of the services that are now available with i-mode include game playing, video viewing and convenient access to the latest news and weather forecasts.

**(i) i-appli: i-mode with Java**

This service group consists of software (programs) used with i-mode compatible mobile phone terminals. Downloading the software makes it possible to automatically update the news and weather forecast displays as well as to play new games.

**(ii) i-area: Location Based Service**

This is DoCoMo's location information service. The i-area service enables the user to check the weather forecast, traffic and store information, and other convenient information for local areas as well as the map information to the user's current location.

**(iii) i-motion : Dynamic Video Content**

This feature refers to video distribution programs for i-mode mobile phone terminals and the contents. The high-speed packet communication of FOMA entertains users with the latest movie theatre information and details of the sports highlights available in video.

**(iv) i-motion mail**

This service transfers video captured with an i-motion compatible mobile phone via e-mail. It features a transmission speed of up to 15 frames/sec, thus permitting smooth motion video to be enjoyed on a mobile phone.

**(v) i-shot : Digital Camera Capability**

A function that supports transfer of still images captured with an i-mode compatible phone. The images may also be sent to mobile phones of other carriers and PCs.

**(vi) i-channel**

This service distributes the latest news, weather forecasts, and other information to i-channel compatible i-mode phones. The information is displayed on a standby screen without any special operation and users can access more detailed information by pressing a button.

## 2.7 MOBILE DEVICE PAGE DESCRIPTION LANGUAGES

**Q30. Explain in detail about Page description languages.**

*Ans :* **(Imp.)**

Page description language is a type of computer language used primarily for the printing industry. Computers are generally connected to large printing machines, and by using a specialized language for both devices to communicate, efficiency in setting and printing materials is greatly increased. There are a wide variety of description languages, but the most common is Adobe, PostScript.

Although many page description language varieties are detailed enough to be considered programming languages, a large portion of them are not. These are known as markup languages. Similar to hypertext markup language (HTML), page description markup languages are capable of speaking to a limited number of programs. Just as HTML is used primarily to speak with web browsers, most page description language varieties can be read by a particular machine, program, or computer.

Page description languages are often created using binary or textual commands. In the case of a binary language, graphical and textual formatting are turned into a series of ones and zeros using the description language. This code is sent to the printer and then transferred back into a visual graphic as it is printed. Binary codes are the same ones used by every computer. When a command is typed into a keyboard, for example, a series of ones and zeros representing the key tells the computer what to do.

The main purpose for using a description language is to better communicate various aspects of a printed material from a computer to a printing machine. Text and graphics are laid out on a computer screen, but using only output bitmaps limits the amount of information that can be received by a printer. Using a page description language relays more information, faster.

The benefits of using page description languages include higher quality materials and more efficient printing. Since information is better received by a printer using page description languages, the color, layout, and resolution is often of a better quality than they would be if the same item were printed without them. These languages can also instruct printers on the quantity of materials to be printed.

## 2.8 Mobile Device Application Software

**Q31. What is Mobile Application?**

*Ans :*

A mobile application, most commonly referred to as an app, is a type of application software designed to run on a mobile device, such as a smartphone or tablet computer. Mobile applications frequently serve to provide users with similar services to those accessed on PCs. Apps are generally small, individual software units with limited function. This use of app software was originally popularized by Apple Inc. and its App Store, which offers thousands of applications for the iPhone, iPad and iPod Touch.

A mobile application also may be known as an app, web app, online app, iPhone app or smartphone app.

Mobile applications are a move away from the integrated software systems generally found on PCs. Instead, each app provides limited and isolated functionality such as a game, calculator or mobile web browsing. Although applications may have avoided multitasking because of the limited hardware resources of the early mobile devices, their specificity is now part of their desirability because they allow consumers to hand-pick what their devices are able to do.

The simplest mobile apps take PC-based applications and port them to a mobile device. As mobile apps become more robust, this technique is somewhat lacking. A more sophisticated approach involves developing specifically for the mobile environment, taking advantage of both its limitations and advantages. For example, apps that use location-based features are inherently built from the ground up with an eye to mobile given that the user is not tied to a location, as on PC.

Apps are divided into two broad categories: native apps and web apps. Native apps are built for a specific mobile operating system, usually iOS or Android. Native apps enjoy better performance and a more finely-tuned user interface (UI), and usually need to pass a much stricter development and quality assurance process before they are released.

Web apps are used in HTML5 or CSS and require minimum device memory since they're run through a browser. The user is redirected on a specific web page, and all information is saved on a server-based database. Web apps require a stable connection to be used.

There are several types of apps currently available.

- **Gaming apps**

  The equivalent of computer video games, they are among the most popular types of apps. They account for one-third of all app downloads and three-fourths of all consumer spending.

- **Productivity apps**

  These focus on improving business efficiency by easing various tasks such as sending emails, tracking work progress, booking hotels, and much more.

- **Lifestyle and entertainment apps**

  Increasingly popular, these encompass many aspects of personal lifestyle and socialization such as dating, communicating on social media, as well as sharing (and watching) videos. Some of the most widely known apps such as Netflix, Facebook or TikTok fall into this category.

Other app types include mobile commerce (M-commerce) apps used to purchase goods online such as Amazon or eBay, travel apps that help a traveler in many ways (booking tours and tickets, finding their way through maps and geolocation, travel diaries, etc.), and utility apps such as health apps and barcode scanners.

**Q32. What is application software?**

*Ans :*

Application software is a computer program that performs a specific function, be it educational, personal, or business. It is also known as an end-user program or a productivity program.Application software is developed to assist you with a particular process that may be related to creativity, productivity, or better communication. It helps you

in completing your tasks, be it jotting down notes, completing your online research, setting an alarm, keeping an account log, or even playing games.Application software programs are specific in their functionality and do the job that they are designed to do. For instance, a browser is an application used specifically for browsing the Internet. Similarly, MS PowerPoint is an application designed specifically for making presentations. All the apps that we see on our smartphones are examples of types of application software.

**Q33. Discuss in detail about few of the application software's .**

*Ans :* **(Imp.)**

**1. Presentation software**

Presentation is a type of application software that enables you to represent your thoughts and ideas with ease and clarity by using visual information. It lets you display the information in the form of slides. You can make your slide more informative and engrossing by adding text, images, graphs, and videos. It has three components:

- Text editor to input and format text
- Insert graphics, text, video, and multimedia files
- Slideshow to display the information

**2. Web browsers**

Web browsers are application software used to browse the internet for locating and retrieving data across the web. The most popular web browsers are Google Chrome and Internet Explorer. Other examples of browsers include Firefox, MS Edge, Safari, etc.

**3. Multimedia software**

Multimedia application software lets you create or record images, and create audio or video files. This software is extensively used in animation, graphics, image, and video editing. Popular examples are VLC media player and Windows media player.

**4. Education and reference software**

This application software, also termed as academic software, is specifically designed to facilitate learning of a particular subject. Various kinds of tutorial software are included in this category. Some of these are JumpStart, MindPlay, Moodle, and Kid Pix.

**5. Graphics software**

Graphics application software allows you to edit or make changes in visual data or images. It comprises illustration and picture editor software. Adobe Photoshop and PaintShop Pro are a few examples of graphics software.

**6. Spreadsheet software**

Spreadsheet application software is used to perform calculations. In this software, data is stored in a table format. The intersecting area, called cells, are separated to define fields such as text, date, time, and number. It allows the users to provide formulas and functions to perform calculations. Microsoft Excel and Google Sheets are examples of spreadsheet software.

**7. Database software**

Database application software is used to create and manage a database. Also known as a DBMS (Database Management System), it helps you organize your data. So, when you run an application, data is fetched from the database, modified, and is stored back in the database. Oracle, MySQL, Microsoft SQL Server, PostgreSQL, MongoDB, and IBM Db2 are some of the popular databases.

**8. Word processing software**

Word processing application software is used to format and manipulate text, thus, creating memos, letters, faxes, and documents. Word processing software is also used to format and beautify the text. It provides you a whole lot of features, including thesaurus, synonyms and antonyms. Along with Word Art features, the font option lets you change font color, effect, and style as per your choice. Grammar and spell check options are also available to check for errors. Leading examples include G Doc and Microsoft Word Doc.

**9. Simulation software**

Simulation application software is used in the fields of military engineering, practical education in certain industries, machinery testing, industrial training, video games, etc. It is used where work on the actual system or physical environment can be hazardous.

**Q34. List out various functions of application softwares.**

*Ans :*

Application software programs are designed to facilitate a large number of functions. Some of these include:

- Data and information management
- Document management (document exchange systems)
- Visuals and video development
- Emails, text messengers, audio and video chats, and collaboration
- Accounting, finance, and payroll management
- Resource management (ERP and CRM systems)
- HR management such as hiring, on-boarding, and separation
- Project management
- Business process management
- Educational software (LMS and e-learning systems)
- Healthcare application software

# Short Question and Answers

**1. What is a mobile client.**

*Ans :*

A mobile client is a technology designed to extend the features of a company's mobile telephone system. The technology makes it easier for employees to:

- Separate personal and business communications while using one smartphone
- Manage business calls while out of the office
- Transition smoothly from using a company desktop computer to a mobile device

A mobile client is designed to make it easier to integrate portable devices into a company's communication workflows.

A mobile client is invaluable if your company has a largely mobile workforce, or if has a team structure where people shift dynamically across mobile and desktop devices. Using this technology, your people can easily keep track of their communications, and your customers and clients will be presented with a unified and consistent corporate face.

**2. Hybrid Devices**

*Ans :*

Hybrid devices refer to the computers manufactured with functionalities of multiple devices that have similar features. Hybrid devices are commonly available in the form of combination devices with the functionalities of laptop and tablet computers. They are accessible in both detachable and convertible forms. The convertible hybrid devices can be transformed onto a tablet by rotating, sliding or folding the keyboard within or behind the frame of the system. The detachable variants can disengage their keyboard and operate as lightweight tablet personal computers (PC). These devices also consist of additional accessories, processors, sensors and storage space for effective cloud management and orchestration, disaster recovery and hybrid hosting. As a result, they find extensive applications across various industries, including education, banking, financial services and insurance (BFSI), telecommunication, manufacturing and transportation.

**3. Vehicle mounted Devices.**

*Ans :*

Vehicle-mounted devices or Vehicle-mounted computers are digital devices that are designed to perform multiple business-specific operations while being attached or mounted to vehicles. These vehicles can vary, from full-fledged trucks and logistics vehicles to forklifts used in complex warehouse environments, factory floors, and manufacturing units.

Vehicle-mounted devices are needed to perform accurate and quick operations, calculations and logging, making the job of frontline workers and field-forces more efficient and error-free.

Vehicle-mounted devices are rugged devices designed to perform in harsh weather and extreme environmental conditions including shocks and vibrations. Vehicle-mounted devices are deployed for heightened productivity, to ensure that the mobile workforce or field-force is always supplied with the latest data and information, can compute precise results leaving no room for human error and manage large-scale inventories with efficiency.

**4. Location Tracking .**

*Ans :*

Location tracking refers to technologies that physically locate and electronically record and track the movement of people or objects. Location tracking technology is in use every day with GPS navigation, locations located on digital pictures and searching for businesses nearby using common apps. While location tracking is often associated with smartphone use since smartphones have a GPS chip, there are other ways location tracking is done.

The Global Positioning System (GPS) is location tracking technology that uses data from 24 satellites orbiting the earth. A GPS satellite calculates location by timing how long it takes a radio signal

traveling to reach either a fixed or mobile tracking device on earth such as a GPS navigation device built into your car or a smartphone with a GPS chip.

Using multiple satellites, a GPS device can identify it's longitude and latitude location and display the information to the person using the device or send the information to a software app or program. A common everyday example is a use of Internet and mobile map applications on smartphones that can calculate your current position using your GPS location and show where you're located on a map. Because your location coordinates are sent to a map application, your location is now known by the application, which is location tracking.

**5. GPS**

*Ans :*

The Global Positioning System is an array of satellites that exist solely to help find things across the planet. Any device with a GPS receiver (which includes most smartphones) can ping the satellites with that receiver. This will cause it to communicate with at least four satellites, and the satellites can compare the signal delay to pinpoint where the signal originated. This allows your phone to know exactly where you are and provide turn-by-turn navigation. A common business use case is GPS fleet tracking software, which businesses use to remotely keep tabs on their company vehicles and their drivers' performance.

**6. Wi-Fi**

*Ans :*

Wi-Fi location tracking is a bit different from other methods. Typically, a device only connects to one Wi-Fi network at a time. This eliminates the possibility of triangulation. Instead, this form of location tracking uses IP addresses. Every network has a physical IP address that allows the greater internet to know where it is. This is necessary for it to accurately send information across internet infrastructure. When your phone connects to a Wi-Fi network, it pairs with the physical IP of that network. That allows location services to know your current address.

**7. RFID**

*Ans :*

RFID tracking is effectively a combination of these other methods. The RFID scanner typically has a static location. When it pings off of other networks, the location of the scanner can be logged. When the RFID scanner is activated, it can tag its location when it records the access. This can identify the location of the device accessing the scanner.

**8. Triangulation.**

*Ans:*

**Meaning**

Triangulation is the process of determining the exact location of a radio transmitter. This can be done using various techniques such as through radial distance, direction or receiving a signal from two to three different points and then assessing the exact location by overlapping of the three radial distances. Triangulation in cellular communication is commonly used to pinpoint the exact geographical location of a user.

Triangulation is a method for calculating a position that relies on a known distance between two measuring apparatuses and the measured angles from those two points to an object. This works using the angle-side-angle triangle congruency theorem to the find the location of an object.

**9. What is Mobile Operating System?**

*Ans :*

A mobile operating system allows the user to run other different application software on the mobile, tablets, etc. Moreover, we can say that it is a type of operating system which is specially designed for mobiles, tablets, smartwatches, etc. Furthermore, they are a mixture of computer OS with some additional features for mobiles. Also, they are comparatively light and simple.

An operating system (OS) is a program that acts as an interface between the system hardware and the user. Moreover, it handles all the interactions between the software and the hardware.

**10. Define Micro Browser. List out its advantages.**

*Ans :*

A microbrowser, also called a mobile browser or wireless Internet browser, is a web browser designed to be used on a mobile device like a smartphone or tablet. It functions like a traditional web browser, but is optimized for viewing pages on a small screen, and to operate efficiently with limited memory and processing power.

The first microbrowser was called PocketWeb, and it was created in 1994 for Apple's Newton PDA. The first commercial microbrowser, released in 1996, was called Net Hopper.

A microbrowser makes it possible to view a Web page on a mobile phone/gadget. Initially, Web browsers were used to access content and websites from a WAP protocol and supported basic HTML, XML and WDML Web page formats.

**11. What is meant by WAP ?**

*Ans :*

WAP stands for Wireless Application Protocol. It is a protocol designed for micro-browsers and it enables the access of internet in the mobile devices. It uses the mark-up language WML (Wireless Markup Language and not HTML). It enables creating web applications for mobile devices. In 1998, WAP Forum was founded by Ericson, Motorola, Nokia and Unwired Planet whose aim was to standardize the various wireless technologies via protocols.

**12. What are the applications of WAP ?**

*Ans:*

The following are some most used applications of Wireless Application Protocol or WAP:

- WAP facilitates you to access the Internet from your mobile devices.
- You can play games on mobile devices over wireless devices.
- It facilitates you to access E-mails over the mobile Internet.
- Mobile hand-sets can be used to access timesheets and fill expenses claims.
- Online mobile banking is very popular nowadays.
- It can also be used in multiple Internet-based services such as geographical location, Weather forecasting, Flight information, Movie & cinema information, Traffic updates etc. All are possible due to WAP technology.

# Choose the Correct Answers

1. The mobile phone is an invention of an American engineer named as [ d ]

   (a) Sir Philo Taylor Farnsworth (b) Sir Thomas Edison

   (c) Sir Igory Sikorsky (d) Sir Martin Cooper

2. In which one of the following year Mobile phones were invented? [ a ]

   (a) 1973 (b) 1952

   (c) 1930 (d) 1927

3. In which one of the following countries, the first phone call was made? [ a ]

   (a) New York (b) Spain

   (c) France (d) Italy

4. Which of the following is not an OS for mobile? [ a ]

   (a) Palm (b) Windows

   (c) Mango (d) Android

5. _____ is the protection of smart-phones, phablets, tablets, and other portable tech-devices, & the networks to which they connect to, from threats & bugs. [ d ]

   (a) OS Security (b) Database security

   (c) Cloud security (d) Mobile security

6. Mobile security is also known as _____. [ b ]

   (a) OS Security (b) Wireless security

   (c) Cloud security (d) Database security

7. Which of the following tool is used for Blackjacking? [ b ]

   (a) BBAttacker (b) BBProxy

   (c) Blackburried (d) BBJacking

8. Which of the following is not a security issue for PDAs? [ a ]

   (a) Password theft (b) Data theft

   (c) Reverse engineering (d) Wireless vulnerability

9. Android is _____. [ a ]

(a) an operating system (b) a web browser

(c) a web server (d) None of the above

10. Under which of the following Android is licensed? [ c ]

(a) OSS (b) Sourceforge

(c) Apache/MIT (d) None of the above

# Fill in the Blanks

1. A _____ is a technology designed to extend the features of a company's mobile telephone system.
2. A _____ is a wireless handheld device that allows users to make and receive calls.
3. _____ is a term for a small, mobile, handheld device that provides computing and information storage and retrieval capabilities for personal or business use,
4. A _____ may be a pc that will be easily carried to a variety of locations. It's also called a transportable pc.
5. _____ is the front-end application view to which user interacts in order to use the software.
6. _____ devices refer to the computers manufactured with functionalities of multiple devices that have similar features.
7. _____ refers to technologies that physically locate and electronically record and track the movement of people or objects.
8. The _____ is location tracking technology that uses data from 24 satellites orbiting the earth.
9. _____ tracking is effectively a combination of these other methods.
10. _____ works much like GPS. Instead of connecting to satellites, though, your device is connecting to cellular towers.
11. _____ is a method for calculating a position that relies on a known distance between two measuring apparatuses and the measured angles from those two points to an object.
12. A _____ allows the user to run other different application software on the mobile, tablets, etc.
13. GSM stands for _____.
14. CDMA stands for _____.



**ANSWERS**

1. Mobile client
2. Mobile phone
3. Personal digital assistant
4. Laptop
5. User interface
6. Hybrid
7. Location tracking
8. Global Positioning System
9. Cellular tracking
10. RFID
11. Triangulation
12. Mobile operating system
13. Global System for Mobile Communications
14. Code Division Multiple Access

# One Mark Answers

**1. GPS**

*Ans:*

The Global Positioning System is an array of satellites that exist solely to help find things across the planet.

**2. Wi-Fi**

*Ans:*

Wi-Fi location tracking is a bit different from other methods. Typically, a device only connects to one Wi-Fi network at a time. This eliminates the possibility of triangulation.

**3. RFID**

*Ans:*

RFID tracking is effectively a combination of these other methods. The RFID scanner typically has a static location. When it pings off of other networks, the location of the scanner can be logged. When the RFID scanner is activated, it can tag its location when it records the access.

**4. Triangulation**

*Ans:*

Triangulation is the process of determining the exact location of a radio transmitter. This can be done using various techniques such as through radial distance, direction or receiving a signal from two to three different points and then assessing the exact location by overlapping of the three radial distances.

**5. Microbrowser**

*Ans:*

A microbrowser, also called a mobile browser or wireless Internet browser, is a web browser designed to be used on a mobile device like a smartphone or tablet.

UNIT III

**WIRELESS COMMUNICATIONS TECHNOLOGY**

**Wireless wide area network (WWAN) technology:** cellular systems 2G (CDMA, TDMA, GSM), 2.5G (GPRS, EDGE), 3G (WCDMA/UMTS, CDMA2000), 4G, 5G. Wireless local area network (WLAN) technology (wi-fi), Wireless metropolitan area network (WMAN) technology (WIMAX) Wireless personal area network (WPAN) technology (Bluetooth).

## 3.1 WIRELESS WIDE AREA NETWORK (WWAN) TECHNOLOGY

**Q1. Give a brief overview of wireless wide area network.**

*Ans :*

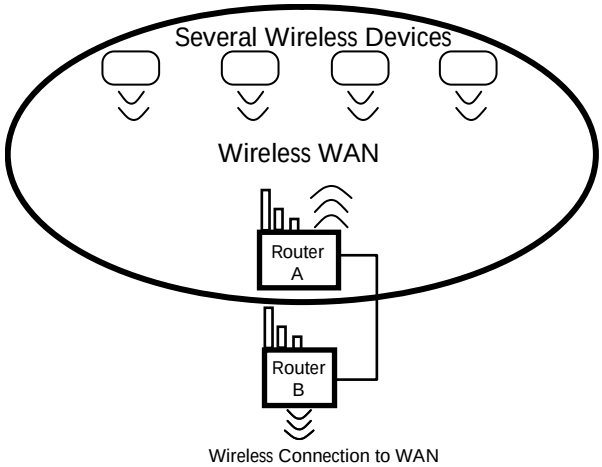
WWAN (Wireless Wide Area Network) is a WAN (Wide Area Network) and the only thing is that the connectivity is wireless. It provides regional, nationwide and global wireless coverage. Where Wide Area Network can be wired or wireless the Wireless Wide Area Network connections are completely wireless. In our day today life we are using the Wireless Wide Area Network of different sizes and depending on it delivery of telephonic calls, Web pages and streaming video, data sharing occurs.

WLAN (Wireless Local Area Network) differs from WWAN (Wireless Wide Area Network) technology wise for example when WLAN uses WiFi to connect and transfer data, WWAN uses telecommunication cellular network technologies such as 2G, 3G, 4G LTE, and 5G to transfer data.

WWAN not only always refers to a wide area rather a closed area with large geographic coverage is also considered as WWAN. For example a MANET (Mobile ad hoc networks) with nodes on buildings and towers or planes. A Low Power and low bit rate Wireless Wide Area Network (LPWAN) is also considered as WWAN. For example transmission of small packets of information between things in case of IoT (Internet of Things) implemented applications.

A general example of WWAN which we use in our daily life is a laptop installed with WWAN card establishes a secure and fastest connection and brings us to online so that we do our work from anywhere.

The below figure illustrates the wireless connection to Wide Area Network.



In the above figure, several wireless devices are configured with the WLAN (Wireless Local Area Network) served by the Router-A and Router-B is a wireless router which connects to Router-A through ethernet and connected to the WAN (Wide Area Network) wirelessly flashed with DD-WRT.

**Families of WWAN**

The main three families of WWAN technologies include

1. GSM/UMTS
2. WiMAX
3. CDMA One/CDMA2000

**Characteristics of WWAN**

1. Reduced transmission speed as compared to physical connection.
2. It is based on IEEE 802.16 standards.
3. On increase of distance, decrease of throughput occurs and vice versa.
4. Getting faster due to Gigabit-Class LTE.

**Q2. List out the advantages and disadvantages of WWAN.**

*Ans :*

**Advantages of WWAN**

- Global wireless coverage
- Flexible with cloud management, deploying and relocating
- Better security than WLAN
- Diverse, cost effective backup for data applications.
- Quick deployment for new applications.

**Disadvantages of WWAN**

- Replacement of lost WWAN may be costly.
- To maintain the reliable network connectivity.
- To build a cost effective solution is a challenge.
- Decreased throughput during large coverage area.

## 3.2 Cellular Systems 2G ( CDMA, TDMA, GSM)

**Q3. What are the features of cellular systems?**

*Ans :*

Cellular network is an underlying technology for mobile phones, personal communication systems, wireless networking etc. The technology is developed for mobile radio telephone to replace high power transmitter/receiver systems. Cellular networks use lower power, shorter range and more transmitters for data transmission.

**Features**

Wireless Cellular Systems solves the problem of spectral congestion and increases user capacity. The features of cellular systems are as follows:

- Offer very high capacity in a limited spectrum.
- Reuse of radio channel in different cells.
- Enable a fixed number of channels to serve an arbitrarily large number of users by reusing the channel throughout the coverage region.
- Communication is always between mobile and base station (not directly between mobiles).
- Each cellular base station is allocated a group of radio channels within a small geographic area called a cell.
- Neighboring cells are assigned different channel groups.
- By limiting the coverage area to within the boundary of the cell, the channel groups may be reused to cover different cells.
- Keep interference levels within tolerable limits.
- Frequency reuse or frequency planning.
- Organization of Wireless Cellular Network.

**Q4. How data communication is possible In cellular networks?**

*Ans :*

The coverage area of cellular networks are divided into cells, each cell having its own antenna

for transmitting the signals. Each cell has its own frequencies. Data communication in cellular networks is served by its base station transmitter, receiver and its control unit.

The shape of cells can be either square or hexagon:

**i) Square**

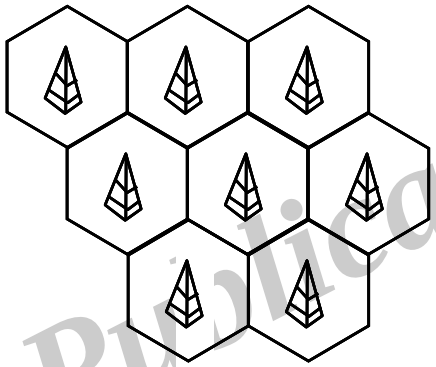
A square cell has four neighbors at distance d and four at distance Root 2 d

- Better if all adjacent antennas equidistant
- Simplifies choosing and switching to new antenna

**ii) Hexagon**

A hexagon cell shape is highly recommended for its easy coverage and calculations. It offers the following advantages:-

- Provides equidistant antennas
- Distance from center to vertex equals length of side



**iii) Frequency Reuse**

Frequency reusing is the concept of using the same radio frequencies within a given area, that are separated by considerable distance, with minimal interference, to establish communication.

Frequency reuse offers the following benefits:

- Allows communications within cell on a given frequency
- Limits escaping power to adjacent cells
- Allows re-use of frequencies in nearby cells
- Uses same frequency for multiple conversations
- 10 to 50 frequencies per cell

For example, when N cells are using the same number of frequencies and K be the total number of frequencies used in systems. Then each cell frequency is calculated by using the formulae K/N.

In Advanced Mobile Phone Services (AMPS) when K = 395 and N = 7, then frequencies per cell on an average will be 395/7 = 56. Here, cell frequency is 56.

**Q5. What is CDMA one? Describe the features and applications of CDMAone.**

*Ans :* **(Imp.)**

CDMAone or IS-95 is a second generation (2G) digital cellular technology that is based on spread spectrum technique that improves channel capacity substantially by accommodating a large number of users in a single transmission channel. It is based on the wireless communication protocol IS-95 and is known by its brand name CDMAone.

It was first developed by Qualcomm in 1995, and is primarily used in North America where it competes with Digital AMPS (IS 136). The data rate of CDMAone is around 300 to 500 Kbps and operates in 1900 MHz band as well as 800 MHz band. The 3G version of CDMAone is known as CDMA2000 which is gradually replacing CDMAone in North America. In India, Reliance offers CDMA service to around 40 million subscribers.

CDMA systems employ a combination of digital transmission and spread spectrum technology. The analog audio (voice) signal is first digitized into binary elements using Analog to Digital Converters (ADC). Next, the frequency of the digital signal is varied according to a definite pattern or code. The modulated digital signal is then transmitted through the wireless medium and at the receiving end the signal is decoded at the receiver with the same code pattern as used in the transmitter. The code pattern is kept secret to maintain the privacy of the signal and also to make it hacker proof. CDMA uses wide bandwidth for the signal, so that they include a large range of frequencies and appear as noise signals and are hard to be intercepted or demodulated by unwanted users. Further, spread spectrum (wide band) signals are difficult to interfere (jam) with than narrowband signals. These two qualities, namely low probability of intercept and anti-jam feature, made spread spectrum most appropriate for military applications. The coding used in spread spectrum systems are pseudo-random in nature which means they are not real (random) Gaussian code, but statistically generated code sequence which can be repeated over and over again. Actually, the spread spectrum signals are intentionally made of much wider band than required to carry the information, in order to make them more noise like so that they become much difficult to intercept and decode.

Another important feature of spread spectrum is that as they are of wide bandwidth, they transmit at a much lower spectral power density (of the order of watts per Hertz) than narrow band signals. This low transmitter power density leads to significant cost cutting. Also, both spread and narrow band signals can be transmitted over the same channel without any significant interference.

Powered by the above advantages of spread spectrum, CDMA systems have emerged as a major 2G cellular system in North America and in a number of other countries and is rapidly evolving into 3G systems, known as CDMA2000 following IX EV-DO standard. Major advantages of using CDMAone systems are as follows:

- Increased communication security
- Low probability of interference with other signals
- Simultaneous multi-user access
- Increased efficiency, as same channel can accommodate more subscribers
- Low power requirement
- Extended coverage to remote areas.

**Q6. What is CDMA? Explain the features of CDMA.**

*Ans :* **(Imp.)**

CDMA technology, predominantly used in North America, is based on IS 95 protocol, first developed by Qualcomm. CDMA differs from FDMA or TDMA in its use of spread spectrum techniques for transmitting voice and data over wireless medium. Instead of dividing RF spectrum into separate user channels by frequency slices (FDMA) or time slots (TDMA), CDMA separates users by assigning them different digital code sequence within the same (wide) frequency spectrum. It ensures increased channel capacity and immunity from interference among different signals. The CDMA standard is developed and maintained by GDMA Development Group (CDG), a consortium of major CDMA manufacturers and operators. CDG's responsibilities include standardization and improvement of CDMA technology towards third generation systems, incorporating IS-95 CDMA air interface and implementing ANSI-41 network standard for switch interconnection.

### Requirements

The three major requirements of CDMA spread spectrum system are as follows:

- The bandwidth of the spread signal must be greater than that necessary to send the information. This reduces chance of interference between different signals and also can accommodate a large number of signals to achieve multi-user access and improved capacity.
- Each information signal in the spread bandwidth is accompanied by a coding sequence which is independent of the information signal. Both the information signal and the coding sequence are sent together from the sender (transmitter) through the wireless medium and are received by the receiver at the receiving end.
- The receiver receives the signal in synchronous mode and recovers original information data from the code sequence and reproduces the information signal. Different code sequences are used for different user signals and it allows the receiver to receive and reproduce multiple signals synchronously using the same frequency band at the same time. In order to protect the signal from tampering during transmission, the code is made pseudo random, i.e. it appears as random, but it is actually deterministic so that the receiver can reconstruct the code for synchronous detection. The pseudo random code is also known as pseudo noise as due to a large number of signals present in the widespread band, the combined signal appears like a noise rather than a focused signal. It makes it hard to intercept a spread spectrum signal compared to a focused narrowband signal.

  The CDMA standard only defines the specifications for the air interface, i.e. the radio link part of the technology. In contrast to GSM standard that defines the total network infrastructure, CDMA allows each network operator to adopt the network structure as they, find suitable. The CDMA technology provides reliable digital systems offering higher capacity, larger coverage area and improved voice quality. It also offers simplified system planning through the use of same frequency in every sector of every cell.

### Features

The main features of CDMA systems are discussed below:

1. **Improved capacity:** CDMA system maximizes spectral efficiency (high data rate transmitted over a given bandwidth) by allowing a large number of signals transmitted through a single 1.25 MHz channel. But, in order to maintain such a high data rate, the signal to noise ratio must be maintained at a satisfactory (high) level to ensure good voice quality. However, in order to improve channel capacity, i.e. maximum number of simultaneous calls handled by the channel, the spectral efficiency must be kept at a low to avoid interference between different calls. Although dynamic power control is performed to maintain a good voice quality to combat the dampening effects due to random variation of external RF environment, signal fading and external interference, a proper balance between spectral efficiency and channel capacity is required to achieve higher number of simultaneous calls and higher data rates in CDMA systems. This is achieved through radio resource management techniques that ensure both high channel capacity as well as high data rate of transmission without adding more radio spectrum or more base station sites.

   CDMA system limits the signal power level to a lower value in order to maintain higher channel capacity. So, the cell size in CDMA networks are kept small, which ensures better coverage in densely populated urban areas.

2. **Soft handover:** Handover is the process by which a call is passed from one cell to another adjacent cell as the user moves between cells. In traditional hard handover, the connection to the current cell is broken first and then the connection to the new cell is made. This is known as break-before-make handover. In CDMA, soft handover is used where the connection to the new cell is made first, and then the connection to the old cell is broken (make-before-break). This reduces the number of dropped cells and ensures a smooth transition between cells. Soft handover requires less power, which reduces interference and helps improving channel capacity.

3. **Roaming:** Major development initiative is taken by CGD for CDMA enhancement to ensure advanced roaming facility that enables transparent roaming between different cellular networks, such as GSM etc., across the globe. It allows users to avail roaming facility with selection of networks and other location based services. Registration, authentication and credit-checking will be performed automatically while the users switch to different networks during their travel. However, prior roaming arrangement between network operators is required to ensure smooth operation across the globe.

4. **Multipath signal handling:** One of the main advantages of CDMA systems is the capability of handling multipath signal to improve signal strength. Multipath signals are reflected signals that arrive in the receiver with different time delays. Narrowband systems, such as FDMA or TDMA cannot discriminate between the original signal and the multipath signals, and hence, resort to equalization method to minimize signal disturbance. CDMA, being a wideband system, receives multipath signals and combines them to make a stronger signal at the receiver. For this purpose, CDMA uses rake receivers which are a set of receivers capable of receiving multipath signals. One of the rake receivers (finger) continuously searches for different multipath signals and after receiving one, feeds th£ signal to other three receivers. The three receivers then demodulate their received signals corresponding to the strong multipath. All the three signals from the receivers (fingers) are then combined to get an even stronger signal at the receiver.

**Q7. List out various advantages and disadvantages of CDMA.**

*Ans :*

**Advantages**

CDMA has a soft capacity. The greater the number of codes, the more the number of users. It has the following advantages:-

- CDMA requires a tight power control, as it suffers from near-far effect. In other words, a user near the base station transmitting with the same power will drown the signal latter. All signals must have more or less equal power at the receiver
- Rake receivers can be used to improve signal reception. Delayed versions of time (a chip or later) of the signal (multipath signals) can be collected and used to make decisions at the bit level.
- Flexible transfer may be used. Mobile base stations can switch without changing operator. Two base stations receive mobile signal and the mobile receives signals from the two base stations.
- Transmission Burst – reduces interference.

**Disadvantages**

The disadvantages of using CDMA are as follows:-

- The code length must be carefully selected. A large code length can induce delay or may cause interference.
- Time synchronization is required.
- Gradual transfer increases the use of radio resources and may reduce capacity.
- As the sum of the power received and transmitted from a base station needs constant tight power control. This can result in several handovers.

**Q8. Discuss overview of TDMA.**

*Ans :*

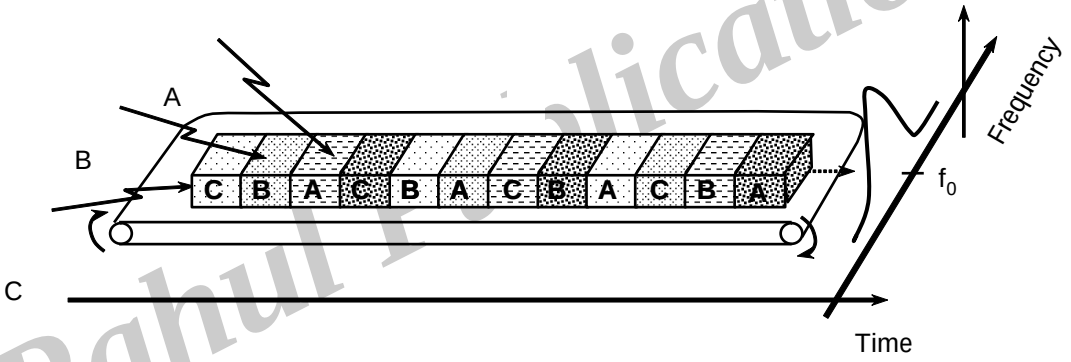
Time Division Multiple Access (TDMA) is a digital cellular telephone communication technology. It facilitates many users to share the same frequency without interference. Its technology divides a signal into different timeslots, and increases the data carrying capacity.

**TDMA Overview**

Time Division Multiple Access (TDMA) is a complex technology, because it requires an accurate synchronization between the transmitter and the receiver. TDMA is used in digital mobile radio systems. The individual mobile stations cyclically assign a frequency for the exclusive use of a time interval.

In most of the cases, the entire system bandwidth for an interval of time is not assigned to a station. However, the frequency of the system is divided into sub-bands, and TDMA is used for the multiple access in each sub-band. Sub-bands are known as carrier frequencies. The mobile system that uses this technique is referred as the multi-carrier systems.

In the following example, the frequency band has been shared by three users. Each user is assigned definite timeslots to send and receive data. In this example, user 'B' sends after user 'A,' and user 'C' sends thereafter. In this way, the peak power becomes a problem and larger by the burst communication.






**Q9. Discuss advantages and disadvantages of TDMA.**

*Ans :*

**Advantages**

Here is a list of few notable advantages of TDMA:

- Permits flexible rates (i.e. several slots can be assigned to a user, for example, each time interval translates 32Kbps, a user is assigned two 64 Kbps slots per frame).
- Can withstand gusty or variable bit rate traffic. Number of slots allocated to a user can be changed frame by frame (for example, two slots in the frame 1, three slots in the frame 2, one slot in the frame 3, frame 0 of the notches 4, etc.).
- No guard band required for the wideband system.
- No narrowband filter required for the wideband system.

**Disadvantages**

The disadvantages of TDMA are as follow:

- High data rates of broadband systems require complex equalization.

- Due to the burst mode, a large number of additional bits are required for synchronization and supervision.
- Call time is needed in each slot to accommodate time to inaccuracies (due to clock instability).
- Electronics operating at high bit rates increase energy consumption.
- Complex signal processing is required to synchronize within short slots.

**Q10. What is GSM Technology?**

*Ans :*

GSM is a mobile communication modem; it stands for global system for mobile communication (GSM). The idea of GSM was developed at Bell Laboratories in 1970. It is a widely used mobile communication system in the world. GSM is an open and digital cellular technology used for transmitting mobile voice and data services operate at the 850MHz, 900MHz, 1800MHz, and 1900MHz frequency bands.

GSM technology was developed as a digital system using the time division multiple access (TDMA) technique for communication purposes. A GSM digitizes and reduces the data, then sends it down through a channel with two different streams of client data, each in its own particular time slot. The digital system has the ability to carry 64 kbps to 120 Mbps of data rates.

**GSM Modem**

There are various cell sizes in a GSM system such as macro, micro, pico, and umbrella cells. Each cell varies as per the implementation domain. There are five different cell sizes in a GSM network macro, micro, pico, and umbrella cells. The coverage area of each cell varies according to the implementation environment.

The time division multiple access (TDMA) technique relies on assigning different time slots to each user on the same frequency. It can easily adapt to data transmission and voice communication and can carry 64 kbps to 120Mbps of data rate.

**Q11. Explain GSM Technology architecture.**

*Ans :*

A GSM network comprises of many functional units. These functions and interfaces are explained in this chapter. The GSM network can be broadly divided into:

- The Mobile Station (MS)
- The Base Station Subsystem (BSS)
- The Network Switching Subsystem (NSS)
- The Operation Support Subsystem (OSS)

**GSM - The Mobile Station**

The MS consists of the physical equipment, such as the radio transceiver, display and digital signal processors, and the SIM card. It provides the air interface to the user in GSM networks. As such, other services are also provided, which include:

- Voice teleservices
- Data bearer services
- The features' supplementary services


The MS Functions

The MS also provides the receptor for SMS messages, enabling the user to toggle between the voice and data use. Moreover, the mobile facilitates access to voice messaging systems. The MS also provides access to the various data services available in a GSM network. These data services include:

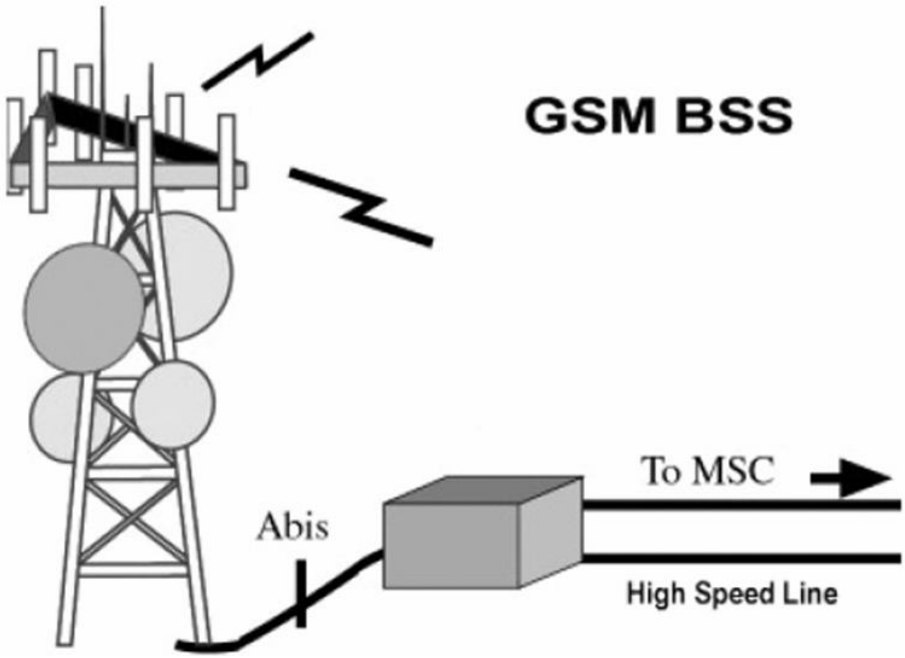
- X.25 packet switching through a synchronous or asynchronous dial-up connection to the PAD at speeds typically at 9.6 Kbps.
- General Packet Radio Services (GPRSs) using either an X.25 or IP based data transfer method at the speed up to 115 Kbps.
- High speed, circuit switched data at speeds up to 64 Kbps.

GSM - The Base Station Subsystem (BSS)

The BSS is composed of two parts:

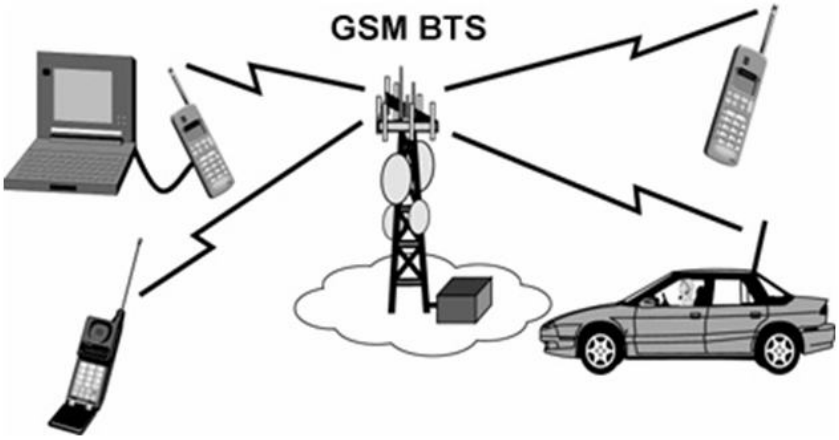
- The Base Transceiver Station (BTS)
- The Base Station Controller (BSC)

The BTS and the BSC communicate across the specified Abis interface, enabling operations between components that are made by different suppliers. The radio components of a BSS may consist of four to seven or nine cells. A BSS may have one or more base stations. The BSS uses the Abis interface between the BTS and the BSC. A separate high-speed line (T1 or E1) is then connected from the BSS to the Mobile MSC.




**The Base Transceiver Station (BTS)**

The BTS houses the radio transceivers that define a cell and handles the radio link protocols with the MS. In a large urban area, a large number of BTSs may be deployed.




The BTS corresponds to the transceivers and antennas used in each cell of the network. A BTS is usually placed in the center of a cell. Its transmitting power defines the size of a cell. Each BTS has between 1 and 16 transceivers, depending on the density of users in the cell. Each BTS serves as a single cell. It also includes the following functions:

- Encoding, encrypting, multiplexing, modulating, and feeding the RF signals to the antenna
- Transcoding and rate adaptation
- Time and frequency synchronizing
- Voice through full- or half-rate services
- Decoding, decrypting, and equalizing received signals
- Random access detection
- Timing advances
- Uplink channel measurements

**The Base Station Controller (BSC)**

The BSC manages the radio resources for one or more BTSs. It handles radio channel setup, frequency hopping, and handovers. The BSC is the connection between the mobile and the MSC. The BSC also translates the 13 Kbps voice channel used over the radio link to the standard 64 Kbps channel used by the Public Switched Telephone Network (PSDN) or ISDN.

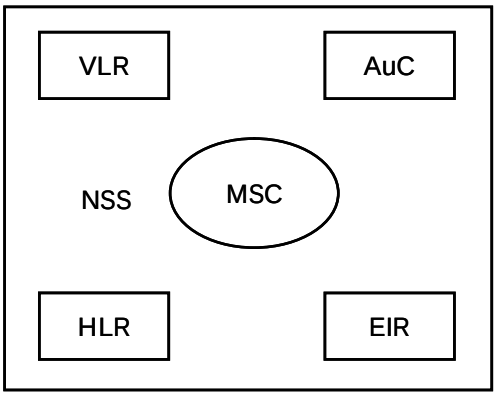
It assigns and releases frequencies and time slots for the MS. The BSC also handles intercell handover. It controls the power transmission of the BSS and MS in its area. The function of the BSC is to allocate the necessary time slots between the BTS and the MSC. It is a switching device that handles the radio resources.

The additional functions include:

- Control of frequency hopping
- Performing traffic concentration to reduce the number of lines from the MSC
- Providing an interface to the Operations and Maintenance Center for the BSS
- Reallocation of frequencies among BTSs
- Time and frequency synchronization
- Power management
- Time-delay measurements of received signals from the MS

### GSM - The Network Switching Subsystem (NSS)

The Network switching system (NSS), the main part of which is the Mobile Switching Center (MSC), performs the switching of calls between the mobile and other fixed or mobile network users, as well as the management of mobile services such as authentication.




The switching system includes the following functional elements:

### Home Location Register (HLR)

The HLR is a database used for storage and management of subscriptions. The HLR is considered the most important database, as it stores permanent data about subscribers, including a subscriber's service profile, location information, and activity status. When an individual buys a subscription in the form of SIM, then all the information about this subscription is registered in the HLR of that operator.

### Mobile Services Switching Center (MSC)

The central component of the Network Subsystem is the MSC. The MSC performs the switching of calls between the mobile and other fixed or mobile network users, as well as the management of mobile services such as registration, authentication, location updating, handovers, and call routing to a roaming subscriber. It also performs such functions as toll ticketing, network interfacing, common channel signaling, and others. Every MSC is identified by a unique ID.

### Visitor Location Register (VLR)

The VLR is a database that contains temporary information about subscribers that is needed by the MSC in order to service visiting subscribers. The VLR is always integrated with the MSC. When a mobile station roams into a new MSC area, the VLR connected to that MSC will request data about the mobile station from the HLR. Later, if the mobile station makes a call, the VLR will have the information needed for call setup without having to interrogate the HLR each time.

### Authentication Center (AUC)

The Authentication Center is a protected database that stores a copy of the secret key stored in each subscriber's SIM card, which is used for authentication and ciphering of the radio channel. The AUC protects network operators from different types of fraud found in today's cellular world.

### Equipment Identity Register (EIR)

The Equipment Identity Register (EIR) is a database that contains a list of all valid mobile equipment on the network, where its International Mobile Equipment Identity (IMEI) identifies each MS. An IMEI is marked as invalid if it has been reported stolen or is not type approved.

### GSM - The Operation Support Subsystem (OSS)

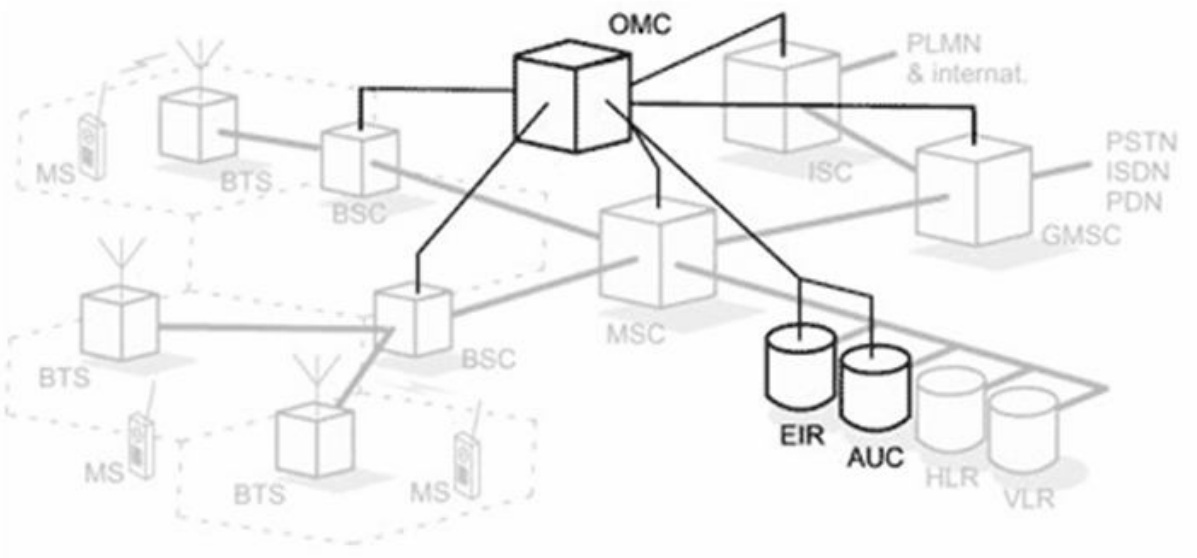
The operations and maintenance center (OMC) is connected to all equipment in the switching system and to the BSC. The implementation of OMC is called the operation and support system (OSS).

Here are some of the OMC functions:

- Administration and commercial operation (subscription, end terminals, charging, and statistics).
- Security Management.
- Network configuration, Operation, and Performance Management.
- Maintenance Tasks.

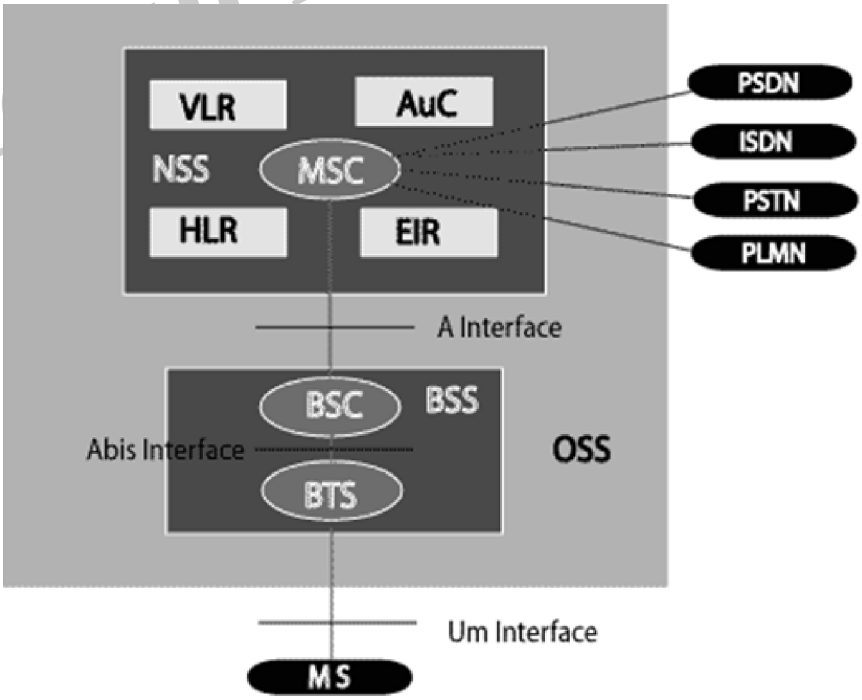
The operation and Maintenance functions are based on the concepts of the Telecommunication Management Network (TMN), which is standardized in the ITU-T series M.30.

Following is the figure, which shows how OMC system covers all the GSM elements.




The OSS is the functional entity from which the network operator monitors and controls the system. The purpose of OSS is to offer the customer cost-effective support for centralized, regional, and local operational and maintenance activities that are required for a GSM network. An important function of OSS is to provide a network overview and support the maintenance activities of different operation and maintenance organizations.

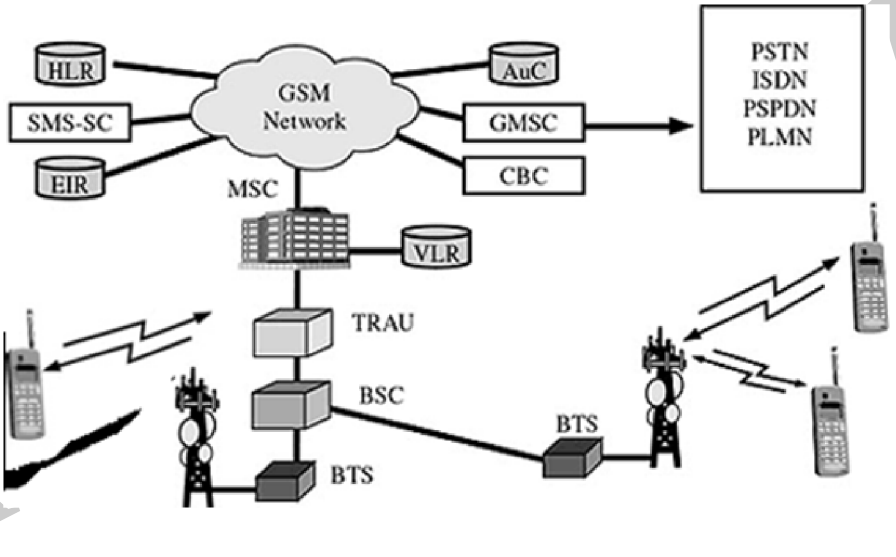
A simple pictorial view of the GSM architecture is given below:



The additional components of the GSM architecture comprise of databases and messaging systems functions:

- Home Location Register (HLR)
- Visitor Location Register (VLR)
- Equipment Identity Register (EIR)
- Authentication Center (AuC)
- SMS Serving Center (SMS SC)
- Gateway MSC (GMSC)
- Chargeback Center (CBC)
- Transcoder and Adaptation Unit (TRAU)

The following diagram shows the GSM network along with the added elements:-




The MS and the BSS communicate across the Um interface. It is also known as the air interface or the radio link. The BSS communicates with the Network Service Switching (NSS) center across the A interface.

**Q12. List out various major applications and features of GSM Technology.**

*Ans :* **(Imp.)**

**Applications**

The applications of GSM technology include the following.

**i) Intelligent GSM Technology for Automation and Security**

These days, the GSM mobile terminal has become one of the items that are constantly with us. Just like our wallet/purse, keys or watch, the GSM mobile terminal provides us a communication channel that enables us to communicate with the world. The requirement for a person to be reachable or to call anyone at any time is very appealing.

This project, as the name says the project is based on GSM network technology for transmission of SMS from sender to receiver. SMS sending and receiving is used for ubiquitous access to appliances and allowing breach control at home. The system proposes two sub-systems. The appliance control subsystem enables the user to control home appliances remotely and the security alert subsystem gives automatic security monitoring.

The system is capable enough to instruct users via SMS from a specific cell number to change the condition of the home appliance according to the user's needs and requirements. The second aspect is that of security alert which is achieved in a way that on the detection of intrusion, the system allows automatic generation of SMS thus alerting the user against security risk.

GSM technology will allow communication anywhere, anytime, and with anyone. The functional architecture of GSM employing intelligent networking principles, and its ideology, which provides the development of GSM is the first step towards a true personal communication system that enough standardization to ensure compatibility.

### ii) GSM Applications in Medical Services

Consider Two Situations like the following

- A person is critically injured or has fallen ill and needs to be immediately taken care of. All he or the person accompanying him has is a mobile phone.
- A patient is discharged from the hospital and thinks of taking rest at his home, but still has to go to the hospital for regular checkups. He may have a mobile phone and also some medical sensor devices like health monitoring devices.

In both situations, the only way which can provide a solution is by using the mobile communication system. In other words, using communication technologies any situation like the above can be handled just by transmitting the patient details through the communication network and receiving them and processing them at the receiver section-either a the healthcare center or at the doctor's home.

The doctor simply monitors the patient details and gives back the instructions to the person (in the 1st case) so that he can at least take some precautions before finally reaching the hospital and in the 2nd case monitors the test results of the patient and in case of any abnormalities, takes the next step for further treatment.

This whole situation is the telemedicine services. The telemedicine system can be used in either of the three ways.

- Using Video conferencing, where patients sitting at one place can have direct interaction with the health care providers and accordingly carry on the curing process.
- By using health monitoring sensors that keep updating about the health of the patient and accordingly guide the health care providers to carry on the treatment.
- By transmitting the acquired medical data and transmit the acquired data for consultation and processing.

**Features**

GSM introduced two new concepts, such as voice digitization and text messaging. It employed data encryption to digital voice or text data to ensure secured data transmission across cellular networks. Based on these concepts, GSM offered a number of features and services. These are as follows:

1. **SIM cards:** Subscriber Identity Module (SIM) is a processor-based smart card that is inserted into GSM phones in order to store user account and other personal information. As soon as the SIM card is plugged in a GSM phone, it becomes activated and starts making/receiving phone calls using the number stored in the SIM card. SIM cards are also programmed to display custom menus offering personalized services, such as SMS, time setting, music/video playing, etc. The user can retain the SIM card while changing the handset, or can change SIM card to switch to a different number/operator.

2. **Phone locking:** Phone locking or SIM card locking is a process by which the network operators restrict the use of the SIM cards (used by their subscribers) only within their network. The network operators provide the SIM cards to their customers, but they become invalid outside their network. If the user wants to use the SIM card in other operator's network, the SIM locking should be removed either by the original operator (for a fee) or by the user through some software. In some countries phones are sold by network operators in locked state. However, in some countries, such as India, Bangladesh, Hong Kong, Malaysia, Pakistan, etc., all the cell phones are sold unlocked.

3. **Short Messaging Service (SMS):** Short Messaging Service (SMS) is a unique feature oFGSM that achieved immense popularity among users and is sometimes termed as the Killer Application of GSM. SMS is a bi-directional data service that allows mobile users to send/receive short alphanumeric (up to 160 characters) text messages from their mobile devices. SMS operates in store-and-forward mode and can be used in point-to- point mode or in cell broadcast mode for bulk message delivery. The messages are sent using Mobile Application Part (MAP) protocol and are stored in a centralized message centre called SMSC (Short Message Service Centre). SMSC acts as a gateway to external systems, such as internet or other mobile networks to forward SMS feeds for delivery. Apart from SMS, GSM supports other supplementary call services such as call forwarding, call waiting, caller identification, three-way conversations and call barring.

4. **GSM handover:** Handover refers to the process by which a mobile phone is switched from one channel frequency to another during the progress of a call. As the mobile user travels from one geographic location to another, he leaves one cell site and enters a new one. Accordingly, the mobile device is assigned a new channel frequency corresponding to the base station of the new cell site.

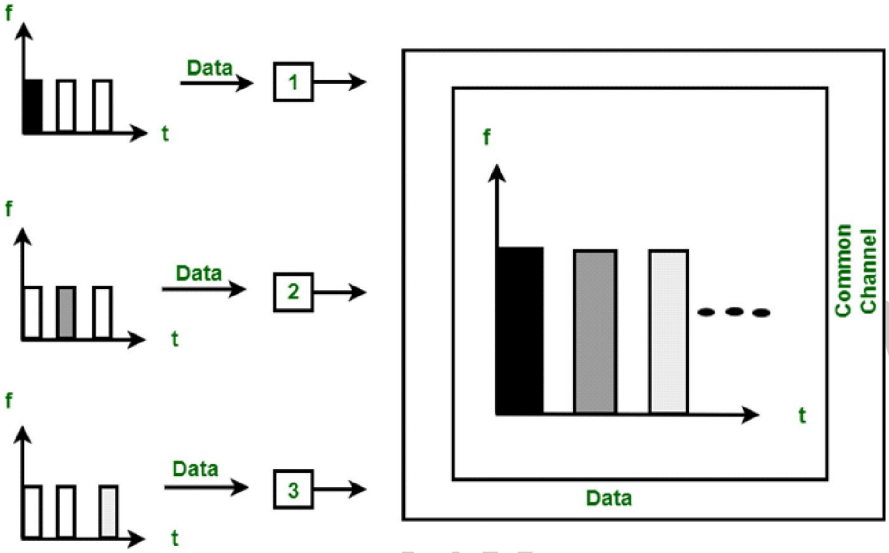
6. **GSM security:** One of the most important features of GSM is the provision it makes to keep the network secure. The security arrangement is made in two levels, in the network level and in the subscriber level. In network level, all the communications, both speech and data are encrypted to prevent fraudulent intrusion by unwanted users. In the subscriber level, all GSM subscribers are provided with a SIM card that stores the subscriber identity number, the encryption key and the decryption algorithm. Each subscriber is given a secret (encryption) key which is stored in the SIM card. A copy of the secret key is stored in the Authentication Centre (AuC) in the base station subsystem of the cell site?

**Q13. Write the differences between TDMA and CDMA**

*Ans :*

**1. Time Division Multiple Access (TDMA)**

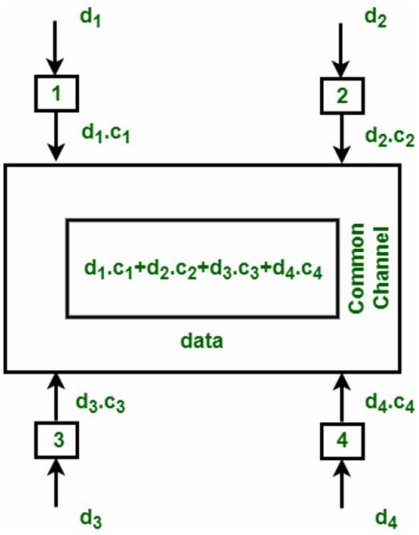
TDMA is the channelization protocol in which bandwidth of channel is divided into various stations on a time basis. There is a time slot given to each station, the station can transmit data during that time slot only which is as follows:




Each station must aware of its beginning of time slot and the location of the time slot. TDMA requires synchronization between different stations. It is type of access method in the data link layer. At each station, data link layer tells the station to use the allocated time slot.

**2. Code division multiple access (CDMA)**

In CDMA, all the stations can transmit data simultaneously. It allows each station to transmit data over the entire frequency all the time. Multiple simultaneous transmissions are separated by unique code sequence. Each user is assigned with a unique code sequence.



In the above figure, there are 4 stations marked as 1, 2, 3 and 4. Data assigned with respective stations as $d_1$, $d_2$, $d_3$ and $d_4$ and the code assigned with respective stations as $c_1$, $c_2$, $c_3$ and $c_4$.

**Difference between TDMA and CDMA**

| S. No. | TDMA | CDMA |
|---|---|---|
| 1. | TDMA stands for Time Division Multiple Access. | CDMA stands for Code Division Multiple Access. |
| 2. | In this, only the sharing of time of satellite transponder takes place. | In this, there is sharing of both i.e. band and time among different stations takes place. |
| 3. | There is no need of any codeword. | There is no need of any codeword. |
| 4. | In this, guard time of the adjacent slots are necessary. | In this, both guard bands and guard time are necessary. |
| 5. | Synchronization is required. | No need of synchronization. |
| 6. | There is average capacity of the system. | There is large capacity of the system. |
| 7. | It is less flexible than CDMA. | Flexibility is high. |
| 8. | In this, there is no Near-far problem. | There is existence of Near-far problem. |
| 9. | Rate of data is average. | Rate of data is high. |

**Q14. Write the differences between GSM and CDMA.**

*Ans :*

The differences between GSM and CDMA are as follows:

| S. No. | Nature | GSM | CDMA |
|---|---|---|---|
| 1. | Full form | Global System for Mobile Communication. | Code Division Multiple Access. |
| 2. | Technology used | FDMA(Frequency division multiple access) and TDMA (Time division multiple access). | CDMA(Code division multiple access). |
| 3. | Availability | GSM is globally widely used and available. | CDMA is available in fewer countries and carriers. |
| 4. | Data speed rate | 42Mbps in HSPA (3G). | 3.6 Mbps in CDMA. |
| 5. | Features | GSM supports transmitting data and voice both at once. | CDMA does not support this feature. |
| 6. | Customer Information | Stored in a SIM card. | Stored in a headset or phone. |

## 3.3 2.5 G (GPRS,EDGE)

**Q15. Discuss a brief overview of GPRS.**

*Ans :* **(Imp.)**

General Packet Radio System is also known as GPRS is a third-generation step toward internet access. GPRS is also known as GSM-IP that is a Global-System Mobile Communications Internet Protocol as it keeps the users of this system online, allows to make voice calls, and access internet on-the-go. Even Time-Division Multiple Access (TDMA) users benefit from this system as it provides packet radio access.

GPRS also permits the network operators to execute an Internet Protocol (IP) based core architecture for integrated voice and data applications that will continue to be used and expanded for 3G services.

GPRS supersedes the wired connections, as this system has simplified access to the packet data networks like the internet. The packet radio principle is employed by GPRS to transport user data packets in a structure way between GSM mobile stations and external packet data networks. These packets can be directly routed to the packet switched networks from the GPRS mobile stations.

In the current versions of GPRS, networks based on the Internet Protocol (IP) like the global internet or private/corporate intranets and X.25 networks are supported. The basic processes used in GPRS networks:

- **Attach process:** Process by which the MS attaches (i.e., connects) to the SGSN in a GPRS network.
- **Authentication process:** Process by which the SGSN authenticates the mobile subscriber.
- **PDP activation process:** Process by which a user session is established between the MS and the destination network.
- **Detach process:** Process by which the MS detaches (i.e., disconnects) from the SGSN in the GPRS network.
- **Network-initiated PDP request for static IP address:** Process by which a call from the packet data network reaches the MS using a static IP address.
- **Network-initiated PDP request for** dynamic IP address: Process by which a call from the packet data network reaches the MS using a dynamic IP address.

Data routing or routing of data packets to and fro from a mobile user, is one of the pivot requisites in the GPRS network. The requirement can be divided into two areas:

1. Data packet routing
2. Mobility management.

**1. Data Packet Routing**

The important roles of GGSN involve synergy with the external data network. The GGSN updates the location directory using routing information supplied by the SGSNs about the location of an MS. It routes the external data network protocol packet encapsulated over the GPRS backbone to the SGSN currently serving the MS. It also decapsulates and forwards external data network packets to the appropriate data network and collects charging data that is forwarded to a charging gateway (CG).

There are three important routing schemes:

- **Mobile-originated message:** This path begins at the GPRS mobile device and ends at the host.
- **Network-initiated message when the MS is in its home network:** This path begins at the host and ends at the GPRS mobile device.
- **Network-initiated message when the MS roams to another GPRS network -** This path begins at the host of visited network and ends at the GPRS mobile device.

The GPRS network encapsulates all data network protocols into its own encapsulation protocol called the GPRS tunnelling protocol (GTP). The GTP ensures security in the backbone network and simplifies the routing mechanism and the delivery of data over the GPRS network.

## 2. Mobility Management

The operation of the GPRS is partly independent of the GSM network. However, some procedures share the network elements with current GSM functions to increase efficiency and to make optimum use of free GSM resources (such as unallocated time slots).

An MS can be in any of the following three states in the GPRS system. The three-state model is unique to packet radio. GSM uses a two-state model either idle or active.

### Active State

Data is transmitted between an MS and the GPRS network only when the MS is in the active state. In the active state, the SGSN knows the cell location of the MS.

Packet transmission to an active MS is initiated by packet paging to notify the MS of an incoming data packet. The data transmission proceeds immediately after packet paging through the channel indicated by the paging message. The purpose of the paging message is to simplify the process of receiving packets. The MS listens to only the paging messages instead of to all the data packets in the downlink channels. This reduces battery usage significantly.

When an MS has a packet to transmit, it must access the uplink channel (i.e., the channel to the packet data network where services reside). The uplink channel is shared by a number of MSs, and its use is allocated by a BSS. The MS requests use of the channel in a random access message. The BSS allocates an unused channel to the MS and sends an access grant message in reply to the random access message.

### Standby State

In the standby state, only the routing area of the MS is known. (The routing area can consist of one or more cells within a GSM location area).

When the SGSN sends a packet to an MS that is in the standby state, the MS must be paged. Because the SGSN knows the routing area of the MS, a packet paging message is sent to the routing area. On receiving the packet paging message, the MS relays its cell location to the SGSN to establish the active state.

### Idle State

In the idle state, the MS does not have a logical GPRS context activated or any Packet-Switched Public Data Network (PSPDN) addresses allocated. In this state, the MS can receive only those multicast messages that can be received by any GPRS MS. Because the GPRS network infrastructure does not know the location of the MS, it is not possible to send messages to the MS from external data networks.

### Routing Updates

When an MS that is in an active or a standby state moves from one routing area to another within the service area of one SGSN, it must perform a routing update. The routing area information in the SGSN is updated, and the success of the procedure is indicated in the response message.

A cell-based routing update procedure is invoked when an active MS enters a new cell. The MS sends a short message containing the identity of the MS and its new location through GPRS channels to its current SGSN. This procedure is used only when the MS is in the active state.

The inter-SGSN routing update is the most complicated routing update. The MS changes from one SGSN area to another, and it must establish a new connection to a new SGSN. This means creating a new logical link context between the MS and the new SGSN and informing the GGSN about the new location of the MS.

Following three key features describe wireless packet data:

- **The always online feature:** Removes the dial-up process, making applications only one click away.
- **An upgrade to existing systems:** Operators do not have to replace their equipment; rather, GPRS is added on top of the existing infrastructure.
- **An integral part of future 3G systems:** GPRS is the packet data core network for 3G systems EDGE and WCDMA.

**Q16. What are the goals and benefits of GPRS?**

*Ans :*

**Goals**

GPRS is the first step toward an end-to-end wireless infrastructure and has the following goals:

- Open architecture
- Consistent IP services
- Same infrastructure for different air interfaces
- Integrated telephony and Internet infrastructure
- Leverage industry investment in IP
- Service innovation independent of infrastructure

**Benefits**

**i) Higher Data Rate**

GPRS benefits the users in many ways, one of which is higher data rates in turn of shorter access times. In the typical GSM mobile, setup a establishment time offered while GPRS is in practice is lower than one second and ISDN-line data rates are up to many 10 kbit/s.

**ii) Easy Billing**

GPRS packet trans mission offers a more user-friendly billing than that offered by circuit switched services. In circuit switched services, billing is based on the duration of the connection. This is unsuitable for applications with bursty traffic. The user must pay for the entire airtime, even for idle periods when no packets are sent (e.g., when the user reads a Web page).

In contrast to this, with packet switched services, billing can be based on the amount of transmitted data. The advantage for the user is that he or she can be "online" over a long period of time but will be billed based on the transmitted data volume.

**Q17. What are the basic characteristics and applications of GPRS?**

*Ans :*

GPRS has opened a wide range of unique services to the mobile wireless subscriber. Some of the characteristics that have opened a market full of enhanced value services to the users. Below are some of the characteristics:

- **Mobility:** The ability to maintain constant voice and data communications while on the move.
- **Immediacy:** Allows subscribers to obtain connectivity when needed, regardless of location and without a lengthy login session.
- **Localization:** Allows subscribers to obtain information relevant to their current location.

Using the above three characteristics varied possible applications are being developed to offer to the mobile subscribers. These applications, in general, can be divided into two high-level categories:

- Corporation
- Consumer

These two levels further include:

- **Communications:** E-mail, fax, unified messaging and intranet/internet access, etc.
- **Value-added services:** Information services and games, etc.
- **E-commerce:** Retail, ticket purchasing, banking and financial trading, etc.
- **Location-based applications:** Navigation, traffic conditions, airline/rail schedules and location finder, etc.
- **Vertical applications:** Freight delivery, fleet management and sales-force automation.
- **Advertising:** Advertising may be location sensitive. For example, a user entering a mall can receive advertise-ments specific to the stores in that mall.

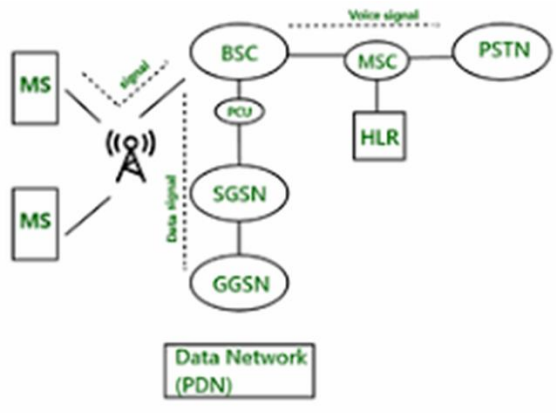
Along with the above applications, non-voice services like SMS, MMS and voice calls are also possible with GPRS. Closed User Group (CUG) is a common term used after GPRS is in the market, in addition, it is planned to implement supplementary services, such as Call Forwarding Unconditional (CFU), and Call Forwarding on Mobile subscriber Not Reachable (CFNRc), and closed user group (CUG).

**Q18. Draw and explain the architecture of GPRS.**

*Ans :*

GPRS architecture works on the same procedure like GSM network, but, has additional entities that allow packet data transmission. This data network overlaps a second-generation GSM network providing packet data transport at the rates from 9.6 to 171 kbps. Along with the packet data transport the GSM network accommodates multiple users to share the same air interface resources concurrently.

Following is the GPRS Architecture diagram:




GPRS attempts to reuse the existing GSM network elements as much as possible, but to effectively build a packet-based mobile cellular network, some new network elements, interfaces, and protocols for handling packet traffic are required.

Therefore, GPRS requires modifications to numerous GSM network elements as summarized below:

| GSM Network Element | Modification or Upgrade Required for GPRS |
|---|---|
| Mobile Station (MS) | New Mobile Station is required to access GPRS services. These new terminals will be backward compatible with GSM for voice calls. |
| BTS | A software upgrade is required in the existing Base Transceiver Station(BTS). |
| BSC | The Base Station Controller (BSC) requires a software upgrade and the installation of new hardware called the packet control unit (PCU). The PCU directs the data traffic to the GPRS network and can be a separate hardware element associated with the BSC. |
| GPRS Support Nodes (GSNs) | The deployment of GPRS requires the installation of new core network elements called the serving GPRS support node (SGSN) and gateway GPRS support node (GGSN). |
| Databases (HLR, VLR, etc.) | All the databases involved in the network will require software upgrades to handle the new call models and functions introduced by GPRS. |

### i) GPRS Mobile Stations

New Mobile Stations (MS) are required to use GPRS services because existing GSM phones do not handle the enhanced air interface or packet data. A variety of MS can exist, including a high-speed version of current phones to support high-speed data access, a new PDA device with an embedded GSM phone, and PC cards for laptop computers. These mobile stations are backward compatible for making voice calls using GSM.

### ii) GPRS Base Station Subsystem

Each BSC requires the installation of one or more Packet Control Units (PCUs) and a software upgrade. The PCU provides a physical and logical data interface to the Base Station Subsystem (BSS) for packet data traffic. The BTS can also require a software upgrade but typically does not require hardware enhancements.

fWhen either voice or data traffic is originated at the subscriber mobile, it is transported over the air interface to the BTS, and from the BTS to the BSC in the same way as a standard GSM call. However, at the output of the BSC, the traffic is separated; voice is sent to the Mobile Switching Center (MSC) per standard GSM, and data is sent to a new device called the SGSN via the PCU over a Frame Relay interface.

### iii) GPRS Support Nodes

Following two new components, called Gateway GPRS Support Nodes (GSNs) and, Serving GPRS Support Node (SGSN) are added:

### iv) Gateway GPRS Support Node (GGSN)

The Gateway GPRS Support Node acts as an interface and a router to external networks. It contains routing information for GPRS mobiles, which is used to tunnel packets through the IP based internal backbone to the correct Serving GPRS Support Node. The GGSN also collects charging information connected to the use of the external data networks and can act as a packet filter for incoming traffic.

### v) Serving GPRS Support Node (SGSN)

The Serving GPRS Support Node is responsible for authentication of GPRS mobiles, registration of mobiles in the network, mobility management, and collecting information on charging for the use of the air interface.

### vi) Internal Backbone

The internal backbone is an IP based network used to carry packets between different GSNs. Tunnelling is used between SGSNs and GGSNs, so the internal backbone does not need any information about domains outside the GPRS network. Signalling from a GSN to a MSC, HLR or EIR is done using SS7.

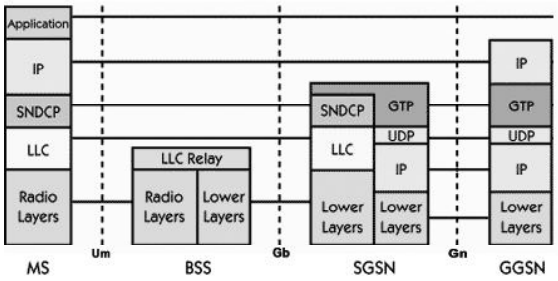
### vii) Routing Area

GPRS introduces the concept of a Routing Area. This concept is similar to Location Area in GSM, except that it generally contains fewer cells. Because routing areas are smaller than location areas, less radio resources are used While broadcasting a page message.

## Q19. Draw and explain GPRS Protocol stack.

*Ans :*

The flow of GPRS protocol stack and end-to-end message from MS to the GGSN is displayed in the below diagram. GTP is the protocol used between the SGSN and GGSN using the Gn interface. This is a Layer 3 tunneling protocol.




The process that takes place in the application looks like a normal IP sub-network for the users both inside and outside the network. The vital thing that needs attention is, the application communicates via standard IP, that is carried through the GPRS network and out through the gateway GPRS. The packets that are mobile between the GGSN and the SGSN use the GPRS tunneling protocol, this way the IP addresses located on the external side of the GPRS network do not have deal with the internal backbone. UDP and IP are run by GTP.

SubNetwork Dependent Convergence Protocol (SNDCP) and Logical Link Control (LLC) combination used in between the SGSN and the MS. The SNDCP flattens data to reduce the load on the radio channel. A safe logical link by encrypting packets is provided by LLC and the same LLC link is used as long as a mobile is under a single SGSN.

In case, the mobile moves to a new routing area that lies under a different SGSN; then, the old LLC link is removed and a new link is established with the new Serving GSN X.25. Services are provided by running X.25 on top of TCP/IP in the internal backbone

**Q20. What parameters are used in QoS profiles in GPRS.**

*Ans :*

Quality of Service (QoS) requirements of conventional mobile packet data applications are in assorted forms. The QoS is a vital feature of GPRS services as there are different QoS support requirements for assorted GPRS applications like realtime multimedia, web browsing, and e-mail transfer.

GPRS allows defining QoS profiles using the following parameters :

- Service Precedence
- Reliability
- Delay and
- Throughput

These parameters are described below:

**Service Precedence**

The preference given to a service when compared to another service is known as **Service Precedence. This** level of priority is classified into three levels called:

- High
- Normal
- Low

When there is network congestion, the packets of low priority are discarded as compared to high or normal priority packets.

**Reliability**

This parameter signifies the transmission characteristics required by an application. The reliability classes are defined which guarantee certain maximum values for the probability of loss, duplication, mis-sequencing, and corruption of packets.

**Delay**

The delay is defined as the end-to-end transfer time between two communicating mobile stations or between a mobile station and the GI interface to an external packet data network.

This includes all delays within the GPRS network, e.g., the delay for request and assignment of radio resources and the transit delay in the GPRS backbone network. Transfer delays outside the GPRS network, e.g., in external transit networks, are not taken into account.

**Throughput**

The throughput specifies the maximum/peak bit rate and the mean bit rate.

Using these QoS classes, QoS profiles can be negotiated between the mobile user and the network for each session, depending on the QoS demand and the available resources.

The billing of the service is then based on the transmitted data volume, the type of service, and the chosen QoS profile.

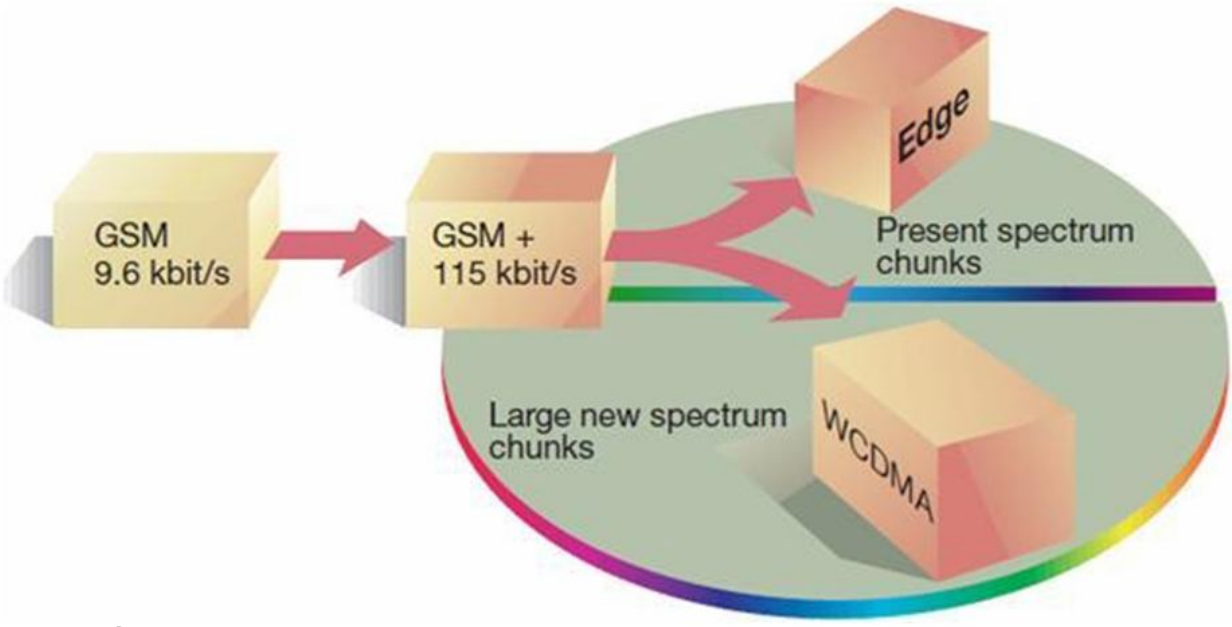
**Q21. What is EDGE ? What are the key elements of EDGE ?**

*Ans :* **(Imp.)**

Enhanced Data Rates for GSM (Global System for Mobile) Evolution

EDGE is an enhanced version of GSM and offers high speed 3G built on GSM. It is type of data system used on GSM network used to allow improved data transmission rates.Itcan transmit three times more bits than GPRR in the same length of time. EDGE is an “add-on” to GPRS, it cannot work alone. It was deployed on GSM networks by AT&T in 2003 in the United States.

EDGE is a 2.5G technology that is based on GPRS and can be used to offer personalised multimedia services similar to 3G technologies.It can be used to transmit both voice and data. It however is just an add-on to GPRS and can not work alone. EDGE allows subscribers to access the Internet and to send and receive data, e.g. digital images and videos, with a broadband like transmission speed of 384 kbps that is about three times faster than an ordinary GPRS network. This speed is sufficient even for video-transmissions and in that sense it rivals the 3G Universal Mobile Telecommunications System (UMTS) technology.EDGE is reputed to possess high potential and a growing importance in many regions of the world, e.g. the Americas, Australia and India, where it is reported to be gaining market rapidly.The main advantage of EDGE is that it could allow network carriers to offer 3G-like services without having to actually acquire a 3G license. Implementing EDGE is relatively simple, as it works with the existing GSM/GPRS structure. It may also be used with laptops with the help of a card.EDGE however does not seem to have very bright prospects in Europe for a practical reason: Most of the network carriers in Europe have invested heavily in the expensive UMTS licensesand building a UMTS network.




**Data Speed**

EDGE has successfully replaced GSM without disrupting the existing frequency reuse scheme. Technically, EDGE provides a speed of 384kbps (which is much higher than data rate of GPRS) but labeled as 2.75G by industry.

**Key Elements added in EDGE**

- **Use of 8PSK:** Modulation format has been changed to 8PSK which provides the advantage to convey 3 bits per symbol.
- **Base station:** Some small changes have been made in the base station.
- **Upgrade to network architecture:** It offers IP based transfer rate which makes it necessary to add some more network elements.
- **Mobile stations: To** use EDGE facilities, it is mandatory to gave a GSM EDGE handset because each and every set can't be upgraded.

**Q22. List out the features of EDGE.**

*Ans :*

Following are the features of EDGE.

- Provide increase data rate, e.g. high speed on GSM radio carriers as provided by broadband.
- It can retransmit a packet with more robust coding which means re-segmentation is possible.
- In EDGE packets are addressed up to 2048 while in GSM it is from 1 to 128.
- Similarly EDGE has a window size of 1024 and GSM window size was 64.
- EDGE reduces the number of bursts to retransmit when error occurs.
- It allows multimedia file transfer, web browsing and video conferencing through wireless terminals.
- It enables operators to triple the data rate of subscribers and provide extra capacity to their voice communications.
- It requires less radio resources to support the same traffic as supported by GSM networks.

**Q23. Draw and explain GSM EDGE network architecture.**

*Ans :*

The GSM EDGE network architecture needed to be updated from the basic GSM network, although it was basically the same as that needed for GPRS.

The large advantage of using GSM EDGE was that it required little upgrade from GPRS and it was also on the evolutionary path from 2G GSM to 3G UMTS. In this way, any upgrades for the GSM EDGE network, would be applicable to the 3G network.

As both GPRS and now EDGE carried packet data, it was necessary for the packet data to be handled by entities that were not present on the basic 2G GSM network. Accordingly the introduction of GPRS and EDGE technology saw the addition of some new entities within the over network architecture.

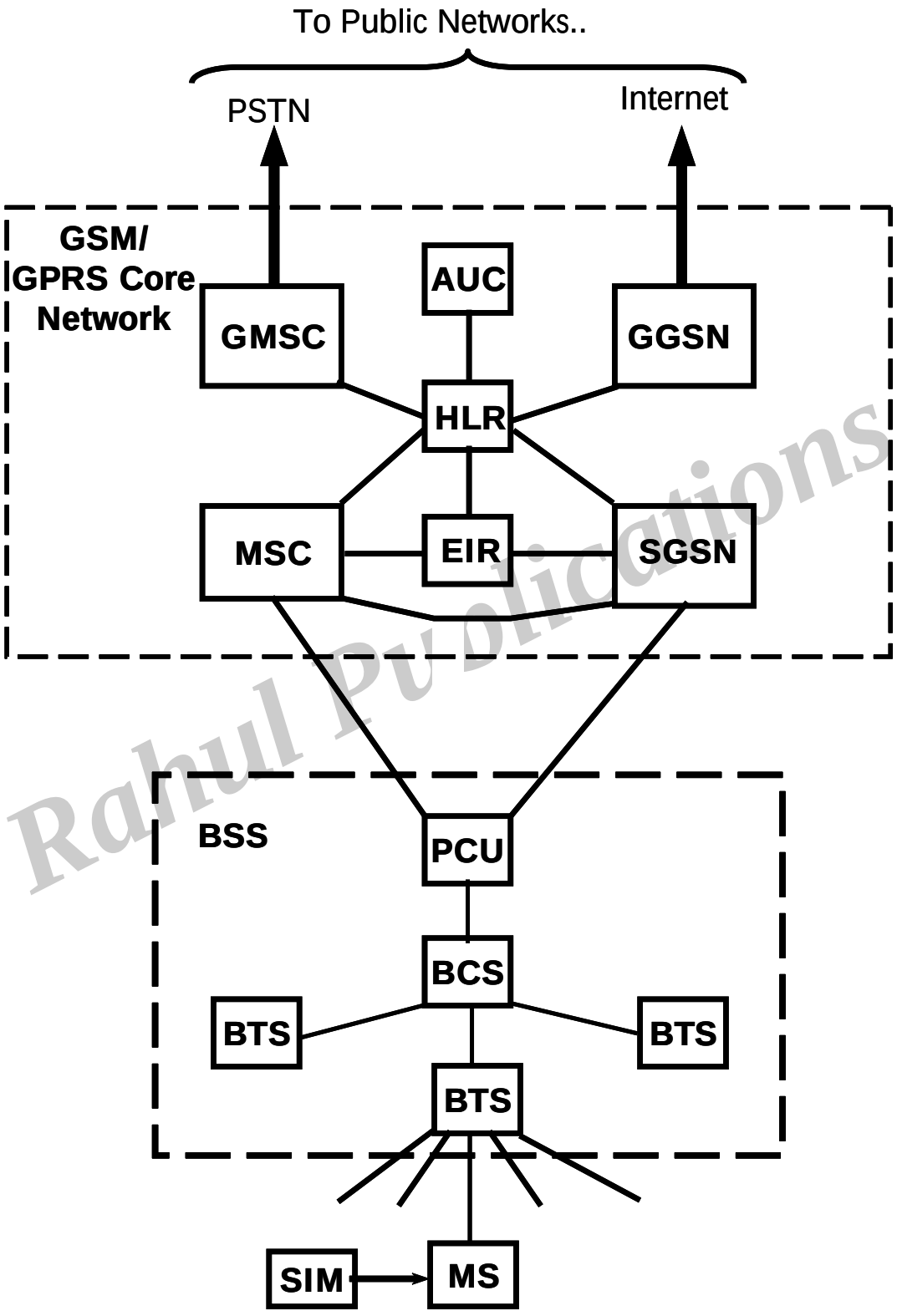
The two main elements that are required by the GSM EDGE network architecture are the GGSN and SGSN. These enable the network to be able to cater for the packet data that is passed over the network. A network entity called a PCU was also required in the base station controller to route packet and circuit switched data to the required main network entities.

**GSM EDGE network architecture upgrades**

Although in practice a variety of elements are required within the network architecture, the main new network architecture entities that are needed for the EDGE upgrade are:

- **SGSN:** GPRS Support Node - this forms a gateway to the services within the network.
- **GGSN:** Gateway GPRS Support Node which forms the gateway to the outside world.
- **PCU:** Packet Control Unit which differentiates whether data is to be routed to the packet switched or circuit switched networks.

A simplified view of the GSM EDGE network architecture can be seen in the diagram below. From this it can be seen that it is very similar to the more basic GSM network architecture, but with additional elements.



The network architecture for GSM EDGE was basically the same as that used with GPRS

**SGSN network entity**

The SGSN or Serving GPRS Support Node element of the GPRS network provides a number of takes focussed on the IP elements of the overall system. It provides a variety of services to the mobiles:

- Packet routing and transfer
- Mobility management
- Authentication
- Attach/detach
- Logical link management
- Charging data

There is a location register within the SGSN and this stores location information (e.g., current cell, current VLR). It also stores the user profiles (e.g., IMSI, packet addresses used) for all the GPRS users registered with the particular SGSN.

**GGSN network entity**

The GGSN, Gateway GPRS Support Node is one of the most important entities within the GSM EDGE network architecture.

The GGSN organises the inter-working between the GPRS / EDGE network and external packet switched networks to which the mobiles may be connected. These may include both Internet and X.25 networks.

The GGSN can be considered to be a combination of a gateway, router and firewall as it hides the internal network to the outside. In operation, when the GGSN receives data addressed to a specific user, it checks if the user is active, then forwarding the data. In the opposite direction, packet data from the mobile is routed to the right destination network by the GGSN.

**PCU**

The PCU or Packet Control Unit is a hardware router that is added to the BSC. It differentiates data destined for the standard GSM network (circuit switched data) and data destined for the EDGE network (Packet Switched Data). The PCU itself may be a separate physical entity, or more often these days it is incorporated into the base station controller, BSC, thereby saving additional hardware costs.

**GSM EDGE network upgrade**

One of the advantages of the migration to GSM EDGE was that the network required little upgrade from what was used for GPRS and what would be used for the future 3G UMTS networks.

This presented a particularly attractive option for network operators who would need little capital expenditure investment to provide the additional capability. Additionally it would be required for the future 3G networks and therefore any investment would be required later anyway.

The EDGE network adds to the existing GSM network. The main new entities required within the network are the SGSN and GGSN, and these are required as the starting point.

The base station subsystems require some updates. The main one is the addition of the PCU described above. Some modifications may be required to the BTS, but often only a software upgrade is required, and this may often be achieved remotely. In this way costs are kept to a minimum.

The GSM EDGE network was steadily upgraded to enable it to handle the required packet data and to ready the network for the future 3G UMTS system that was about to be launched.

## 3.4 3G (WCDMA/UMTS, CDMA2000)

**Q24. Define 3G Systems.**

*Ans :*

Third Generation systems or 3G systems refer to mobile communication systems that follow IMT-2000 (International Mobile Telecommunication-2000) standards defined by International Telecommunication Union (ITU). These systems are characterized by high data transmission rates, of the order of 200 Kbps up to 6 Mbps. They employ packet switched mode of data transmission along with spread spectrum technique to achieve high speed internet data transfer suitable for multimedia applications under mobile environment. 3G systems support high speed broadband internet access, video calling, mobile TV or multimedia gaming through mobile devices.

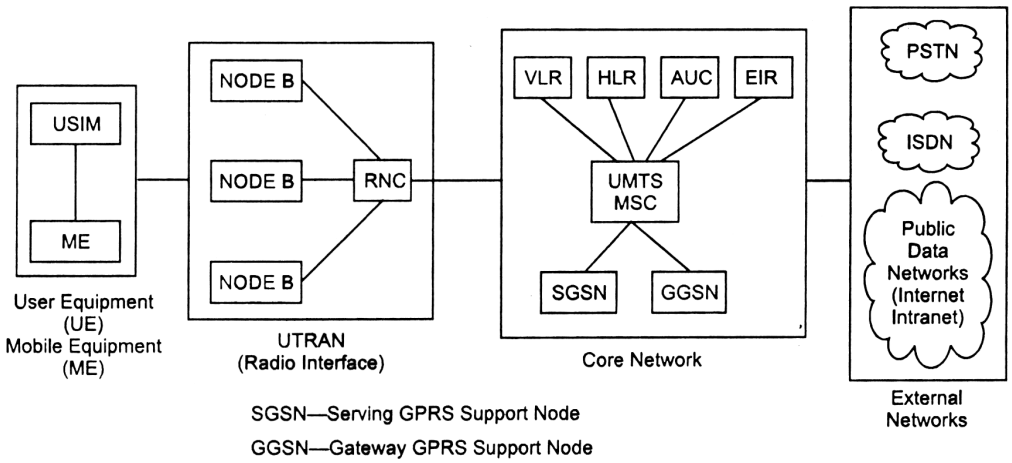
**Q25. Explain in detail about UMTS.**

*Ans :* **(Imp.)**

Universal Mobile Telecommunication System (UMTS) is a 3G standard for mobile communication that provides enhanced data rate (of the order of 2 Mbps) and supports a full range of high speed multimedia services including broadband internet access. It follows 3GPP (Third Generation Partnership Project) specifications, defined under IMT-2000 standard. It is based on a technology known as FOMA (Freedom of Mobile Multimedia Access) and employs Wideband Code Division Multiple Access (W-CDMA) to achieve higher spectral efficiency and bandwidth than 2G GSM systems. For these reasons, UMTS is often referred to as 3GSM system to indicate the 3G evolution from basic GSM foundation (Figure).

The features of UMTS are: UMTS combines two packet access technologies namely HSDPA (High Speed Downlink Packet Access) and HSUPA (High Speed Uplink Packet Access) to achieve very high bandwidth data transfer capabilities. These packet access technologies allow high speed multimedia broadcast/multicast facilities, interactive gaming and large file download through broadband internet access. The speed offered by HSPA technology is comparable to traditional fixed line broadband internet access or satellite digital broadcast services. With the help of HSPA+ (High Speed Packet Access Evolved) technology, UMTS can achieve maximum theoretical data transfer rate of 45 Mbps. However, in practical cases, UMTS provides up to 2 Mbps (2048 Kbps) data transfer rates under indoor/stationary environment. In densely populated urban areas, the actual data rate becomes 384 Kbps and for satellite applications, the speed becomes 144 Kbps.





The speed is much higher than 2G GSM speed of 9.6 Kbps or 114 Kbps (GPRS) and is suitable for several high speed multimedia applications. Apart from normal speech (telephony) services, UMTS supports a number of packet switched network-based data services. These include:

- **Conversational Applications:** Voice Telep-hony, video telephony, video gaming
- **Streaming Applications:** Multimedia services, video on demand, webcast, mobile TV.
- **Interactive Applications:** Web browsing, network gaming, database access.
- **Back-end Applications:** E-mail, SMS, file download.

**Functions**

The basic functions of these three components are discussed below:

**1. Core Network (CN)**

UMTS core network contains two types of components, namely circuit switched components and packet switched components. Circuit switched components are similar To GSM network components, such as Mobile Switching Centre (MSC), Visitor Location Register (VLR), Equipment Identity Register (EIR), Home Location Register (HLR) and Authentication Centre (AuC). The packet switched elements are Serving GPRS Support Node (SGSN) and Gateway GPRS Support Node (GGSN). Apart from these network elements, core network also contains some databases and additional network management functions. In order to upgrade a GSM system to UMTS system, the core network elements need to be modified according to UMTS specifications. However, the subscribers can maintain their old (GSM) number, with the help of Number Portability Database (NPDB). MSC, VLR and SGSN are often merged together to become UMTS MSC.

**2. Radio interface**

UMTS radio interface is based on UTRAN (Universal Terrestrial Radio Access Network) air interface that employs wide band CDMA (WCDMA) technology. WCDMA is a Direct Sequence CDMA (DS CDMA) where user speech data is multiplied (coded) with quasi random bit sequences (derived from WCDMA spreading codes) and scrambled and mixed together and sent to destination location. WCDMA has two basic modes of operation namely, Frequency Division Duplex (FDD) and Time Division Duplex (TDD). At the receiving end, the scrambled data is decoded using decoder circuits, and the original message is reconstructed after integrity and validity checking.

**3. User equipment**

UMTS user equipment consists of a UMTS Subscriber Identity Module (USIM) card whose functionalities are similar to that of GSM SIM card. Their purpose is to store user identification information, such as International Mobile Subscriber Identity' (IMSI), Temporary Mobile Subscriber Identity (TMSI), International Mobile Equipment Identity (IMEI), etc. The UMTS mobile equipment can operate in three modes:

- **PS/CS mode:** To support both packet switched and circuit switched functions.
- **PS mode:** To support only packet switched functions
- **CS mode:** To support only circuit switched functions.

**Q26. Explain in detail about WCDMA Technology.**

*Ans :*

Wideband Code Division Multiple Access (WCDMA) is a radio access technology that is used in third generation (3G) cellular systems, such as UMTS. It employs direct sequence spread spectrum (DS CDMA or wideband CDMA and hence the name) technique for channel access and offers higher bandwidth and much higher speed compared to 2G systems. The bandwidth of the carrier frequency in WCDMA systems is approximately 5 MHz and using this wide bandwidth, it can support over 100 simultaneous voice calls. WCDMA systems are capable of providing data rates up to 2 Mbps and using HSPA+ enhancements it can support data rates up to 14 Mbps or higher. WCDMA technology supports a wide variety of high speed communication services involving data, voice, images or video under mobile as well as stationary environments. The communication speed ranges from 384 Kbps (for moving vehicles under wide area access) to 2 Mbps (for stationary users under local area access).

WCDMA is available in two different modes of operation namely, Frequency Division Duplex (FDD) mode and Time Division Duplex (TDD) mode.

**1. FDD**

In Frequency Division Duplex mode, two different frequency bands are used for uplink and downlink transmissions. For any connection, a pair of frequency bands with specified separation is allotted to the user.

**2. TDD**

In TDD, both uplink and downlink transmissions are carried over same frequency band, but in separate synchronized time intervals. The time slot in a physical “channel is divided into two transmission and reception parts.

The capability of operating either in FDD or TDD mode leads to efficient utilization of available frequency spectrum.

The key features of WCDMA radio interface are as follows:

- Supports high speed data transmission: 384 Kbps for moving vehicles and 2 Mbps for stationary users
- Supports both FDD and TDD modes of operation
- Highly flexible: supports multiple parallel variable rate services for each connection
- Supports advanced techniques such as adaptive antennas, transmitter diversities, etc. to improve capacity and coverage area
- Supports inter frequency handover as well as handover to other systems such as GSM
- Efficient packet access.

**Q27. Compare and UMTS and contrast WCDMA.**

*Ans :*

| Sl. No. | UMTS | WCDMA |
|---|---|---|
| 1. | UMTS is faster than WCDMA in that it offers a speed of HSPDA in the communication network. Hence bandwidth does not affect the performance of the system. | WCDMA runs at the speed of GSM, which is slower than UMTS. Hence when considering both WCDMA and UMTS, WCDMA comes as a second preference to the users. |
| 2. | UMTS is a cellular technology that transfers data with the help of packets. Radio technology is not used, and hence efficiency cannot be offered in the system as much as that of WCDMA. UMTS is used instead of GSM networks in the system. | Radio technology is used in the system, and hence communication is done between two devices as an interface is used in the system. This makes the system more efficient and does not make any issues while transferring data. |
| 3. | UMTS has a maximum of 45 Mbps if HSPA is activated, which helps to transfer data with more efficiency. This is one of the popular air interfaces used in mobile devices. | WCDMA is based on CDMA and has downlink and uplink channels to transfer data with a speed of 5MHz used in the channels. This is an upgrading of CDMA where very less speed is used as per the standard. This can be utilized for the data in the system. |
| 4. | UMTS phones specifically are not available as it depends on any of the access networks to provide support. Hence UMTS and WCDMA work together in the system. | If a WCDMA phone has a sim slot and a UMTS arena, we can say that the phone supports both GSM and WCDMA. |
| 5. | The basic channel is not CDMA but GSM. UMTS is developed as an upgrading format of GSM available to the universe as a single protocol. | CDMA is used as a basic channel in WCDMA to support communication and be efficient. |
| 6. | The signals are not handled easily and, in some cases, can be in different paths. This makes communication difficult though it is done. This is the reason that UMTS depends on other networks. | The signal can be handled easily in any paths, and this explains the efficiency of the system. WCDMA uses radio technology to transfer data. Also, there are code division channels for separation. |
| 7. | The area of coverage is less, but if it is combined with WCDMA, it is more. | The area of coverage is more for WCDMA. |
| 8. | UMTS alone cannot be used in communication devices. | WCDMA is mostly used in all phones, and in some cases, it is combined with GSM or UMTS. |



**Q28. 'CDMA 2000 incorporated a number of advanced features that are crucial for enhancing the channel capacity as well as data speed'. Explain.**

*Ans :* **(Imp.)**

CPMA 2000, also known as IMT-CDMA MC (Multi Carrier) is a 3G mobile technology based on IMT 2000 standard developed by International Telecommunication Union (ITU). CDMA 2000 is based on CDMA technology and the specification is developed by Third Generation Partnership Project 2 or 3GPP2. The basic purpose of CDMA 2000 was to transform 2G CDMAOne systems to 3G CDMA 2000 systems. It has already been implemented to several IS-95 (CDMAOne) networks as an evolutionary step from CDMAOne to CDMA 2000, as CDMA 2000 provides full backward compatibility with IS-95 systems.

World's first 3G commercial system was launched by SK telecom in South Korea, in October 2000 using CDMA 2000 IX.

CDMA 2000 has different versions, each having some enhancements than the previous version. These are as follows:

1. **CDMA 2000 IX or IX RTT:** This is the core or basic version of CDMA 2000 standard. The term IX RTT (Radio Transmission Technology) means 1 times to indicate that it provides the same bandwidth as IS 95 (CDMAOne), i.e. a duplex pair of 1.25 MHz radio channels. It supports data speed of up to 140 Kbps while occupying a very small amount of spectrum (1.25 MHz per channel) thus saving the precious spectrum resource for operators.
2. **CDMA 2000 IX EV DO:** IX EV DO (Evolution Data Optimized), is an enhancement over IX and it puts voice and data on separate channels (DO: Data Only) to achieve data rate up to 2.4 Mbps. It employs multiplexing technique involving both CDMA and TDMA in order to improve individual user's throughput as well as overall system throughput.
3. **CDMA 2000 IX EV DV:** IX EV DV is the next enhancement that promises data rate ranging from 3 Mbps to 5 Mbps. EV DV stands for Evolution Data Voice, as it is backward compatible with IS-95 and supports both voice and data transmission over the same frequency band.

## 3.5 4G, 5G

**Q29. What is 4G ? List out the features of 4G wireless technology.**

*Ans :* **(Imp.)**

The First generation wireless mobile communication systems were introduced in early eighties and second generations systems in the late 1980s were intended primarily for transmission of voice. The initial systems used analog frequency modulation where as the second as well as the subsequent mobile systems use digital communication techniques with time division multiplexing (TDM), frequency division multiplexing (FDM) or the code division multiple access (CDMA). The third generation wireless systems which are just getting introduced in the world markets offer considerably higher data rates, and allow significant improvements over the 2G systems. The 3G Wireless systems were proposed to provide voice and paging services to provide interactive multimedia including teleconferencing and internet access and variety of other services. However, these systems offer wide area network (WAN) coverage of 384 kbps peak rate and limited coverage for 2 Mbps. Hence providing broadband services would be one of the major goals of the 4G Wireless systems.

**Features**

The following are some possible features of the 4G systems :

1. Support interactive multimedia, voice, video, wireless internet and other broadband services.
2. High speed, high capacity and low cost per bit.
3. Global mobility, service portability, scalable mobile networks.
4. Seamless switching, variety of services based on Quality of Service (QoS) requirements
5. Better scheduling and call admission control techniques.
6. Ad hoc networks and multi-hop networks.

**Application**

- Advanced mobile web access
- IP telephony
- High-resolution high-speed gaming services
- Streamed multimedia and data
- High-definition mobile TV
- Video conferencing
- 3D television

**Q30. List out higher layer issues in 4G.**

*Ans :*

4G is going to be a packet-based network. Since it would carry voice as well as internet traffic it should be able to provide different level of QoS. Other network level issues include Mobility Management, Congestion control, and QoS Guarantees :

**i) Mobility Management**

Mobility Management includes location registration, paging and handover. The MT should be able to access the services at any place possible. The global roaming can be achieved by with the help of multi-hop networks that can include the WLANs or the satellite coverage in remote areas. A seamless service (Ex : soft handover of the MT from one network to another or from one kind of service to other) is also important. The hand-over techniques should be designed so that they make efficient use of the network (routing) and make sure that hand offs are not done too often.

New techniques in location management might be implemented. Each MT need not do location registration everytime. They can instead do concatenated location registration, which reports to the network that they are concatenated to a common object. Ex- MTs in a train need to re-register only when they get off the train and till the network knows that they are in the train.

**ii) Congestion Control**

Congestion control will be another critical issues in the high performance 4G networks. Two basic approaches can be taken towards the congestion control : 1. avoidance or prevention of the congestion and 2. detection and recovery after congestion. The avoidance scheme will require the network to suitably implement the admission control (measurement based or pre-computed model) and scheduling techniques. The detection and recovery would require flow control and feedback traffic management. A conservative approach might be proposed for the 4G systems because of the wide variety of QoS requirements.

**iii) Quality of Service (QoS)**

4G systems are expected to provide real-time and internet-like services. The real-time services can be classified into two kinds:

- **Guaranteed:** pre-computed delay bound is required for the service. Ex voice
- **Better-than-best effort:**
  1. **Predictive:** Service needs upper bound on end-to-end delay.
  2. **Controlled delay:** service might allow dynamically variable delay.
  3. **Controlled load:** Service needs resources (bandwidth and packet processing).

**Q31. What are the challenges of 4G?**

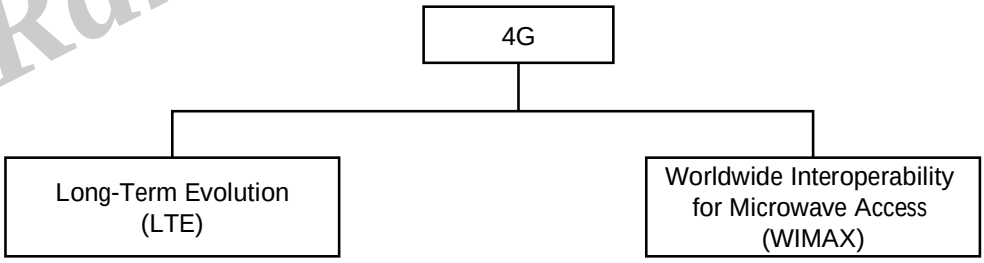
*Ans :*

1. Multi-access interface, timing and recovery.
2. Higher frequency reuse leads to smaller cells that may cause intra-cell interference or higher noise figures due to reduced power levels.
3. The Digital to analog conversions at high data rates, multiuser detection and estimation (at base stations), smart antennas and complex error control techniques as well dynamic routing will need sophisticated signal processing.
4. Issues in the interface with the ad hoc networks should be sorted out. 4G systems are expected to interact with other networks like the Bluetooth, hiperlan, IEEE802.11b, etc.
5. Voice over multi-hop networks is likely to be an interesting problem because of the strict delay requirements of voice.
6. Security will be an important issue.
7. A new IP protocol might be needed because of the variable QoS services and the network should do "better than best" effort.
8. Networking protocols that adapt dynamically to the changing channel conditions.
9. Seamless roaming and seamless transfer of services.

**Q32. What are the major categories of 4G?**

*Ans :*

4G comes in two main categories:




**(i) Long - Term Evolution (LTE):** Long term evolution or LTE is an extension of the 3G technology. It is a standard for high-speed mobile communication, based upon GSM/EDGE and UMTS/HSPA technologies. The peak data rate for download is 100 Mbps and upload is 50 Mbps. The LTE Advanced meets the specifications of IMT-Advanced standard for 4G technology. Its peak data rates are 1000 Mbps for downlink and 500 Mbps for uplink.

**(ii) Worldwide Interoperability for Microwave Access (WIMAX):** WiMAX is a mobile wireless broadband access (MWBA) standard is sometimes branded 4G. It offers peak data rates of 128 Mbps for downlink and 56 Mbps for uplink over 20 MHz wide channels. The latest version of WIMAX is not compatible to the earlier versions and instead is compatible with LTE.

**Q33. List out the advantages and disadvantages of 4G.**

*Ans :*

**Advantages of 4G**

- 4G networks provide flexibility and mobility.
- It is more reliable than other data services.
- With 4G networks, the downloading and uploading speeds can be much faster than the wired or 2G and 3G networks even in rural areas also.
- It works with the same mobile internet connection as our mobile phones and hence does not need a phone line.
- The 4G networks provide area coverage of more than 30 miles with overlapping network ranges, and it ensures complete connectivity all the time.
- It provides complete security, privacy, and safety, which is the issue with the Wi-Fi networks. Using 4G, users who contain sensitive information on their mobile devices can use the internet securely.
- It enables the users to choose many options.

**Disadvantages of 4G**

- The old devices do not support the 4G network; hence the customer is forced to buy the new device to make use of the 4G network.
- 4G technology uses various antennas and transmitters, and users would experience poor battery life of the mobile phone while using this network. So, to use the internet for a longer period, we need to have more battery power.
- In 4G, it is easier to obtain information from users illegally.
- It may be being attacked with the jamming frequencies; hence the chances of privacy breach are increased.
- 4G networks need complex hardware.
- If some areas do not yet have a 4G mobile network, then users would be forced to use 3G or Wi-Fi connectivity. And after using 3G instead of 4G network, users would still have to pay the same amount as specified by the 4G network plan. This issue can only be resolved if mobile carriers expand their network coverage to include more regions for the 4G network.
- The 4G networks have higher data prices for the users.
- 4G network needs expensive infrastructure for the operation. 4G is optimal for the data rates but not necessarily best for the voice services.

**Q34. Define 5G systems.**

*Ans :*

Fifth Generation (5G) systems are the next evolutionary mobile network systems that will come after 4G systems. The standard is, at present, in its developmental stages and is expected to be launched around the year 2020. In the history of mobile communication systems, it has been found that in every

10 years, a new generation of mobile network is launched. The first generation (1G) system, namely AMPS was first introduced in late seventies (1978) in USA. The second generation (2G) system, i.e. GSM first appeared in late eighties (1988) followed by CDMA, another 2G system. The third generation system (3G) was first introduced in the year 2000 in the form of UMTS and CDMA 2000, and is widely deployed around the world for fast internet download and multimedia application).

5G will also utilize the benefits of Artificial Intelligence (AI), which will gather relevant information from internet based on certain user defined criteria and employ the information in a variety of business applications. For example, while passing across a bill board displaying a certain product, the availability and retail outlet details of the particular product in near vicinity will be extracted and displayed in the mobile device. In yet another application of AI, during video call, the picture along with the smell of the place of the caller can be perceived. Support of IPv6 will be provided whereby each mobile device will be allotted a unique IP address so that they can independently connect to wireless internet, thus giving rise to a Wireless World Wide Web (WWWW).

**Q35. List out various advantages and disadvantages of 5G.**

*Ans :*

**Advantages**

1. Better coverage area, less traffic, and high data speed at the edge of the cell.
2. Provide good efficiency in terms of energy and spectrum.
3. It has multiple data transfer capacities.
4. 5G technologies consume low battery in comparison to 1G, 2G, 3G, and 4G.
5. As per security terms, 5G is more secure than the rest.
6. 5G supports the Virtual Private Network (VPN).
7. It has very low latency (time taken by data from origin to destination).
8. 5G regulate the bandwidth requirement according to the application as some application requires low BW whereas some require High BW.
9. 5G can connect more devices simultaneously than other technologies.

**Disadvantages**

1. 5G requires high investment in infrastructure development, and up-gradation and degradation are also costly.
2. As 5G provides a high data speed, so it requires more storage capacity in smartphones and also requires huge battery power.
3. There is no specific standard known for 5G till now as 4G has its VoLTE.
4. Wi-Fi is cheaper and easily feasible, so Wi-Fi is already a better alternative over 5G, which requires high costs and maintenance than Wi-Fi.
5. As 5G network technologies are under the working mode, so still have lots of drawbacks and will take time to be operational globally.

**Q36. What are the differences between 4G and 5G.**

*Ans :*

| Sl. No. | 4G Technology | 5G Technology |
|---|---|---|
| 1. | 4G stands for the fourth-generation technology. | 5G stands for fifth-generation technology. |
| 2. | The maximum theoretical uploading speed of 4G technology is 500Mbps. | The maximum uploading speed of 5G technology is 1.25Gbps. |
| 3. | The maximum theoretical downloading speed of 4G is 1Gbps. | The maximum downloading speed of 5G is 2.5Gbps. |
| 4. | The latency of 4G is approximately 50ms. | The latency of 5G is approximately 1ms. |
| 5. | The 4G network is slow and less efficient when comparing with the 5G network. | 5G is the fastest and most efficient mobile network. |
| 6. | 4G technology is unable to differentiate between fixed and mobile devices. | 5G technology is capable of identifying fixed, and mobile devices with the help of cognitive radio technique, and hence offer the most suitable delivery channel. |

## 3.6 WIRELESS LOCAL AREA NETWORK (WLAN) TECHNOLOGY, (WI-FI)

**Q37. Explain WLAN in detail.**

*Ans ;* **(Imp.)**

Wireless LANs (WLANs) are wireless computer networks that use high-frequency radio waves instead of cables for connecting the devices within a limited area forming LAN (Local Area Network). Users connected by wireless LANs can move around within this limited area such as home, school, campus, office building, railway platform, etc.

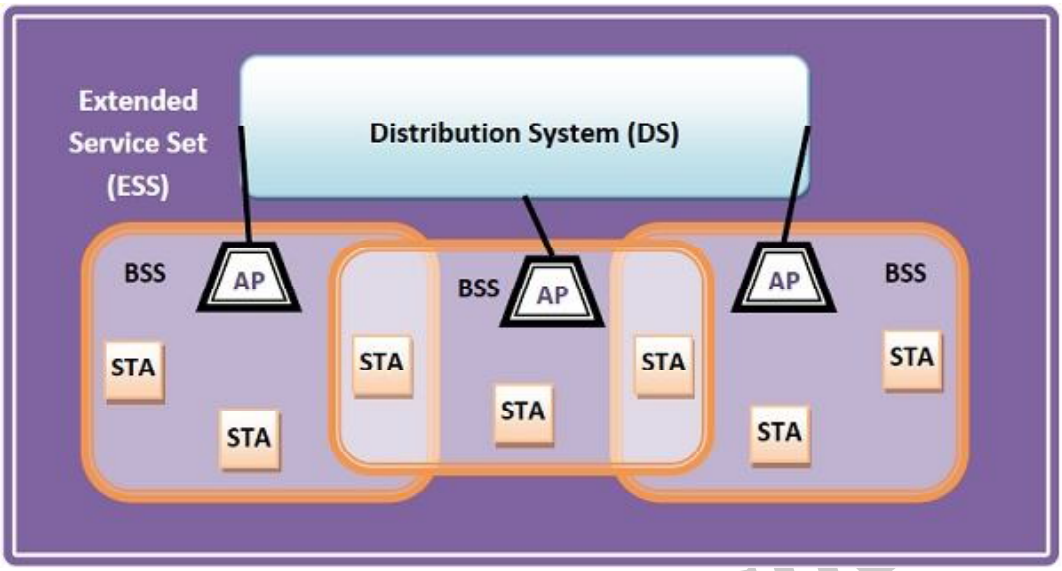
Most WLANs are based upon the standard IEEE 802.11 standard or WiFi.

**Components of WLANs**

The components of WLAN architecture as laid down in IEEE 802.11 are "

- **Stations (STA):** Stations comprises of all devices and equipment that are connected to the wireless LAN. Each station has a wireless network interface controller. A station can be of two types
  - Wireless Access Point (WAP or AP)
  - Client
- **Basic Service Set (BSS):** A basic service set is a group of stations communicating at the physical layer level. BSS can be of two categories.
  - Infrastructure BSS
  - Independent BSS

- **Extended Service Set (ESS):** It is a set of all connected BSS.
- **Distribution System (DS):** It connects access points in ESS.




**Types of WLANS**

WLANs, as standardized by IEEE 802.11, operates in two basic modes, infrastructure, and ad hoc mode.

- **Infrastructure Mode:** Mobile devices or clients connect to an access point (AP) that in turn connects via a bridge to the LAN or Internet. The client transmits frames to other clients via the AP.
- **Ad Hoc Mode:** Clients transmit frames directly to each other in a peer-to-peer fashion.

**Q38. What are the advantages of WLAN.**

*Ans :*

- **Flexibility:** Within radio coverage, nodes can communicate without further restriction. Radio waves can penetrate walls, senders and receivers can be placed anywhere (also non-visible, e.g., within devices, in walls etc.).
- **Planning:** Only wireless ad-hoc networks allow for communication without previous planning, any wired network needs wiring plans.
- **Design:** Wireless networks allow for the design of independent, small devices which can for example be put into a pocket. Cables not only restrict users but also designers of small notepads, PDAs, etc.
- **Robustness:** Wireless networks can handle disasters, e.g., earthquakes, flood etc. whereas, networks requiring a wired infrastructure will usually break down completely in disasters.
- **Cost:** The cost of installing and maintaining a wireless LAN is on average lower than the cost of installing and maintaining a traditional wired LAN, for two reasons. First, after providing wireless

access to the wireless network via an access point for the first user, adding additional users to a network will not increase the cost. And second, wireless LAN eliminates the direct costs of cabling and the labor associated with installing and repairing it.

- **Ease of Use:** Wireless LAN is easy to use and the users need very little new information to take advantage of WLANs.

**Q39. Discuss various disadvantages of WLANs.**

*Ans :*

- **Quality of Services:** Quality of wireless LAN is typically lower than wired networks. The main reason for this is the lower bandwidth due to limitations is radio transmission, higher error rates due to interference and higher delay/delay variation due to extensive error correction and detection mechanisms.
- **Proprietary Solutions:** Due to slow standardization procedures, many companies have come up with proprietary solutions offering standardization functionality plus many enhanced features. Most components today adhere to the basic standards IEEE 802.11a or 802.11b.
- **Restrictions:** Several govt. and non-govt. institutions world-wide regulate the operation and restrict frequencies to minimize interference.
- **Global operation:** Wireless LAN products are sold in all countries so, national and international frequency regulations have to be considered.
- **Low Power:** Devices communicating via a wireless LAN are typically power consuming, also wireless devices running on battery power. Whereas the LAN design should take this into account and implement special power saving modes and power management functions.
- **License free operation:** LAN operators don't want to apply for a special license to be able to use the product. The equipment must operate in a license free band, such as the 2.4 GHz ISM band.
- **Robust transmission technology:** If wireless LAN uses radio transmission, many other electrical devices can interfere with them (such as vacuum cleaner, train engines, hair dryers, etc.).Wireless LAN transceivers cannot be adjusted for perfect transmission is a standard office or production environment.

**Q40. What is WiFi ? What are its uses ?**

*Ans :* **(Imp.)**

WiFi stands for Wireless Fidelity. WiFiIt is based on the IEEE 802.11 family of standards and is primarily a local area networking (LAN) technology designed to provide in-building broadband coverage.

Current WiFi systems support a peak physical-layer data rate of 54 Mbps and typically provide indoor coverage over a distance of 100 feet.

WiFi has become the *de facto* standard for *last mile* broadband connectivity in homes, offices, and public hotspot locations. Systems can typically provide a coverage range of only about 1,000 feet from the access point.

WiFi offers remarkably higher peak data rates than do 3G systems, primarily since it operates over a larger 20 MHz bandwidth, but WiFiWiFi systems are not designed to support high-speed mobility.

One significant advantage of WiFi over WiMAX and 3G is its wide availability of terminal devices. A vast majority of laptops shipped today have a built-in WiFi interface. WiFi interfaces are now also being built into a variety of devices, including personal data assistants (PDAs), cordless phones, cellular phones, cameras, and media players.


## Usage and Application of Wifi

Many applications exist for Wi-Fi, including in all segments where computers or digital media are used. Wi-Fi can also be used for entertainment.

As an example, the following applications are described:

- We use Wi-Fi every day. With Wi-Fi, we can connect to the internet from any Wi-Fi-capable device.Wi-Fi allows us to have wireless communication, including streaming or casting audio or video to any device.
- Data transfer rates are also very fast when using Wi-Fi to share files, data, etc., among two or more computer or mobile phone.
- Another important attribute is the capability to print any document using a Wi-Fi printer.
- Wi-Fi can also be used as a HOTSPOT, providing Wireless Internet access for a specific area. While the main network connection is active, consumers of Wi-Fi-enabled devices can access the primary network connection via Hotspot, which provides them with temporary internet connectivity. To create a hotspot, Wi-Fi adapters spread radio signals by utilising the owner's network connection.


- Also one can create a Point-to-Point network using Wi-Fi or WLAN techno-logy. Two sites that are hard to reach by wire, such as two corporate office buildings, can be connected using this method.
- VoWi-Fi is also recognised as voice-over Wi-Fi, which is another useful tool. Few years ago, telecom firmsput forward theVoLTE (Voice over LTE) (Voice over Long-Term Evolution ). In recent years, VoWi-Fi has become increasingly popular, allowing us to make calls and anyone using our home Wi-Fi network. The only requirement is that our mobile phone must be connected to Wi-Fi. Instead of using the mobile SIM network, voice is transferred over Wi-Fi, resulting in very high voice quality. VoWi-Fi is already supported by a large number of mobile phones.
- **Internet via Wi-Fi in offices**: In offices, all computer systems are linked to the Internet via Wi-Fi. In the case of Wi-Fi, there is no need for complicated wiring. Also, the network's speed is excellent. It's possible to present an entire Wi-Fi project, such as a spreadsheet or ppt, to all participants at once.
- A cable break in Wi-Fi does not result in a loss of network connectivity, as it would be in the case of a cable.
- By deploying routers at specific locations, a city can also provide network connectivity using W-Fi. Because of its flexibility, schools, colleges, and universities have already implemented Wi-Fi networks.

- As a positioning system, Wi-Fi can be used to recognise a device's area by detecting the placements of Wi-Fi hotspots.

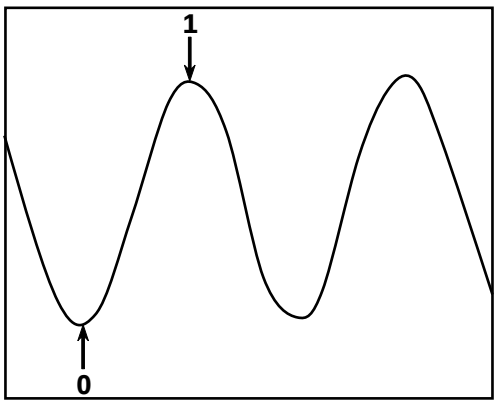
**Q41. What is Wi-Fi protocol?**

*Ans :*

First and foremost, Wi-Fi is a wireless communication system that transmits networks using electromagnetic waves. The radiofrequency is utilised in Wi-Fi because we understand that there are several types of electromagnetic waves based on their frequency, including X-rays, Gamma-rays, radio waves, microwaves, etc.

- **Base station network or Ethernet (802.3) connection**: It is the primary host network from which the router receives its network connection.
- **Access Point or Router:** Network bridge, also known as an access point or router, connects wired and wireless networks. A wired Ethernet connection is accepted, and the wired connection is converted to a wireless connection, which is then spread via radio waves.
- **Accessing Device:** There are several ways to gain access to information. From our mobile, computer, etc., we access Wi-Fi and surf the web using Wi-Fi.

Also, routers and our devices read data in binary form. In this case, routers transmit radio waves to our devices, obtaining and reading the waves in binary form. All of us are familiar with the binary representation of a wave, in which the topmost pick is 1 and the lower pick 0 in binary.




**Q42. List out basic advantages and disadvanatges of WiFi.**

*Ans :*

The advantages of Wi-Fi Tt include

- A **versatile network connection** and the absence of complicated wiring requirements for installation.
- Everywhere in the Wi-Fi range can access it.
- Independent users are not required to obtain regulatory approval.
- In addition, Wi-Fi Extenders make it possible to expand the network.
- It's easy and quick to set up.
- Only the SSID and password need to be configured.
- As part of its security measures, Wi-Fi networks encrypt radio signals using WPA encryption.
- It is also more affordable.
- Hotspots are another feature that it offers.
- Roaming is supported as well.

**Disadvantages**

- Mobile phones, laptops, and other devices with batteries consume a lot of power when using Wi-Fi.
- Even when encryption is in place, security issues can still arise.
- Wi-Fi can be attacked and accessed in the same way that recognised devices become unidentified to the router.
- In comparison to a direct cable connection, the speed is slower.
- People can be harmed by it because it emits radiation like cell phones.
- Thunderstorms, for example, can interfere with Wi-Fi signals.
- Because it lacks a firewall, unauthorised access to Wi-Fi is possible.
- Since a router is required to access the internet via Wi-Fi, we can't access the internet if the power goes out.

## 3.7 Wireless Metropolitan area network (WMAN) Technology, WIMAX, Wireless Personal Area Network (WPAN) technology (Bluetooth)

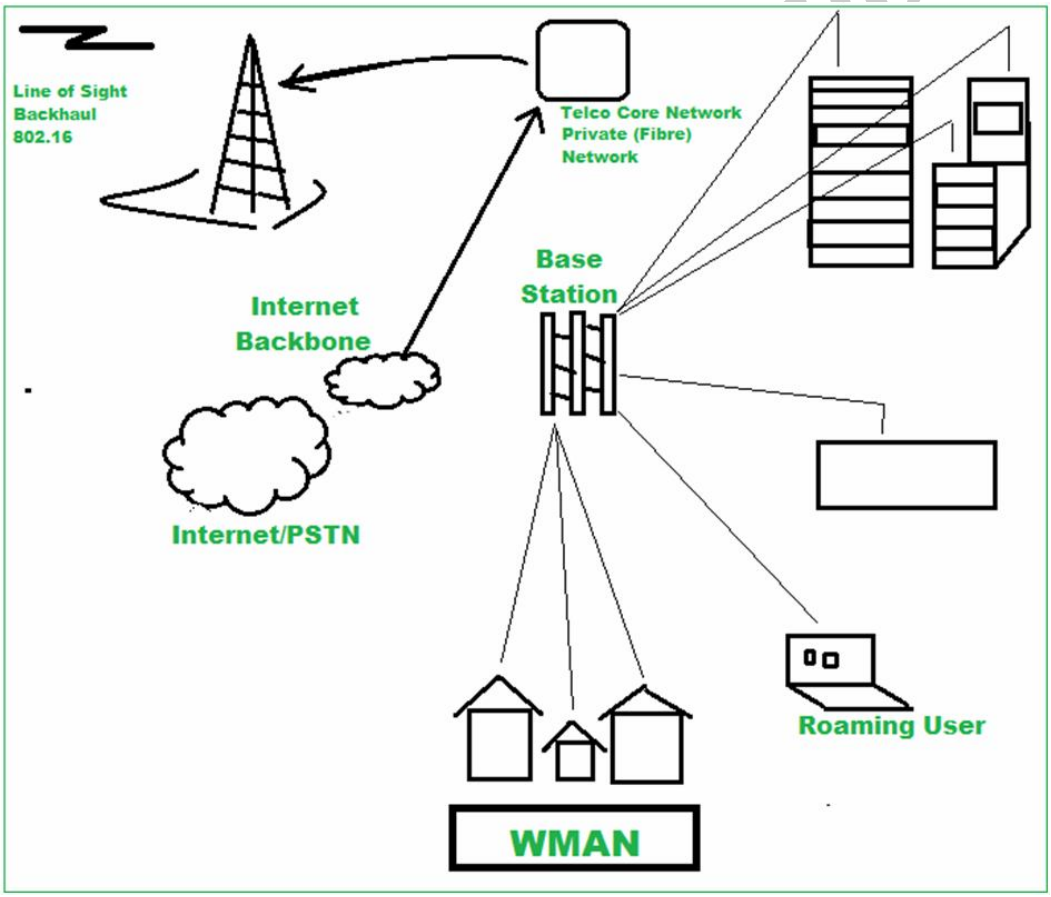
**Q43. Explain the concept of WMAN?**

*Ans :* **(Imp.)**

Wireless Metropolitan Area Network (WMAN) is a type of Metropolitan Area Network (MAN) and the only thing is that the connectivity is wireless. It spans multiple locations within a geographic area and it serves the range greater than 100 meters. It is one type of wireless networking which has a coverage area approximately the size of a city. Generally it spans or covers an area which is larger than the Wireless Local Area Network (WLAN) but smaller than Wireless Wide Area Network (WWAN). WMAN connections can be Point to Point or Point to Multipoint networks. It is a newer type networking technology which supplements to some wired technologies like Gigabit Ethernet, Resilient Packet Ring (RPR), SONET over IP etc.

A WMAN is mostly governed by a single entity such as an Internet Service Provider (ISP), government entity, or any other large corporation. A the user has to take the authorized access from the providers to use WMAN as the access is restricted only to the authorized users/subscribers.

The below figure illustrates a WMAN




**Types of WMAN**

There are two fundamental types of wireless MAN i.e.

1. **Back haul:** It is an enterprise type of network, cellular-tower connection. It can also use WiFi hotspot. In this type of network fixed wireless is used which saves large amount of money per year. Digital Subscriber Line (DSL) can also be used in Back haul, but Wireless connection is faster and less cost than normal fiber optics connection.

2. **Last mile:** It is used for temporary networks means where network requirement is for a temporary period. Like some large construction buildings/sites where conventional network service ( like DSL broadband and cable modem) is disrupted.

**WMAN Technology**

1. **Wireless Interoperable Metropolitan Area Exchange (WiMAX)**

   WiMAX is mostly used Wireless Metropolitan Area Network (WMAN) technology based on the IEEE 802.16 set of standards. It provides Multiple Physical Layer (PHY) and Media Access Control (MAC) options. It acts as an alternate wireless version of Ethernet and deployed in a variety of spectrum bands: 2.3GHz, 2.5GHz, 3.5GHz, and 5.8GHz.

2. **Local Multipoint Distributed Service (LMDS)**

   It is a broadband microwave wireless transmission technology which provides reliable digital two-way voice, data and Internet services. It is a wireless point to multipoint communication system that's why called as Local Multipoint Distribution System where Local refers to signal range limit, Multipoint refers to broadcast access, Distributed refers to transmission of wide range of data, Service refers to relationship between operators and users. It generally uses low powered, high frequency i.e. 25 to 31 GHz over a short distance.

3. **Multi-Channel Multipoint Distributed Service (MMDS)**

   MMDS was previously known as Wireless Cable or Broadband Radio Service (BRS). It is a wireless telecommunication technology which operates in the ultra-high-frequency (UHF) portion of the radio spectrum between 2.5GHz and 2.7GHz and is used for telecommunications technology and general-purpose broadband networking.

**Q44. List out any four characteristics and benefits of WMAN.**

*Ans :*

**Characteristics of WMAN**

1. Connection can be Point to Point or Point to Multipoint networks.
2. Service to multiple nodes from one access point.
3. Covers a larger area within a radius up to 50 km.
4. Stable connections to the terminals.

**Benefits of WMAN**

- Covers multiple locations within a metropolitan area.
- Does not require high cost for infrastructure in placing fiber or copper cabling and leasing lines.
- Works as backups for wired networks.
- Easy to use, extend, exchange.

**Q45. Describe the concept of WiMAX?**

*Ans :* **(Imp.)**

WiMAX is one of the hottest broadband wireless technologies around today. WiMAX systems are expected to deliver broadband access services to residential and enterprise customers in an economical way.

Loosely, WiMax is a standardized wireless version of Ethernet intended primarily as an alternative to wire technologies (such as Cable Modems, DSL and T1/E1 links) to provide broadband access to customer premises.

More strictly, WiMAX is an industry trade organization formed by leading communications, component, and equipment companies to promote and certify compatibility and interoperability of broadband wireless access equipment that conforms to the IEEE 802.16 and ETSI HIPERMAN standards.

WiMAX would operate similar to WiFi, but at higher speeds over greater distances and for a greater number of users. WiMAX has the ability to provide service even in areas that are difficult for wired infrastructure to reach and the ability to overcome the physical limitations of traditional wired infrastructure.

- WiMAX is a Acronym for Worldwide Interoperability for Microwave Access.
- WiMAX is a Based on Wireless MAN technology.
- WiMAX is a wireless technology optimized for the delivery of IP centric services over a wide area.
- WiMAX is a scalable wireless platform for constructing alternative and complementary broadband networks.
- WiMAX can satisfy a variety of access needs. Potential applications include extending broadband capabilities to bring them closer to subscribers, filling gaps in cable, DSL and T1 services, WiFi, and cellular backhaul, providing last-100 meter access from fibre to the curb and giving service providers another cost-effective option for supporting broadband services.
- WiMAX can support very high bandwidth solutions where large spectrum deployments (i.e. > 10 MHz) are desired using existing infrastructure keeping costs down while delivering the bandwidth needed to support a full range of high-value multimedia services.
- WiMAX can help service providers meet many of the challenges they face due to increasing customer demands without discarding their existing infrastructure investments because it has the ability to seamlessly interoperate across various network types.
- WiMAX can provide wide area coverage and quality of service capabilities for applications ranging from real-time delay-sensitive voice-over-IP (VoIP) to real-time streaming video and non-real-time downloads, ensuring that subscribers obtain the performance they expect for all types of communications.
- WiMAX, which is an IP-based wireless broadband technology, can be integrated into both wide-area third-generation (3G) mobile and wireless and wireline networks allowing it to become part of a seamless anytime, anywhere broadband access solution.

**WiMax Speed and Range**

WiMAX is expected to offer initially up to about 40 Mbps capacity per wireless channel for both fixed and portable applications, depending on the particular technical configuration chosen, enough to support hundreds of businesses with T-1 speed connectivity and thousands of residences with DSL speed connectivity. WiMAX can support voice and video as well as Internet data.

WiMax developed to provide wireless broadband access to buildings, either in competition to existing wired networks or alone in currently unserved rural or thinly populated areas. It can also be used to connect WLAN hotspots to the Internet. WiMAX is also intended to provide broadband connectivity to mobile devices. It would not be as fast as in these fixed applications, but expectations are for about 15 Mbps capacity in a 3 km cell coverage area.

With WiMAX, users could really cut free from today's Internet access arrangements and be able to go online at broadband speeds, almost wherever they like from within a MetroZone.

WiMAX could potentially be deployed in a variety of spectrum bands: 2.3GHz, 2.5GHz, 3.5GHz, and 5.8GHz.

**Q46. Explain WiMAX Technology in detail.**

*Ans :*

WiMAX is a technology based on the IEEE 802.16 specifications to enable the delivery of last-mile wireless broadband access as an alternative to cable and DSL. The design of WiMAX network is based on the following major principles "

- **Spectrum:** Able to be deployed in both licensed and unlicensed spectra.
- **Topology:** Supports different Radio Access Network (RAN) topologies.

- **Interworking:** Independent RAN architecture to enable seamless integration and interworking with WiFi, 3GPP and 3GPP2 networks and existing IP operator core network.
- **IP connectivity:** Supports a mix of IPv4 and IPv6 network interconnects in clients and application servers.
- **Mobility management**: possibility to extend the fixed access to mobility and broadband multimedia services delivery.

WiMAX has defined two MAC system profiles the basic ATM and the basic IP. They have also defined two primary PHY system profiles, the 25 MHz-wide channel for use in (US deployments) the 10.66 GHz range, and the 28 MHz wide channel for use in (European deployments) the 10.66 GHz range.

WiMAX Physical and MAC Layers are explained in separate chapters of this tutorial.

The WiMAX technical working group is defining MAC and PHY system profiles for IEEE 802.16a and HiperMan standards. The MAC profile includes an IP-based version for both wireless MAN (licensed) and wireless HUMAN (licence-exempt).

IEEE Standard 802.16 was designed to evolve as a set of air interfaces standards for WMAN based on a common MAC protocol, but with physical layer specifications dependent on the spectrum of use and the associated regulations.

The WiMAX framework is based on several core principles:

- Support for different RAN topologies.
- Well-defined interfaces to enable 802.16 RAN architecture independence while enabling seamless integration and interworking with WiFi, 3GPP3 and 3GPP2 networks.
- Leverage and open, IETF-defined IP technologies to build scalable all-IP 802.16 access networks using common off the shelf (COTS) equipment.
- Support for IPv4 and IPv6 clients and application servers, recommending use of IPv6 in the infrastructure.
- Functional extensibility to support future migration to full mobility and delivery of rich broadband multimedia.

**Q47. Define Wireless Personal Area Network mean? List out the basic characteristics of WPAN.**

*Ans :* **(Imp.)**

A wireless personal area network (WPAN) is a type of personal network that uses wireless communication technologies to communicate and transfer data between the user's connected devices. It allows an individual to connect all or most of his or her devices together and access the Internet or a local network using any of the native/supported wireless communication techniques.

WPAN is also known as a short wireless distance network.

WPAN works much like a standard personal area network (PAN) except that it uses a wireless communication medium instead of a wired connection. Typically, the devices in WPAN include peripheral and hand-held devices such as PDAs, smart phones and tablet PCs. A WPAN's range depends on the wireless router's capabilities, access point or the device itself, but it is usually restricted to a house or small office. WPAN can be created using Wi-Fi, Bluetooth, infrared, Z-wave or any similar wireless technologies. In some cases, one of the Internet enabled/powered devices acts as an access point and provides network and Internet access to other devices.

For example, a laptop can be connected to the Internet wirelessly by creating a Bluetooth WPAN with a cell phone. The General Packet Radio Service (GPRS) Internet connectivity of the cell phone can be shared with the laptop, and all data packets to and from the laptop are sent over the Bluetooth-powered WPAN.

Here are the main characteristics of a WPAN:

- Short-range communication
- Low power consumption
- Low cost
- Small personal networks
- Communication of devices within a personal space

**Q48. Explain in detail about Bluetooth technology.**

*Ans :* **(Imp.)**

Bluetooth technology is a high speed and low powered wireless technology designed to connect phones or other portable equipment for communication or file transmissions. This is based on mobile computing technology. Following is a list of some prominent features of Bluetooth technology:

- Bluetooth is also known as IEEE 802.15 standard or specification that uses low power radio communications to link phones, computers and other network devices over a short distance without using any type of connecting wires.
- As Bluetooth is an open wireless technology standard so, it is used to send or receive data to connected devices present across a certain distance using a band of 2.4 to 2.485 GHz.
- In Bluetooth technology, the wireless signals transmit data and files over a short distance, typically up to 30 feet or 10 meters.
- Bluetooth technology was developed by a group of 5 companies known as Special Interest Group formed in 1998. The companies are Ericsson, Intel, Nokia, IBM, and Toshiba.
- The range of Bluetooth technology for data exchange was up to 10 meters in older versions of devices, but the latest version of Bluetooth technology i.e., Bluetooth 5.0, can exchange data in the range of about 40-400 meters.
- The average speed of data transmission in Bluetooth technology was around 1 Mbps in the very first version. The second version was 2.0+ EDR, which provided the data rate speed of 3Mbps. The third was 3.0+HS, which provided the speed of 24 Mbps. The latest version of this technology is 5.0.
- In Bluetooth technology, the network of Bluetooth consists of a Personal Area Network
- Bluetooth's architecture is also called a "Piconet" because it is made of multiple networks.
- It contains a minimum of 2 to a maximum of 8 Bluetooth peer devices.
- It usually contains a single master and up to 7 slaves.
- Piconet provides the technology which facilitates data transmission based on its nodes, i.e., Master node and Slave Nodes.
- The master node is responsible for sending the data while the slave nodes are used to receive the data.
- In Bluetooth technology, data transmission occurs through Ultra-High frequency and short-wavelength radio waves.
- The Piconet uses the concept of multiplexing and spread spectrum. It is a combination of code division multiple access (CDMA) and frequency hopping spread spectrum (FHSS) technique.

**Q49. How does a Bluetooth works?**

**(OR)**

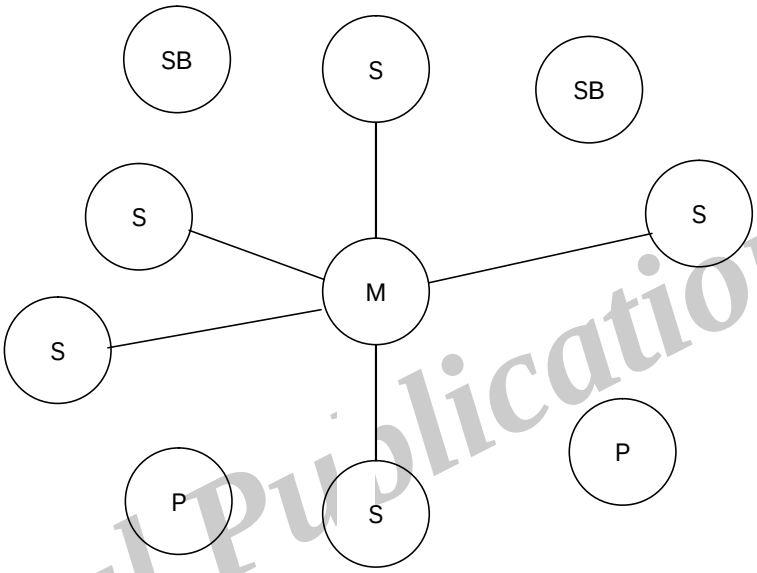
**Explain the mechanism of bluetooth.**

*Ans :*

The master is the device that initiates communication with other devices. The master device handles the communications link and traffic between itself and the slave devices associated with it. The slave devices have to respond to the master device and synchronize their transmit/receive timing with the master device's specified time.

Following is a list of some conditions that must be satisfied for a successful data transmission in Bluetooth technology:

- Maximum number of Master Node - 1
- Maximum number of Slave Nodes - 7
- Maximum number of Nodes in a Piconet - 8
- Maximum number of devices that can be paired - $2^8 - 1 = 255$
- Number of devices that can be parked '! Infinite (")






- The parked node is a type of node that is ready to be connected and stand by node is a type of node that can either become a slave or parked node or remains idle or disconnected.
- In Bluetooth technology, the data transmission can only occur between master and slave nodes. It cannot be done between slave and slave nodes. However, two master nodes can be connected.
- If the connection from the master node gets disconnected, the whole Piconet gets disconnected.
- If there is a connection between two master nodes, then that network is called as Scatter-net.
- It means scatter-nets are created when a device becomes an active member of more than one Piconet and the adjoining device shares its time slots among the different piconets.
- If the number of slaves or devices is increased in a Piconet, then the data transmission speed will be decreased, and if the number of slaves or devices is decreased in number, then the data transmission speed will be increased.

**Q50. List out various advantages and disadvantages of Bluetooth?**

*Ans :*

**Advantages**

Following is a list of some advantages of the Bluetooth technology:

- Bluetooth Technology is based on Wireless technology. That's why it is cheap because it doesn't need any transmission wire that reduces the cost.

- It is very simple to form a Piconet in Bluetooth technology.
- It removes the problem of radio interference by using the Speed Frequency Hopping technique.
- The energy or power consumption is very low, about 0.3mW. It makes it possible for the least utilization of battery life.
- It is robust because it guarantees security at a bit level. The authentication is controlled using a 128bit key.
- You can use it for transferring the data, and verbal communication as Bluetooth can support data channels of up to 3 similar voice channels.
- It doesn't require line of sight and one to one communication as used in other modes of wireless communications such as infrared.

**Disadvantages**

Following is a list of some disadvantages of the Bluetooth technology:

- In Bluetooth technology, the bandwidth is low.
- The data transmission range may also be an issue because it is also less.

**Q51. List out various applications of Bluetooth?**

*Ans :*

Bluetooth technology is used in many communicational and entertainment devices. The following are some most used applications of the Bluetooth technology:

- Bluetooth technology is used in cordless desktop. It means the peripheral devices such as a mouse, keyboard, printer, speakers, etc. are connected to the desktop without a wire.

- It is used in the multimedia transfer, such as exchanging multimedia data like songs, videos, pictures etc. that can be transferred among devices using Bluetooth.
- This technology is also used in the following devices: i.e.
- Bluetooth Speakers.
- Bluetooth Headphones.
- Bluetooth Headsets for calling purposes.
- Bluetooth gaming consoles etc.

# Short Question and Answers

**1. Wireless wide area network.**

*Ans :*

WWAN (Wireless Wide Area Network) is a WAN (Wide Area Network) and the only thing is that the connectivity is wireless. It provides regional, nationwide and global wireless coverage. Where Wide Area Network can be wired or wireless the Wireless Wide Area Network connections are completely wireless. In our day today life we are using the Wireless Wide Area Network of different sizes and depending on it delivery of telephonic calls, Web pages and streaming video, data sharing occurs.

WLAN (Wireless Local Area Network) differs from WWAN (Wireless Wide Area Network) technology wise for example when WLAN uses WiFi to connect and transfer data, WWAN uses telecommunication cellular network technologies such as 2G, 3G, 4G LTE, and 5G to transfer data.

WWAN not only always refers to a wide area rather a closed area with large geographic coverage is also considered as WWAN. For example a MANET (Mobile ad hoc networks) with nodes on buildings and towers or planes. A Low Power and low bit rate Wireless Wide Area Network (LPWAN) is also considered as WWAN. For example transmission of small packets of information between things in case of IoT (Internet of Things) implemented applications.

**2. Cellular systems**

*Ans :*

Cellular network is an underlying technology for mobile phones, personal communication systems, wireless networking etc. The technology is developed for mobile radio telephone to replace high power transmitter/receiver systems. Cellular networks use lower power, shorter range and more transmitters for data transmission.

**3. What is CDMA one?**

*Ans :*

CDMAone or IS-95 is a second generation (2G) digital cellular technology that is based on spread spectrum technique that improves channel capacity substantially by accommodating a large number of users in a single transmission channel. It is based on the wireless communication protocol IS-95 and is known by its brand name CDMAone.

It was first developed by Qualcomm in 1995, and is primarily used in North America where it competes with Digital AMPS (IS 136). The data rate of CDMAone is around 300 to 500 Kbps and operates in 1900 MHz band as well as 800 MHz band. The 3G version of CDMAone is known as CDMA2000 which is gradually replacing CDMAone in North America. In India, Reliance offers CDMA service to around 40 million subscribers.

CDMA systems employ a combination of digital transmission and spread spectrum technology. The analog audio (voice) signal is first digitized into binary elements using Analog to Digital Converters (ADC). Next, the frequency of the digital signal is varied according to a definite pattern or code. The modulated digital signal is then transmitted through the wireless medium and at the receiving end the signal is decoded at the receiver with the same code pattern as used in the transmitter. The code pattern is kept secret to maintain the privacy of the signal and also to make it hacker proof. CDMA uses wide bandwidth for the signal, so that they include a large range of frequencies and appear as noise signals and are hard to be

intercepted or demodulated by unwanted users. Further, spread spectrum (wide band) signals are difficult to interfere (jam) with than narrowband signals. These two qualities, namely low probability of intercept and anti-jam feature, made spread spectrum most appropriate for military applications. The coding used in spread spectrum systems are pseudo-random in nature which means they are not real (random) Gaussian code, but statistically generated code sequence which can be repeated over and over again. Actually, the spread spectrum signals are intentionally made of much wider band than required to carry the information, in order to make them more noise like so that they become much difficult to intercept and decode.

**4. List out various advantages and disadvantages of CDMA.**

*Ans :*

**Advantages**

CDMA has a soft capacity. The greater the number of codes, the more the number of users. It has the following advantages:-

- CDMA requires a tight power control, as it suffers from near-far effect. In other words, a user near the base station transmitting with the same power will drown the signal latter. All signals must have more or less equal power at the receiver
- Rake receivers can be used to improve signal reception. Delayed versions of time (a chip or later) of the signal (multipath signals) can be collected and used to make decisions at the bit level.
- Flexible transfer may be used. Mobile base stations can switch without changing operator. Two base stations receive mobile signal and the mobile receives signals from the two base stations.
- Transmission Burst – reduces interference.

**Disadvantages**

The disadvantages of using CDMA are as follows:-

- The code length must be carefully selected. A large code length can induce delay or may cause interference.
- Time synchronization is required.

**5. What is GSM Technology?**

*Ans :*

GSM is a mobile communication modem; it stands for global system for mobile communication (GSM). The idea of GSM was developed at Bell Laboratories in 1970. It is a widely used mobile communication system in the world. GSM is an open and digital cellular technology used for transmitting mobile voice and data services operate at the 850MHz, 900MHz, 1800MHz, and 1900MHz frequency bands.

GSM technology was developed as a digital system using the time division multiple access (TDMA) technique for communication purposes. A GSM digitizes and reduces the data, then sends it down through a channel with two different streams of client data, each in its own particular time slot. The digital system has the ability to carry 64 kbps to 120 Mbps of data rates.

**6. GPRS**

*Ans :*

General Packet Radio System is also known as GPRS is a third-generation step toward internet access. GPRS is also known as GSM-IP that is a Global-System Mobile Communications Internet Protocol as it keeps the users of this system online, allows to make voice calls, and access internet on-the-go. Even Time-Division Multiple Access (TDMA) users benefit from this system as it provides packet radio access.

GPRS also permits the network operators to execute an Internet Protocol (IP) based core architecture for integrated voice and data applications that will continue to be used and expanded for 3G services.

GPRS supersedes the wired connections, as this system has simplified access to the packet data networks like the internet. The packet radio principle is employed by GPRS to transport user data packets in a structure way between GSM mobile stations and external packet data networks. These packets can be directly routed to the packet switched networks from the GPRS mobile stations.

**7. Benefits of GPRS.**

*Ans :*

**i) Higher Data Rate**

GPRS benefits the users in many ways, one of which is higher data rates in turn of shorter access times. In the typical GSM mobile, setup a establishment time offered while GPRS is in practice is lower than one second and ISDN-line data rates are up to many 10 kbit/s.

**ii) Easy Billing**

GPRS packet trans mission offers a more user-friendly billing than that offered by circuit switched services. In circuit switched services, billing is based on the duration of the connection. This is unsuitable for applications with bursty traffic. The user must pay for the entire airtime, even for idle periods when no packets are sent (e.g., when the user reads a Web page).

In contrast to this, with packet switched services, billing can be based on the amount of transmitted data. The advantage for the user is that he or she can be "online" over a long period of time but will be billed based on the transmitted data volume.

**8. What is EDGE ? What are the key elements of EDGE ?**

*Ans :*

Enhanced Data Rates for GSM (Global System for Mobile) Evolution.

EDGE is an enhanced version of GSM and offers high speed 3G built on GSM. It is type of data system used on GSM network used to allow improved data transmission rates.Itcan transmit three times more bits than GPRR in the same length of time. EDGE is an "add-on" to GPRS, it cannot work alone. It was deployed on GSM networks by AT&T in 2003 in the United States.

EDGE is a 2.5G technology that is based on GPRS and can be used to offer personalised multimedia services similar to 3G technologies.It can be used to transmit both voice and data. It however is just an add-on to GPRS and can not work alone.

EDGE allows subscribers to access the Internet and to send and receive data, e.g. digital images and videos, with a broadband like transmission speed of 384 kbps that is about three times faster than an ordinary GPRS network. This speed is sufficient even for video-transmissions and in that sense it rivals the 3G Universal Mobile Telecommunications System (UMTS) technology.EDGE is reputed to possess high potential and a growing importance in many regions of the world, e.g. the Americas, Australia and India, where it is reported to be gaining market rapidly.The main advantage of EDGE is that it could allow network carriers to offer 3G-like services without having to actually acquire a 3G license. Implementing EDGE is relatively simple, as it works with the existing GSM/GPRS structure. It may also be used with laptops with the help of a card.EDGE however does not seem to have very bright prospects in Europe for a practical reason: Most of the network carriers in Europe have invested heavily in the expensive UMTS licensesand building a UMTS network.

**9. List out the features of EDGE.**

*Ans :*

Following are the features of EDGE.

- Provide increase data rate, e.g. high speed on GSM radio carriers as provided by broadband.
- It can retransmit a packet with more robust coding which means re-segmentation is possible.
- In EDGE packets are addressed up to 2048 while in GSM it is from 1 to 128.
- Similarly EDGE has a window size of 1024 and GSM window size was 64.
- EDGE reduces the number of bursts to retransmit when error occurs.
- It allows multimedia file transfer, web browsing and video conferencing through wireless terminals.
- It enables operators to triple the data rate of subscribers and provide extra capacity to their voice communications.
- It requires less radio resources to support the same traffic as supported by GSM networks.

**10. Define 3G Systems.**

*Ans :*

Third Generation systems or 3G systems refer to mobile communication systems that follow IMT-2000 (International Mobile Telecommunication-2000) standards defined by International Telecommunication Union (ITU). These systems are characterized by high data transmission rates, of the order of 200 Kbps up to 6 Mbps. They employ packet switched mode of data transmission along with spread spectrum technique to achieve high speed internet data transfer suitable for multimedia applications under mobile environment. 3G systems support high speed broadband internet access, video calling, mobile TV or multimedia gaming through mobile devices.

**11. UMTS.**

*Ans :*

Universal Mobile Telecommunication System (UMTS) is a 3G standard for mobile communication that provides enhanced data rate (of the order of 2 Mbps) and supports a full range of high speed multimedia services including broadband internet access. It follows 3GPP (Third Generation Partnership Project) specifications, defined under IMT-2000 standard. It is based on a technology known as FOMA (Freedom of Mobile Multimedia Access) and employs Wideband Code Division Multiple Access (W-CDMA) to achieve higher spectral efficiency and bandwidth than 2G GSM systems.

**12. What is 4G ?**

*Ans :*

The First generation wireless mobile communication systems were introduced in early eighties and second generations systems in the late 1980s were intended primarily for transmission of voice. The initial systems used analog frequency modulation where as the second as well as the subsequent mobile systems use digital communication techniques with time division multiplexing (TDM), frequency division multiplexing (FDM) or the code division multiple access (CDMA). The third generation wireless systems which are just getting introduced in the world markets offer considerably higher data rates, and allow significant improvements over the 2G systems. The 3G Wireless systems were proposed to provide voice and paging services to provide interactive multimedia including teleconferencing and internet access and variety of other services. However, these systems offer wide area network (WAN) coverage of 384 kbps peak rate and limited coverage for 2 Mbps. Hence providing broadband services would be one of the major goals of the 4G Wireless systems.

**13. What are the challenges of 4G?**

*Ans :*

i) Multiaccess interface, timing and recovery.

ii) Higher frequency reuse leads to smaller cells that may cause intra-cell interference or higher noise figures due to reduced power levels.

iii) The Digital to analog conversions at high data rates, multiuser detection and estimation (at base stations), smart antennas and complex error control techniques as well dynamic routing will need sophisticated signal processing.

iv) Issues in the interface with the ad hoc networks should be sorted out. 4G systems are expected to interact with other networks like the Bluetooth, hiperlan, IEEE802.11b, etc.

v) Voice over multi-hop networks is likely to be an interesting problem because of the strict delay requirements of voice.

**14. Define 5G systems.**

*Ans :*

Fifth Generation (5G) systems are the next evolutionary mobile network systems that will come after 4G systems. The standard is, at present, in its developmental stages and is expected to be launched around the year 2020. In the history of mobile communication systems, it has been found that in every 10 years, a new generation of mobile network is launched. The first generation (1G) system, namely AMPS was first introduced in late seventies (1978) in USA. The second generation (2G) system, i.e. GSM first appeared in late eighties (1988) followed by CDMA, another 2G system. The third generation system (3G) was first introduced in the year 2000 in the form of UMTS and CDMA 2000, and is widely deployed around the world for fast internet download and multimedia application).

**15. What is WiFi ?**

*Ans :*

WiFi stands for Wireless Fidelity. WiFiIt is based on the IEEE 802.11 family of standards and is primarily a local area networking (LAN) technology designed to provide in-building broadband coverage.

Current WiFi systems support a peak physical-layer data rate of 54 Mbps and typically provide indoor coverage over a distance of 100 feet.

WiFi has become the *de facto* standard for *last mile* broadband connectivity in homes, offices, and public hotspot locations. Systems can typically provide a coverage range of only about 1,000 feet from the access point.

WiFi offers remarkably higher peak data rates than do 3G systems, primarily since it operates over a larger 20 MHz bandwidth, but WiFiWiFi systems are not designed to support high-speed mobility.

**16. List out various advantages and disadvantages of Bluetooth?**

*Ans :*

**Advantages**

Following is a list of some advantages of the Bluetooth technology:

- Bluetooth Technology is based on Wireless technology. That's why it is cheap because it doesn't need any transmission wire that reduces the cost.
- It is very simple to form a Piconet in Bluetooth technology.
- It removes the problem of radio interference by using the Speed Frequency Hopping technique.
- The energy or power consumption is very low, about 0.3mW. It makes it possible for the least utilization of battery life.
- It is robust because it guarantees security at a bit level. The authentication is controlled using a 128bit key.
- You can use it for transferring the data, and verbal communication as Bluetooth can support data channels of up to 3 similar voice channels.
- It doesn't require line of sight and one to one communication as used in other modes of wireless communications such as infrared.

**Disadvantages**

Following is a list of some disadvantages of the Bluetooth technology:

- In Bluetooth technology, the bandwidth is low.
- The data transmission range may also be an issue because it is also less.

# Choose the Correct Answers

1. _____ converts the message into a sequence of information bits. [ b ]
   (a) Channel encoder (b) Source encoder
   (c) Modulate (d) None
2. Infrared wireless communication work on _____ [ a ]
   (a) Electromagnetic energy (b) Solar energy
   (c) Electrical energy (d) None
3. Which of the following is wireless communication _____ [ d ]
   (a) TV Remote (b) Security system
   (c) Wifi cellular telephone (d) All
4. Bluetooth equipments are _____. [ d ]
   (a) Stereo head set (b) GPs devices
   (c) Pointer (d) All
5. _____ weight less than 10 kgs. [ a ]
   (a) Nano (b) Micro
   (c) Macro (d) None
6. UTMS technology based on _____. [ a ]
   (a) W-CDMA (b) CDMA
   (c) GSM (d) GPP
7. _____ allows the change of short of short messages between mobile station & wireless systems. [ b ]
   (a) Message (b) SMS
   (c) MMS (d) Wireless
8. _____ is a store forward message service. [ a ]
   (a) MMS (b) SMS
   (c) Wireless message (d) None
9. Technology that is portable is _____. [ c ]
   (a) Bluetooth Technology (b) Satellite technology
   (c) Mobile technology (d) None
10. Mobile phone saves _____ diseases for crash users. [ b ]
    (a) Leg and hand diseases (b) Ear and Brain diseases
    (c) Hear and Legs diseases (d) Eyes and Nerves diseases

# Fill in the blanks

1. Communication is a _____ word.
2. _____ is a system which share idea, fooling etc.
3. A _____ is a collection of equipments that are integrates.
4. _____ converts the message signal into sequence of information bit.
5. Point to point link used to separately for _____.
6. Wireless communication is _____.
7. _____ technology permits hands free for incoming calls, tax and automatic synchronization for PDA.
8. _____ satellite weighting less the 10 kgs.
9. Second generation technology depends on _____.
10. _____ allows the exchange of messages mobile to mobile.
11. _____ is the advantage and extension of sms.



**ANSWERS**

1. Latin
2. Communication
3. Communication system
4. Source encoder
5. Optimality
6. Data communication
7. Bluetooth
8. Nano satellites
9. TDMA
10. SMS
11. MMS

# One Mark Answers

**1. Expand WWAN.**

*Ans :*

Wireless Wide Area Network.

**2. CDMA.**

*Ans :*

CDMA technology, predominantly used in North America, is based on IS 95 protocol, first developed by Qualcomm.

**3. TDMA.**

*Ans :*

Time Division Multiple Access (TDMA) is a digital cellular telephone communication technology.

**4. EDGE.**

*Ans :*

Enhanced Data Rates for GSM (Global System for Mobile) Evolution EDGE is an enhanced version of GSM and offers high speed 3G built on GSM.

**5. UMTS.**

*Ans :*

Universal Mobile Telecommunication System (UMTS) is a 3G standard for mobile communication that provides enhanced data rate (of the order of 2 Mbps) and supports a full range of high speed multimedia services including broadband internet access.

**6. WLAN**

*Ans :*

Wireless LANs (WLANs) are wireless computer networks that use high-frequency radio waves instead of cables for connecting the devices within a limited area forming LAN (Local Area Network).

**7. Wi-Fi**

*Ans :*

Wi-Fi is a wireless communication system that transmits networks using electromagnetic waves.

UNIT IV

## M-COMMERCE APPLICATIONS

Mobile financial services, Mobile advertising, Mobile Payment, Mobile Ticketing, Mobile product location and shopping, Mobile business services, Mobile auction, Mobile entertainment, Mobile office, Mobile distance education.

## 4.1 Mobile Financial Services

**Q1. What is MFS ?**

*Ans:*

The use of a mobile phone to access financial services and execute financial transactions. This includes both transactional and non-transactional services, such as viewing financial information on a user's mobile phone. Mobile financial services include both mobile banking (m-banking) and mobile payments (m-payments).

Mobile Financial Services fall into one of three categories:

1. Mobile payments (P2P, P2M, or M2M)
2. Mobile microfinance (loan disbursement and payments),
3. Mobile banking (bill pay or account information, e.g. balances or alerts).

**1. Mobile Payments**

A mobile-based transactional service that can be transferred electronically using mobile networks. A mobile money issuer may, depending on local law and the business model. Finally payments are done using mobiles.

**2. Mobile Microfinance**

Mobile banking has facilitated a new approach to microfinance by using the mobile phone, customer usage data and agents for loan applications, customer due diligence, and credit decision-making. The microfinance culture has begun to merge with the m-payments culture to provide much more than what microfinance services or m-payment services can offer alone.

**3. Mobile Banking**

The use of a mobile phone to access banking services and execute financial transactions. This covers both transactional and non-transactional services, such as viewing financial information on a bank customer's mobile phone.

Mobile banking is a type of electronic banking, or e-banking, which includes a broad array of electronic banking instruments and channels like the internet, POS terminals, and ATMs.

**Q2. What is Mobile Banking? List out various mobile banking services.**

*Ans:* **(Imp.)**

Mobile banking refers to the use of a mobile device to carry out financial transactions. The service is provided by some financial institutions, especially banks. Mobile banking enables clients and users to carry out various transactions, which may vary depending on the institution.

- Mobile banking refers to the use of a mobile device to carry out transactions. The service is provided by some financial institutions, especially banks.
- Mobile banking services can be categorized into the following: account information access, transactions, investments, support services, and content and news.

- To date, many financial institutions and banks make use of both SMS and apps to keep their clients informed of their account activities or to send out alerts to clients regarding possible fraud and/or updates and maintenance of service.

Mobile banking services can be categorized into the following:

**1. Account information access**

Account information access allows clients to view their account balances and statements by requesting a mini account statement, review transactional and account history, keep track of their term deposits, review and view loan or card statements, access investment statements (equity or mutual funds), and for some institutions, management of insurance policies.

**2. Transactions**

Transactional services enable clients to transfer funds to accounts at the same institution or other institutions, perform self-account transfers, pay third parties (such as bill payments), and make purchases in collaboration with other applications or prepaid service providers.

**3. Investments**

Investment management services enable clients to manage their portfolios or get a real-time view of their investment portfolios (term-deposits, etc.)

**4. Support services**

Support services enable clients to check on the status of their requests for loan or credit facilities, follow up on their card requests, and locate ATMs.

**5. Content and news**

Content services provide news related to finance and the latest offers by the bank or institution.

**Q3. Discuss three major mobile banking business models.**

*Ans:*

Mobile banking offers various financial and non-financial banking transactions performed Through mobile devices. Such online banking transactions are usually processed by banking agents that control withdrawals, deposits or fund transfers on behalf of the banks or other financial institutions. These banking agents have collaboration with banks and/or mobile service providers and have become an integral part of mobile banking. Several retail or postal outlets, such as pharmacies, supermarkets, post offices, etc. can act as banking agents and conduct financial transactions performed through mobile devices on behalf of the banks. These banking agents also offer front-end customer support services, such as account opening, lending, deposits, etc. in collaboration with either the banks or the mobile service providers. Depending on whether the mobile banking transactions are controlled by banks or non-bank mobile service providers, three mobile banking business models are available. These are as follows:

**1. Bank-focused Model**

In this model, the financial institution, such as bank provides banking services directly to its customers through mobile devices. The bank provides a customized mobile banking user interface that allows customers to access the bank website over their mobile devices and perform online banking transactions. This is an extension of internet banking and the bank controls the banking transactions for its existing customers.

**2. Bank-led Model**

In this model, the bank makes collaboration with mobile network operators and mobile device manufacturers and provides a common mobile banking platform to mobile users. This is an alternative to conventional branch-based banking, and allows customers to perform mobile banking transactions through some banking agents, instead through bank branches or bank employees. Such branchless mobile banking offers banking transactions through mobile devices,

and is controlled either by telcos (mobile network providers or mobile device manufacturers) or other retail banking agents (such as retail stores or post offices, etc.). The telcos and retail agents offer the front-end customer support to mobile customers and the back end financial processing is controlled by the bank. In this manner, banks enjoy a wider customer base as they use a different delivery channel (mobile devices) and different trade partners (telcos, retail agents) at a much cheaper rate than conventional branch-based model. However, in bank led model, the customer account information is maintained and controlled by the bank, instead of the telcos or retail agents.

**3. Non-bank-led Model**

In this model, the bank and telcos make an agreement to provide a mobile banking platform to the mobile user, but the bank will only provide the funds for a transaction. The account management and other day-to-day functions are performed solely by non-bank partners (telcos) who have a direct contact with the customers. Thus, the bank has a very limited role in customer service or account handling and only provides funds for the transactions.

**Q4. Describe various technologies used in mobile banking.**

*Ans:*

Mobile banking technologies are of two types, namely server side technologies and client side technologies. Server side technologies are stored in a secured server at a bank or at the service provider premises. Examples of server side technologies are SMS banking, WAP applications, IVR (Interactive Voice Response) and USSD2 (Unstructured Supplementary Service Data). Client side technologies are mobile applications stored in the mobile handset or embedded inside the SIM card of the mobile handset. The client applications are usually built under J2ME (Java) environment and have different characteristics and processes depending on user requirements. In each of the above applications, the user first has to activate the service through a registration process. The registration process is defined and endorsed by the bank or the mobile banking service provider and provides an initial identification of the customer to ensure trust and security of the transaction. The consumer identification data such as personal details, credit card details etc. are stored in the server under strictly confidential environment. Each of the above technologies is discussed below:

**1. Interactive Voice Response (IVR)**

Interactive Voice Response is analogous to phone banking where a customer first dials a pre-defined IVR number from the mobile phone. Next, the customer is greeted by pre-recorded welcome message, followed by a menu of different banking options. The customer chooses a particular option by pressing the corresponding number from the keypad and the respective transactional information is announced through a pre-recorded speech. The mobile number of the customer (from which the IVR call is made) supplies the identity information for the customer and provides necessary authentication for making bank transactions. The customer account is identified and the requested information is provided through voice messages using a text-to-speech programme. The major limitation of IVR is that it can only be used for enquiry-based services, and is also more expensive as compared to other methods as it requires to make a phone call which is generally more expensive than sending an SMS or making data transfer through WAP services. IVR systems are usually implemented using PBX systems that hosts IVR dial plans and other information.

**2. SMS Banking**

In SMS banking, user sends a structured SMS code requesting some banking transaction to a pre-assigned number. The bank responds by sending a reply SMS containing the transaction information. SMS banking can be used for both financial and non-financial transactions, though SMS-based financial transactions are seldom used because of security concerns. For example, a customer of Punjab National Bank (PNB) can send an

SMS code PNBBAL, requesting for account balance information. Similarly, a customer of SBI can send an SMS TRN (a/c No.) (PIN No.) (Amount), for making a fund transfer to the specified account number. The main advantage of SMS banking is that almost all mobile phones support SMS service and the cost of banking transaction is just the cost of an SMS which is affordable to all.

The SMS sent by the customer first pass from user handset to the Short Message Service Centre (SMSC) of the Mobile Network Operator (MNO) through the mobile network. Next, SMSC stores and forwards the SMS to the SMS gateway allocated to the mobile banking service provider or the bank. The bank (or mobile banking service provider) uses the user mobile number, forwarded by the SMSC along with the SMS, to identify the user account and respond to the user request. Another important use of SMS banking is sending alert messages to the customers under emergency situations. Whenever there is an ATM fraud happening in a particular region, the bank can send a mass alert to its customers in that region forbidding them to use the ATM. Also, the alerts can be sent on an individual basis whenever any abnormal transaction happens in a customer's account using an ATM or credit card.

### 3. Wireless Application Protocol (WAP)

Wireless Application Protocol (WAP) is an international standard that enables wireless internet access in mobile devices, such as smartphones or tablets. A WAP browser displays websites (known as WAP sites) in the small screen of a mobile device and offers all the basic services of a computer-based web browser, but simplified to operate within the restrictions of the mobile devices, such as small screen size, small processing power, limited storage and power backup. WAP sites are developed using WML (Wireless Markup Language) and are displayed in WAP browsers. The WAP sites are accessed via WAP gateways that forwards bank WAP website to the user's mobile devices through the mobile network. The WAP server is hosted in bank premises and stores WAP sites containing banking applications.

WAP sites offer banking services similar to Internet banking. The users can access the banking websites in their mobile devices and perform banking transactions anytime and anywhere on earth. The users are allowed to perform both enquiry based as well as transaction based banking operations. The actual banking application resides in bank premises and the security of the transaction is maintained exactly in the same manner as in Internet banking. However, in order to access WAP sites, the mobile device must have the right configuration and additional functionalities as specified by the mobile network operator and/or the bank.

### 4. Unstructured Supplementary Service Data (USSD)

Unstructured Supplementary Service Data (USSD) is a communication protocol used by GSM network providers to communicate with the cell phone users. It is a two way communication protocol (unlike SMS which is a one way communication protocol), where a real-time communication channel is established (between the mobile user and the service provider) that allows two-way exchange of data. SMS works in a store-and-forward mode where data can be sent in one direction at a time. USSD is session-based and provides interactive dialogue between the user and the application provider. In a single USSD session, both sides can communicate and exchange messages for a specified period of time. Thus USSD is more responsive in nature than SMS and is used for a variety of applications, such as mobile money service, location based content services, menu based information delivery services and pre-paid callback services.

**5. Standalone Client Applications (J2ME/ Java)**

Standalone mobile application clients are application programs that users can download and install in their mobile devices from bank websites and use them for conducting complex banking transactions from their mobile devices. The applications are mostly developed in Java under J2ME (Java 2 Micro Edition) environments and allow banks to customize the application according to their specific requirements. In order to run the application, the mobile handset must be able to support J2ME, must have enough memory to house the application and must have sufficient graphics capacity to display the user interface of the application. Once the application is downloaded in the mobile handset, it may use SMS, USSD or GPRS to transfer user data or instructions to the bank. The data is transferred in encrypted form in order to ensure end-to-end security of transaction data. The user interface of the mobile applications is similar to that of a website and provides same graphic-rich benefits of the internet to the mobile users. The user follows the application menu, selects a particular transaction and press Enter button to execute the transaction. The transaction data is first encrypted and then sent to the bank (or banking service provider). Once received, the bank will first decrypt the message and then process the requested transaction.

**6. Citi Mobile**

Citi Mobile is a standalone client application offered by Citibank to its customers to provide mobile banking facility. The customers first download the application in their mobile devices from Citibank website and can use it for making banking transactions from their mobile devices. The customer first signs on his/her online banking accounts in Citibank website and enters the mobile number, the name of the mobile carrier and model number/name of the mobile handset. This is required as the Citi Mobile application must be customized to the make and model of the handset. Next, the customer gets two SMS in the handset, one is the download instructions and the other is an activation key, required to set up the application in the phone. The customer then downloads and installs the application in his/her mobile phone, a process that takes two to three minutes. Next, the customer launches the application using the activation key and the mobile banking service becomes available. Before making transactions, the customer has to sign in by entering the mobile number and make account transfers, balance inquiry and payments through the mobile devices. In addition to these, the customer can find Citibank locations and can connect to Citibank customer service with a single click.

**Q5. Explain the advantages of Mobile banking.**

*Ans:* **(Imp.)**

**Advantages**

Mobile banking provides the following advantages :

**(a) Always on 24×7 Accesses**

Banks are able to provide services to the customers for 24 hours per day and 7 days per week. It enables the consumers to be transaction-ready much as cable access has facilitated online PC access and reduced consumer dialup delays.

**(b) Advanced Penetration of Mobile Networks**

The 2G networks already cover more than 90% of the population in the western world and this number is growing steadily.

**(c) Personalisation**

Through Subscriber Identify Module (SIM) cards, mobile customers have a specific profile that enables customised functionality to directly reflect the way they want to transact business over mobile devices. Through the convenient addition of a multi-application, relationship card, mobile customers will also have a built-in platform for a host of other application services, including security keys, virtual credit cards and other customised payment instruments.

**(d) WAP**

Rapid evolution of global protocols such as Wireless Application Protocol (WAP) enables the communication channel between computers and mobile devices. The WAP component essentially provides the facility of reforming data for display in wireless handsets.

**(e) Faster Data Processing Speed**

Increase in bandwidth and data transmission speeds makes mobile data services efficient and cost-effective in a real time environment.

**(f) Security**

In addition to the above mentioned smart card, a private key stored on the SIM card can protect e-banking transactions. Effectively, the mobile phone can become a wireless wallet to protect proprietary purchase and financial information.

**(g) Mobile Payment**

Mobile payment means executing a payment transaction using a wireless device such as mobile phone or personal digital assistant. The mobile device becomes the electronic payments device. Its mobility is its big advantage. It enables payments to be transacted regardless of place and time. Telephone and internet banking afford customers bill payment and purchasing conveniences at any time.

**Q6. List out the disadvantages of Mobile Banking.**

*Ans:*

**Disadvantages**

Following are the disadvantages of Mobile Banking.

**(a) Restricted Plans**

Though there were many plans to enhance mobile banking offerings and services, in reality the initiatives were very restricted. Most applications are informative such as bank balances or credit card or bank amounts rather than interactive services like buying or trading

**(b) Technical Problems**

There are problems of technical issues, security concerns and cost constraints. WAP proved to be too slow and cumbersome to satisfy the customer. People think about security. But, their concerns are not adequately fulfilled by purveyors of m-banking.

**(c) High Charges**

The most significant problem of m-banking is that costs exceed perceived benefits. The charges for data transmitted are still too high to develop mobile banking in several countries.

**(d) Negative Experience in European Countries**

Experience about m-banking in European countries has not been positive. e.g. the British leader in on-line banking decided to abort its mobile offering. It saw little enthusiasm for mobile banking among its customers.

**Q7. What is micro finance?**

*Ans:*

Microfinance, also called microcredit , is a type of banking service provided to unemployed or low-income individuals or groups who otherwise would have no other access to financial services.

- Microfinance is a banking service provided to unemployed or low-income individuals or groups who otherwise would have no other access to financial services.
- Microfinance allows people to take on reasonable small business loans safely, and in a manner that is consistent with ethical lending practices.
- The majority of microfinancing operations occur in developing nations, such as Uganda, Indonesia, Serbia, and Honduras.
- Like conventional lenders, microfinanciers charge interest on loans and institute specific repayment plans.
- The World Bank estimates that more than 500 million people have benefited from micro-finance-related operations.

**Q8. Describe various services of mobile banking.**

*Ans:*

**1. Enquiry-based services**

It includes request for mini statements, account history, card and loan statements, pension plan statement, insurance policy statements, cheque status enquiry, balance enquiry, credit card information, enquiry for due payment dates, information on returned cheque status, etc. It provides valuable market information, such as foreign exchange rates, bank interest rates, commodity prices, stock market quotes and reports, product information and offers. It also provides information regarding various bank branches and ATMs and emergency helpline and contact number.

**2. Transaction-based services**

It includes fund transfer, micro payments, bill payments, commercial payments, subscribing to insurance policies, mobile recharge, withdraw/ deposit by banking/retail agents, peer-to-peer payments, etc. It also involves account administrative services, such as change of PIN, blocking of stolen payment cards, ordering of new cheque books, etc.

**3. Content-based services**

It offers location based services, weather updates, news updates and traffic updates.

**4. Support services**

It includes credit request, insurance coverage request, mortgage approval, request for ATM cards, submission of complaints, loan request, exchange and responding to customer e-mails, etc.

**5. Investment services**

It includes real time stock quotes delivery, portfolio management services, selling and purchase of financial instruments or securities, security alerts and unusual price notifications.

## 4.2 MOBILE ADVERTISING

**Q9. What is mean by mobile advertising?**

*Ans:*

Mobile advertising is the communication of products or services to mobile device and smartphone consumers. The mobile advertising spectrum ranges from short message service (SMS) text to interactive advertisements. Mobile advertising is a subset of mobile marketing.

Mobile advertising targets users according to specified demographics. Mobile networks identify related mobile profiles and preferences and displays corresponding advertisements when consumers download and uses data services like games, applications (apps) or ring tones.

The Mobile Marketing Association (MMA) is a non-profit global trade association that fosters mobile marketing and advertising technologies. It regulates associated terms, specifications and best practices. MMA also oversees global mobile advertising units in messaging, applications, video, television and also on the Web.

Mobile advertising can be done in the following ways:

- **Mobile Web**

  Text tagline ads, mobile Web banner ads, WAP 1.0 banner ads, rich media mobile ads

- **Multimedia Messaging Service**

  Short text ads, long text ads, banner ads, rectangle ads, audio ads, video ads, full ads

- **Mobile Video and TV Advertising Units**

  Ad breaks, linear ad breaks, nonlinear ad breaks, interactive mobile video and TV ads

- **Mobile Applications**

  In-app display advertising units, integrated ads, branded mobile applications, sponsored mobile applications.

**Q10. Explain the working procedure of Mobile advertisements.**

*Ans:*

- Mobile advertising is any form of advertising that appears on mobile devices such as smartphones and tablets using wireless connections.
- Companies advertise through text ads via SMS or through banner advertisements that appear embedded on a mobile web site.
- Ads are tailored based on consumer tastes and/or browsing history using data mining and other information gathering techniques.

Modern technology has given consumers a wider range of options when it comes to how they consume media. In fact, people now spend more time on their smartphones, tablets and other mobile devices than they do sitting in front of the TV. That's because of the ease and cost of these devices, not to mention the availability of wireless connections allowing people to tap in.

In order to keep up with changing consumer habits, companies adapted their advertising campaigns by adopting mobile advertising strategies. That's because the chance that new and existing customers will see an ad through a mobile device is greater than they would through traditional avenues. Because mobile devices typically have smaller screens than computers or laptops, this form of digital advertising is usually optimized for small displays.

The earliest form of mobile advertising took place via SMS text messages. But mobile ad campaigns quickly evolved into mobile web and in-app advertisements. One of the popular models in mobile advertising is known as cost per install (CPI), where payment is based on the user installing an app on their mobile device. CPI mobile advertising networks work either as incent or non-incent. In the incent model, the user is given virtual points or rewards to install the game or app.

Many apps offer a free version that can be downloaded at no cost, but which is paid for by placement of advertisements within the app. Mobile versions of websites also have advertisements that are optimized for mobile displays—smaller than they would appear on the full version of the same website.

Although mobile advertising helps keep company revenues up, there are concerns about consumer privacy. That's because companies use data mining and other ways to collect information about consumers while they use their devices. Advocates argue that companies may share or even sell the data they collect and use with others.

**Q11. List out various types of mobile advertisements.**

*Ans:*

Mobile advertising can take a number of different forms. These include:

- **Push notifications**

  These are pop-ups that appear on a mobile device. These are delivered to consumers at any time. This means users don't actually have to be on an app in order to get a notification.

- **Image text and banner ads**

  Users who click on their ads are redirected to the advertiser's page by opening it up on a browser.

- **Click-to-download ads**

  When a consumer clicks on these ads, they will route them to the Google App or Apple App store. The destination depends on the consumer's operating system and device.

- **Click-to-call ads**

  Advertisers allow users to click on their ads in order to call them directly with their smartphones.

- **Click-to-message ads**

  A consumer who clicks on this type of ad is directed to contact the advertiser directly via SMS.

**Q12. How mobile advertising is different from mobile marketing?**

*Ans:*

Mobile advertising may seem similar to mobile marketing, but the two are inherently different. Mobile marketing is a more general term that encompasses mobile advertising. While it uses personal data collected, mobile marketing also makes use of technology such as location services to personalize ads based on user preference, habits, or location. This means that some mobile advertisements may only appear when a mobile user is in close proximity to a certain store or service provider.

Mobile ad placement works by way of a programmatic bidding process for ad placement, in which advertisers bid in real-time for the right to place an ad on a mobile device. The infrastructure that allows for this process is known as a demand-side platform (DSP). The use of such platforms will enable advertisers to optimize their performance based on a number of key performance indicators (KPI), such as effective cost-per-click (eCPC) and effective cost-per-action (eCPA).

**Q13. Discuss the advantages of Mobile advertising.**

*Ans:* **(Imp.)**

**1. It reaches people in real-time situations**

Mobile devices are carried by their owners almost everywhere they go. Many users will have their mobile devices active even when they are at home. You can contact people through multiple mobile devices if they are in your targeted demographic. The average person in the United States spends more than 3 hours per day on their preferred mobile device. Advertising through mobile gets your message heard.

**2. It requires less content to be effective**

Mobile advertising can be effective with a simple headline and 1-2 lines of follow-up text. It is advertising that is based on images and first impressions more than a complex value proposition. You are creating something that makes the mobile user want to investigate. For many companies, the costs involved in creating this content are much less than video marketing, generalized content marketing, or social media marketing.

**3. It creates instantaneous user responses**

When mobile advertising reaches the correct demographic, 90% of consumers with a smartphone are able to recall a mobile web advertisement that they saw even a week after they had seen it. Although in-app advertising is lower, the recall rate is still at 86%. The engagement rates are much higher for mobile advertising as well, with 11% clicking on an ad and 8% going to the website of the brand after seeing the advertisement.

**4. It places advertising content where people happen to be**

According to information released by eMarketer, in-app activities account for 89.2% of adult smartphone usage time in the United States. For tablets, in-app use accounts for 76.8% of usage time. You must be engaged in some type of mobile advertising to get your message to these people. Although mobile web engagement rates are a little higher, the average person will spend just 16 minutes each day using the mobile web. The remainder of the time is with an app.

**5. It creates content that can be shareable**

Mobile advertising does more than encourage a click or try to get a user to remember a

website or phone number. It also creates content that is easy to share across social media platforms. This type of advertising helps brand ambassadors extend your message to other networks that may not always engage with the goods or services you provide. With the right message and a little luck, your advertisement may even go viral.

**6. It creates data that can be instantly tracked**

The content offered in mobile advertising is designed to create interaction opportunities. When a campaign is released, the responses from users can be tracked instantly. You can see what is working with your ads, what is not working, and make immediate adjustments if you see users in your targeted demographics not responding as anticipated. Over time, this advantage allows you to fine-tune a mobile advertising campaign, so that it is able to provide your company with long-term results.

**7. It gives you access to mobile payments for instant transactions**

Mobile advertising creates the modern equivalent of an impulse purchase. When you stand in line at the grocery store, what do you see? Candy bars, gum, sodas, water, and reading material. These are all items designed to engage a purchase because you're bored, waiting for someone to scan your purchases. Mobile advertising does the same thing. Consumers use their smartphones as a form of entertainment. Boredom creates interest in something new. That is why engagement rates are so high with this option. Your advertisement is able to fulfill a consumer need.

**8. It can be used in multiple ways**

Mobile advertising doesn't always need to be about selling goods or services. You can also use it to ask for feedback about how you are doing. Consumer surveys, reviews, and other feedback options can be completed in real-time, allowing you to see how someone is thinking or feeling about your message at any given moment. That gives you more opportunities to solve problems for people before they spiral out of control and become negative PR for your company.

**Q14. Discuss the disadvantages of Mobile advertising**

*Ans:*

**1. It creates advertising that people hate**

Mobile advertising is an interruptive form of advertising. It allows you to create a message that will be remembered, which can be an advantage. It turns into a disadvantage when you create frustration for the user by interrupting their mobile experience in some way. HubSpot reports that 70% of people who regularly use a mobile device dislike seeing mobile advertising. Mobile ad-blocking apps have increased in popularity by more than 90%. That combination means you must be specific with your targets with advertising, or you could be wasting your money.

**2. It needs to be perfect the first time around.**

Real-time reactions can create positive interactions between users and brands. That means if your message is imperfect in some way, the negative first impression that is made is one that will matter. Your content needs to be error-free. Your ad size should be vertical to get the best result. Page position also matters. The most viewable position for mobile advertising is right above the fold instead of at the top of the page.

**3. It may force some users to make assumptions about your company.**

Because there is less content involved with a mobile advertisement, you're relying on a click or a visit to your website to get the full message sent to a consumer. You're forced into a position where consumers must see your advertisement, then make assumptions about who you are and the value proposition that is being offered. This creates opportunities for your message to be heard in an unintended way, which may drive some

of your targeted demographic away from your business and into the hands of the competition.

**4. It does not have a standard display option to use**

Although advertising providers will do their best to display mobile ads in the way your company submits them, there is no guarantee that users will see them as intended. Phones come in various shapes and sizes. Multiple generations of equipment are being used. Take the iPhone, for example. The iPhone 4 series still produces more than 3% of global web traffic, according to Apple Insider, despite several new series being introduced. How your ad looks in different browsers or apps may change for users as well.

**5. It feels like a telemarketing call**

Remember those phone calls you'd get at dinner time trying to sell you something? That's what mobile ads do for users throughout their day. Even when consumers have opted in to receive marketing messages from you, there is no guarantee that they will continue wanting your messages. Even if you automate your entire process and allow your ads to generate results on their own, there is no guarantee for success with an investment into this advertising option.

**6. It may create navigational difficulties for some users.**

About 80% of the phones owned in the United States are smartphones. That means 20% of users are using standard cell phones to meet their mobile needs. Even when touchscreen capabilities are present, there may be navigation issues to consider when designing a mobile add. Some advertisements may not gain an interaction, even if the user is interested, because it is too difficult for them to access it.

**7. It costs the user something to receive your advertisement.**

This is the primary disadvantage to mobile advertising that should not be forgotten. Even though we live in an era of unlimited data, SMS, and MMS, not every consumer uses an unlimited plan. There are standard data and texting charges which may apply to some accounts. If you're sending a barrage of advertising messages that are being charged $0.10 per item to the user, then you're not going to create positive vibes with the consumer. We must remember that people are paying to see the messages that are being offered to them, in one way or another, and respect that fact.

## 4.3 MOBILE PAYMENTS

**Q15. What is meant by mobile payments?**

*Ans:*

A mobile payment is a money payment made for a product or service through a portable electronic device such as a tablet or cell phone. Mobile payment technology can also be used to send money to friends or family members, such as with the applications PayPal and google pay.

- Initially more popular in Asia and Europe, mobile payments spread to North America and experienced considerable growth.
- Merchants unwilling to retool existing terminals have contributed to the slow growth of mobile pay compared to physical credit cards.
- Mobile payments offer additional privacy and security benefits compared to physical cards.
- There are mobile payment apps for both Apple and Android (Apple Pay and Google Pay).

Many banks have recently adopted technology into their banking apps that allow customers to send money instantly to friends and family members directly from their bank accounts. Mobile payments are also made on site at stores by scanning a barcode on an app on your phone, accepting payments from convenience stores to large, multi-national retailers.

The cost of the purchase may be deducted from a pre-loaded value on the account associated with the particular store, or paid by credit or debit

card. Payment information is encrypted during transmission, so it is thought of as being a safer payment method than paying with a debit or credit card.

**Q16. What are the characteristics of mobile payment systems?**

*Ans:* **(Imp.)**

**1. Simplicity**

The mobile payment system must be simple and user-friendly with rninimum learning curve for the customer to use it. There must be scope for the customer to personalize the application according to his/her convenience.

**2. Availability**

The mobile payment system must be universal in nature and must operate under various domestic, national and global environments. Users must be able to perform financial transactions in C2C (between customers), B2B (between businesses) or B2C (between businesses and customers) modes. The interoperability among various communication standards and mobile network architectures must be maintained. The software must be developed under open technologies that allow interactions among different mobile networking systems.

**3. Security**

The most important feature of any mobile payment system is the security arrangements. At the time of making payment, the customer has to enter the credit card number, bank account number or bank PIN number depending on the particular type of mobile payment used. The important and confidential account information of the customer must be protected from misuse by unwanted hackers which may lead to financial and other losses to the customer. In order to resist hacker or virus attacks, proper security arrangements must be adopted in the form of firewalls, Public Key Encryption (PKI techniques and password authentication. Also, care must be taken to ensure that the customer credit history is kept in strict confidence so that the privacy of the customer is not compromised.

**4. Low cost**

The transaction cost of mobile payment systems must be lower than that of other conventional payment systems. The cost should not be a barrier to the mass deployment of mobile payment options. The lower transaction cost of mobile payments will help to keep it competitive with other payment options in the market.

**5. High speed**

The speed of operation of mobile financial transactions must be high enough to satisfy business and other customers. The mobile network providers, financial institutions and mobile payment service providers must work together to ensure faster transactions across networks and across different financial institutions, so that customers find mobile payments most effective and convenient.

**Q17. Discuss various major mobile payment models with examples.**

*Ans:* **(Imp.)**

**1. Bank-centric Model**

In this model, the banks or financial institutions control all the payment stages and maintain and control both the merchant and consumer accounts. In essence, it is exactly similar to the traditional credit card based payments. The merchant acquiring bank and issuer bank are usually different and the payment gateway is maintained by yet another financial institution like Visa or MasterCard. The role of network operators is just to provide the connectivity for transmitting the payment transactions. Instead of using the

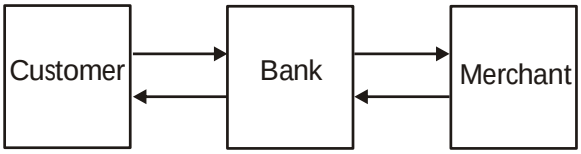



**Fig.: Bank-centric Model**

credit cards, consumers use their NFC enabled mobile devices (which act as a credit card and stores all credit card info inside it) at the POS terminal and make payments exactly in a manner similar to credit card based payments. Example of bank-centric model is Paypass by MasterCard or Visa Mobile by Visa Inc.

### 2. Operator-centric Model

In this model, the mobile network operator controls the entire value chain of the payment system and provides the mobile payment service to the customer without the involvement of a bank or financial institution. The customer holds a pre-paid account with the operator. When the customer pays through the mobile device, the amount is charged with the pre-paid or post-paid account of the customer. The entire payment network and transactions are maintained by the operators themselves and provides POS terminals to the merchants for making payment transactions. The customers can make payments at the merchant POS terminals either by NFC-based smartphones or by sending SMS to the operators. Example of operator-centric model is NTT DoCoMo/ Felica e-wallet service in Japan, GCash and Mobipay in Spain. However, the scope of operator-centric model is limited as the network operators are not banks, and hence, it is not possible for them to provide wide range of financial services provided by banks or financial institutions.

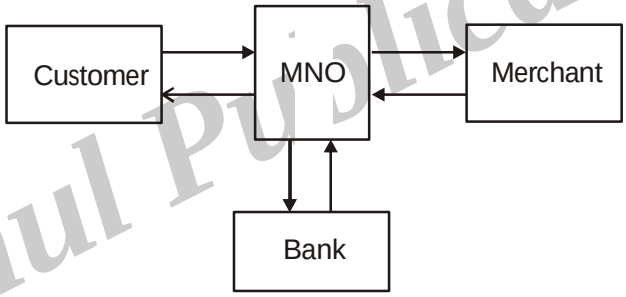



**Fig.: Operator-centric Model**

### 3. Collaboration Model

This model involves collaboration between financial institutions, mobile network operators and other payment service providers who separately contribute to the mobile payment value chain. The mobile network operators are responsible for providing and provisioning of NFC cards in the consumer handsets, and also for providing NFC compatible POS terminals at the merchant locations. The banks or financial institutions perform the roles of acquiring bank, issuer as well as the payment gateway provider. One or more banks can work together to perform the roles of acquirer, issuer or payment gateway provider. Yet another third party can provide the payment application that controls flow of transactions on behalf of the financial institutions. Collaboration model is the most feasible model as it allows respective parties to work efficiently in their own domain and contribute significantly in the value chain. Different stakeholders can focus on their core competencies, and hence, can generate revenue by incremental services and enjoy customer loyalty. Example of collaboration model is Moneta by SK Telecom.

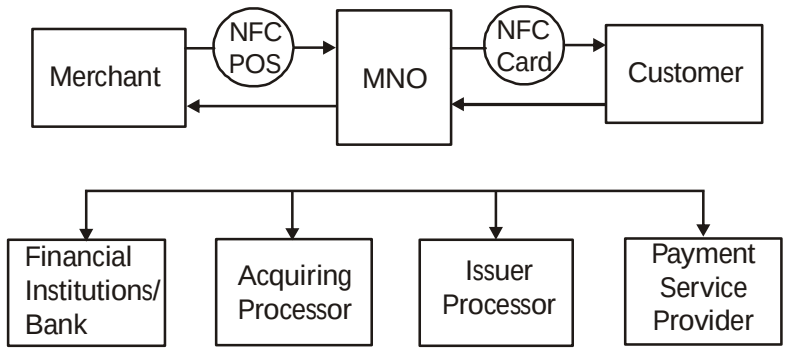



**Fig.: Collaboration Model**

### 4. Peer-to-Peer Model

In this model, mobile payment service providers act independently and offer mobile payment services to the customers. They do not involve banks or mobile operators for processing the payment transactions. They take the payment from the customers, deduct their commission from the payment and forward it to the merchants. They also pay the payment processing fee to the payment gateway provider such as Visa or MasterCard.

The transaction is done peer-to-peer between the customer and the merchant, and hence, the name. In this model, money is transferred from one person to another and bypasses the banks and network providers altogether. This model is particularly applicable to individuals who do not own a bank account and is extensively used in emerging countries for remittance and other micropayment purposes. It also helps merchants as it lowers the transaction fee compared to other three models. Examples of this model are PayPal and Obopay.

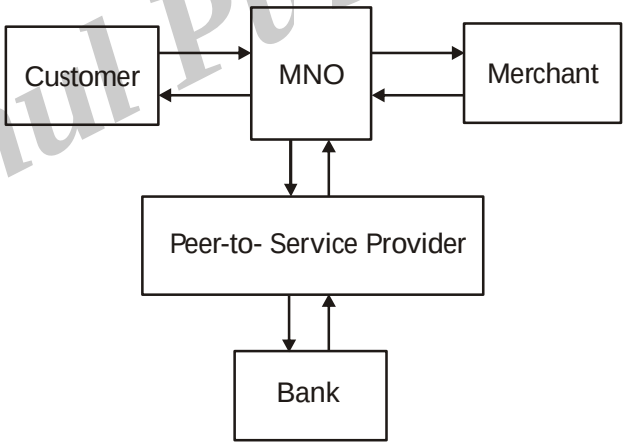



**Fig.: Peer-to-Peer Model**



## Q18. Discuss various types of Mobile Payments.

*Ans:* **(Imp.)**

Mobile payments refer to any payment made using a mobile device. Due to our ever-increasing smartphone dependence, various ways have been developed to allow consumers to pay conveniently through a phone.

There are more types of mobile payments than contactless phone payments, both for remote or face-to-face payments. Let's look at the different ways you can pay with a mobile phone.

### (i) Near-field communication (NFC) payments

NFC phones communicate with with NFC-enabled card machines using close-proximity radio frequency identification. The mobile phones don't have to touch the point of sale to transfer information, i.e. money, but they have to be within a few inches of the terminal.

NFC involves a direct, almost instantaneous transfer of encrypted data to point-of-sale devices, as opposed to chip and PIN technology that takes longer to process. Many mobile phone operators are looking at ways to further develop this technology.

### (ii) Sound waves-based payments

Sound wave-based (or sound signal-based) mobile payments represent a newer, cutting-edge solution that works for most mobile phones. Transactions are processed – without the need for internet – through unique sound waves containing encrypted data about the payment. Sound waves are sent from a terminal to the mobile phone to convey payment details, where after the customer's phone converts that data into analog signals that finalise the transaction.

### (iii) Magnetic secure transmission (MST) payments

A third way to pay with a mobile phone at a card terminal is through magnetic secure transmission (MST). Samsung Pay uses both MST and NFC payments for contactless mobile phone payments.

MST is when a phone emits a magnetic signal imitating the magnetic strip on the payer's credit card, which the card terminal picks up and processes as if a physical card was swiped through the machine. Some card machines may require a software update to accept MST, but most new terminals accept it already.

### (iv) Mobile wallets

A mobile wallet (also called digital wallet) stores payment information on a mobile device, usually in an app. Mobile wallets can utilise different technologies in the payment process, most frequently NFC, but other modalities like QR codes have been used by some services.

Apple Pay is an example that cuts across several categories, allowing contactless payments on card terminals (using fingerprint authentication via the phone), in-app purchases and payments on the internet.

Google Pay and Samsung Pay are two other big mobile wallet contenders.

Digital wallets are very secure to use. They commonly work through complex encryption and tokenisation, a method using time-limited token numbers generated to process the specific transaction using your already-encrypted card "stored" in your mobile wallet.

### (v) Quick response (QR) code payments

QR (abbreviation of "quick response") codes have many uses and are often found in advertising, on product labels and what seem to be the most random places. Not everyone knows they can be used to pay for things too. It works through certain banking apps where your cards are already associated, and other apps by stores and providers where your card details can be connected.

Some e-commerce businesses use QR codes at their website checkout as an alternative to manually entering card details. For card-not-present transactions, this is more secure because your phone, that your card details are securely connected to, confirms you are the owner of the card – and because you're not typing your unencrypted card details on a device screen.

### (vi) Internet payments

Many people simply pay on the internet in their phone browser (e.g. Safari, Chrome) or within apps, provided there's WiFi or a 3G/4G network signal. There are several ways to pay this way

### (vii) Payment links

Overlapping with internet payments, we have payment links. Also named 'pay by link', it is most commonly referring to a button/link sent in an email, text message, messaging app or over social media. When the receiver clicks the link, a checkout page opens up in an internet browser where the recipient

can enter their card details to process a transaction for a specified merchant.

The transaction total can be set in advance by the merchant sending the link, or in some cases entered manually by the recipient for e.g. charity donations. The merchant may itemise the bill so products are included on the customer's digital receipt that follows, or you may only see a transaction amount with merchant details on the checkout page.

**(viii) SMS payments**

SMS payments – also called premium SMS – simply means paying for products or services via a text message. Once you've submitted a text message with the relevant information to the right payee phone number, the payment amount is added to your mobile phone bill. So in effect, you're paying through your phone network provider, perhaps through direct debit or pay-as-you-go – the way you usually pay for your phone use.

Just a few years ago, SMS payments were one of the most popular methods of using mobile phones to pay for goods or services (even for person-to-person payments) or donate to charity, and for good reason due to its simplicity – all the user needs is a phone with text capability and prepaid SIM card or phone contract. With the increase in more advanced smartphones, however, other modes of mobile payments have seen faster growth.

**(ix) Direct carrier billing**

Direct carrier billing (DCB) – also called direct operator billing – is a way to pay through your mobile carrier instead of using bank or card details. A way to do this is to enter your phone number on a payment page or in an app, where after you go through a few authentication steps to confirm you're the owner of that number (for instance, by confirming a text message). The payment will then be deducted from your phone bill or prepaid SIM card as with SMS payments.

Digital services like Google Play and the App Store offer the option to pay by DCB. It is also used for TV voting, charity donations and subscriptions for digital content.

**(x) Mobile banking**

Mobile banking is simply an app provided by the user's bank, through which you can conduct financial transactions directly from your bank account. This is usually used for peer-to-peer transfers and payments to other people, but bills can also be paid this way.

Each bank has their own sign-up procedures for their app to verify you are the owner of the bank account. But once signed up, it is usually easy to log in on your phone and view your account balance and transaction history, make bank transfers, and anything else that your bank allows. Every bank has their own limits for what you can do through the app.

**Q19. Describe various types of mobile payment service providers.**

*Ans:* **(Imp.)**

Mobile payment has become an integral part of mobile commerce and billions of mobile users are resorting to mobile payments due to the convenience and ubiquitous nature of mobile devices. Almost all major banks offer mobile payment options to their customers. All major credit card providers, such as Visa, Master Card and American Express have introduced mobile payment services. Visa offers PayWave service that supports mobile payments from NFC enabled smartphones. MasterCard has launched PayPass mobile payment service for contactless smart card-enabled smartphones in collaboration with Verizon Wireless, AT&T and T-Mobile in USA.

**1. PayPal Here**

PayPal, a wholly-owned subsidiary of the popular e-commerce website, eBay, is an online payment mechanism that allows money transfers through internet. It facilitates online payments during online purchase where the customers can make online payments for the purchased goods without using their credit cards. In order to use PayPal service, the user will have to create a PayPal account and deposit money in that account for future use. At the time of making online purchase, the user enters his PayPal account number, amount to be paid and the recipient details. PayPal transfers the arpount from user's PayPal account to the

recipient by check or electronic deposit in recipient's bank account, or if the recipient is also a PayPal account holder, deposits in his PayPal account. PayPal has introduced PayPal Mobile to support payments through mobile devices. The user, who already has a PayPal account, first registers the mobile device in PayPal website and gets a PIN. At the time of making payment from the mobile device, the user first enters the PIN in the mobile device and sends to PayPal through SMS for authorization. After the PIN is verified, the user enters amount and recipient details and the transaction is completed. The user gets a SMS notification from PayPal confirming the payment. Such SMS-based mobile payments, where the user need not have to use credit/debit cards have become very popular worldwide.

Recently, PayPal has launched PayPal Here, a mobile payment solution that allows small merchants to accept any form of payment including credit/debit and checks using their mobile devices. It includes a free thumb-sized card reader that can be inserted into the audio socket of the mobile device, and an app which converts the mobile device into a card reader. With the help of PayPal Here, merchants can accept payments by swiping cards in the card reader, scanning cards and checks by the phone camera or entering card information into the mobile screen. The app can also send invoices to respective parties and accept PayPal payments by simply taping on the screen and providing the photo of the customer. There is no monthly fee or set up fee for getting PayPal Here service. Merchants only pay a flat rate of 2.7 per cent for each card swipe and PayPal payments. In addition, every PayPal Here merchant gets a business debit card for quick access to cash and 1 per cent cash back for eligible purchases. PayPal Here uses end- to-end encryption to protect card information, and includes PayPal's world-class fraud management capabilities as well as 24 × 7 live customer support.

### 2. Square

Square is a mobile payment service that allows mobile users in USA to accept credit card payments. It includes a free plastic square-shaped card reader that can be inserted in the audio jack of the mobile device whenever required, and a free app that handles the online payments. The users can pay by swiping the card in the Square card reader (fitted in the mobile device) or by manually entering the credit card details in the mobile device through the Square app. The users can get the Square device and the app totally free of cost by registering on to the Square website. They pay 2.75% per card swipe for Visa, MasterCard, Discover and American Express cards. It also allows customers to set up tabs in the Square app., and pay with their names. Customers can sign with finger on the screen for making payments and receive an electronic receipt via text or e-mail. It also supports resending of receipts and issuing of refunds. It is perfect for mobile businesses where merchants are going places and need to accept payments anywhere and anytime using their mobile devices. It also ensures that the funds are deposited within 24 hours of the acceptance of payments through the Square device. Square is compatible with any type of mobile devices such as Apple iPhone, Samsung Galaxy, Motorola Photon, HTC EVO 3D or Google Nexus S using any platform, such as iOS, Android, Symbian or BlackBerry OS. Square's technology is Verisign certified and uses strong 2048 bit encryption techniques including SSL and PGP.

### 3. Google Wallet

Google Wallet is a mobile payment application that allows users to store credit card, loyalty card, and gift card information in their mobile devices. At the checkout points, the users have to tap their NFC-enabled mobile devices in any MasterCard PayPass terminals in order to make credit-based payments. Google does not charge users or merchants for the service and generates revenue through sponsored ads to the service. Any user having a Citi MasterCard can create a Google Wallet account by entering credit card information in the Google Wallet app. After verification, the credit card information is stored in Google Wallet, and at the checkout point users can use it by tapping on the mobile phone and make payments. Google Prepaid card is a virtual card that can be funded with any existing credit/ debit cards and can be stored in Google wallet for future use. Google Wallet can store gift cards issued by partner merchants and at the time of payment, when the user taps to pay, Google Wallet transmits the gift card information to the merchant terminal for redemption. Google wallet is accepted by

thousands of online merchants that support Google Checkout and also on Google's own sites. Users can purchase goods from online shops across the web by signing on Google Wallet account. Google Wallet is protected against unauthorized purchases made through Google Wallet, and the payment information is stored in encrypted form. The Google Wallet app requires a PIN to activate the NFC antenna at the time of payment. Once the transaction is completed the antenna is turned-off and needs the PIN to activate it again.

### 4. Isis

Isis is a mobile payment system that stores all payment cards (such as credit card, debit card, gift card, etc.) and loyalty cards information in smartphones and allows users to perform mobile payment transactions using their smartphones whenever required. Isis- enabled smartphones utilizes NFC (Near Field Communication) technology to communicate with the merchant payment terminals and perform credit/debit card based payment transactions. Isis has collaboration with AT&T, T-Mobile and Verizon Wireless in USA, and works with Visa, MasterCard, Discover and American Express cards.

Isis mobile wallet system consists of two components, the smartphone component and the POS component. The smartphone component is downloaded and installed in the NFC-enabled smartphones of the users. The POS component is installed in the NFC- enabled POS (Point of Sale) terminal of the merchant. After installing the Isis app in the smartphone, the user stores all the credit/ debit/gift card information in the application. At the time of payment in a retail store, the user simply taps the smartphone in front of the Isis-enabled POS terminal of the store, and the payment will be credited to the selected credit/debit account of the user. Instead of carrying all the plastic credit/debit cards and scanning or swiping them in the card readers and supplying PIN for authorization, user only carries the smartphone and makes credit card-based payment at the merchant location. Thus, Isis mobile wallet system greatly simplifies mobile payments, and has become extremely popular among mobile users in USA. Isis not only stores credit cards but also debit cards, reward cards, discount coupons, payment coupons, tickets and transit passes.

In order to protect the mobile wallet from fraudulent attempts, Isis employs a number of security measures. Isis Mobile wallet is PIN protected and can be opened only by entering a 4-digit PIN. The credit card numbers stored in the Isis wallet are invisible and constantly changing security codes are used to prevent any attempt to counterfeit the card. Users can call Isis service centre anytime to report any suspicious activities, and the wallet will be suspended remotely and instantly to prevent any further fraudulent attempt. Isis is available in all major NFC-enabled smartphones, such as Apple iPhone, HTC, LG, Motorola, RIM BlackBerry, Samsung, Sony Ericsson, etc.

### 5. M-Pesa

M-Pesa is a mobile money transfer service offered by Safaricom, the leading communication and mobile network provider in Kenya. The main purpose of M-Pesa (M for mobile, Pesa for money) is to enable mobile users to receive and repay microfinance loans using their mobile handheld devices. It offers a branchless banking service to mobile users who can complete basic banking transactions such as send money to individual or businesses, deposit cash, withdraw cash from designated outlets, buy airtime and loan receipt or repayment. It is a joint venture between Vodafone and Safaricom in partnership with Citibank and Commercial Bank of Africa.

M-Pesa service platform is developed by Vodafone in consultation with Sagentia and it integrates its mobile wallet service with Safaricom's rating, billing and provisioning systems. Subscribers of Safaricom can register for M-Pesa service by filling up a registration form with ID proof. After registration, the original SIM is replaced by M-Pesa-enabled SIM. The user deposits cash in a nearby agent office and receives digital currency called e-Float. The e-Float can be transferred to any person or merchant via encrypted SMS. The user can also encash e-Float and withdraw money from any M-Pesa designated outlets. In order to secure M-Pesa transactions, all transactions are PIN protected. In order to send or withdraw money from M-pesa account, the user has to enter the M-Pesa PIN. At

the time of registering and activating M-Pesa account, the users will receive a 'Secret Word' which will be used for identification purposes for any subsequent calls to M-Pesa or for calling M-Pesa customer service.

M-Pesa was first launched in Kenya in March 2007, and quickly gained popularity and customer confidence due to its extremely simple user-interface and trusted mode of operation. Within two years of its launch, M-Pesa captured 6.5 million customers in Kenya alone. At present, M-Pesa has over 15 million subscribers with over 28000 agents across Kenya and monthly person-to-person transaction is worth over USD 500 million. Later, M-Pesa was launched in other African and Asian countries, such as Tanzania, Afghanistan, South Africa, India and Egypt.

### 6. MobiPay

Mobipay is a mobile payment system operating in Spain, to provide mobile commerce facilities to mobile users. It is a joint venture of all major Spanish operators, such as Telephonica Mobviles, Vodafone and Amena and Spanish financial institutions, such as BBVA and SCH. Mobipay's objective is to launch mobile payment facilities by transforming the mobile handset to a user-friendly safer and flexible device for micro-payments. With Mobipay, the user will be able to perform a variety of financial transactions, such as bill payment, online purchase, tax payments, etc. using their mobile devices. Mobipay is based on a cooperative business model integrating mobile operators and financial institutions. It is established on a single technology standard supplied by Atos Origin which is a renowned information technology service provider that deals with consulting, system integration and managed operations. Atos Origin performs telcofinance activities that involve bank, payment processors, merchants and mobile network operators. The payment system first validates the payment request made from user's mobile handsets against credit/debit cards, virtual wallets, billing systems, etc., and then routes the authorization request for transactions to respective parties. Apart from providing payment services, ATOS origin also provides managed services in business process outsourcing and infrastructure solutions. Mobipay systems are comparatively of lower cost and reduced risk. The system is designed for end-to-end control by trusted partners, and USSD messaging supports secured delivery of sensitive information to authorized users.

### 7. NTT DoCoMo (Osaifu-Keitai)

NTT DoCoMo is the prominent mobile phone operator in Japan that provides mobile phone, video phone, internet phone and internet mail service to the customers. It has established a simple and effective mobile payment solution in collaboration with Sony Felica systems. DoCoMo mobile phones are equipped with embedded Sony Felica contactless chips (NFC) that allows mobile payments in retail stores fitted with Felica Card Reader. Such Felica empowered mobile phones can be used for a variety of payment transactions, such as debit card transactions, credit card transactions and can also act as a personal identification device. Such mobile payment services are analogous to mobile wallet services and are known as Osaifu-Keitai services.

Osaifu-Keitai service allows users to purchase and make subsequent payment in numerous shops equipped with Felica card reader. For making payment, user will only cave to wave the mobile device in front of the Felica card reader device and the in-built NFC technology will accept the payment and the amount will be directly billed to the user's existing credit card account. The current balance and the payment history can be viewed using the mobile handset. The pre-paid users can track remaining balance and :an reload the account as and when required. During any payment transaction, the user can increase the credit limit at any service supported store. Users can accumulate points with regular shopping and electronically redeem whenever required. In order to prevent misuse, NTT DoCoMo provides a full lock function and also a service to find the exact location of the mobile device. Such mobile wallet services are vastly popular in Japan and are also extensively used in Shanghai and Beijing, in China.

### 8. Reliance m-Pay

Reliance m-Pay is a virtual credit card jointly launched by Reliance Communications and HDFC bank in India. It allows users to make payments from

Reliance mobile phones. In order to avail this service, users must have HDFC bank credit card and a Reliance mobile phone. The user need not have to carry the physical credit card as the mobile phone acts as a virtual credit card for making post-paid bill payment, book movie tickets, pay electricity bills, book travel tickets, pay in shops and restaurants and shop on internet. At the time of registration for the service, users get a PIN to be used for authentication purpose. At the time of making payments, users will have to enter the PIN and all payment transactions must be initiated from the registered Reliance mobile phone number to which the service PIN has been issued. Reliance m-Pay cards are accepted by merchants that have collaboration with HDFC and Reliance and the payments are automatically debited from user's HDFC credit card account. The user need not have to enter credit card number, expiry date and other card verification information for using m-Pay service. HDFC bank would authenticate all information and will initiate and authorize all payments performed from user mobile device. Main advantage of virtual credit card is, there is less chance of fraud or misuse as the user never enters any credit card detail at the time of making the payment. Even if the mobile device is lost or stolen, nobody can recover the credit card details and perform illegal transactions. Thus, virtual credit cards have become a preferred medium of mobile payment transactions owing to their convenience and safety.

**Q20. Discuss the advantages of Mobile Payments.**

**(OR)**

**Discuss the Pros of Mobile Payments.**

*Ans:* **(Imp.)**

**1. Security**

One of the amazing and powerful features of Mobile Payment is security. While doing transaction with mobile you don't have to reveal your card information or any personal detail like it usually happens in case of credit cards. No one will get to know your personal data unless one is having your mobile device and PIN or your fingerprint.

**2. Privacy**

Mobile Payments provide you secure and confidential transactions. The truncation remains between you, bank and the receiver. Mobile payments companies doesn't store any information like whom you are sending money, how much transaction has been done and more.

**3. Speed**

No doubt mobile payments are very fast. There are some mobile payments companies which require PIN while some require fingerprint for your respective transactions.

**4. Nothing much in your pocket**

Keeping all credit cards in your pocket might be risky as you may loss it anywhere and anyone can steal it and make use of your money or personal information. With mobile payments, you don't have to play with this risk. You can put all your credit cards in your mobile wallet.

**5. Create Customer Loyalty Program**

Mobile payment options allow you to integrate loyalty and other incentive programs into the mobile payment application in order to add value to their customers. These will make customers happy and also motivate them to return back which increased revenue

**6. Better tracking of inventory**

For small businesses, mobile payment services allow you to track customer's trends so that you can sever your customers in a better way. Mobile payments allow you to track inventory and customer behaviour. You can even learn about customers and use the respective information to improve services.

**7. Cheaper credit card swipe fees**

While doing transaction via credit card you must be aware of its charge per transaction but with mobile payments services the charge per transaction is very less. So, you can easily save your money up to some limit.

**Q21. Discuss various disadvantages of Mobile Payments.**

**(OR)**

**Discuss cons of Mobile Payments**

*Ans:*

**1. Hardware Incompatibility**

Most of the old and low-end smartphones have some compatibility issues. There is a need of NFC reader (Near Field Communication) which is lack in old devices.

**2. Cost**

For accepting payments via mobile devices require some POS hardware which are extremely high in cost.

**3. Device Failure**

For using mobile in performing every activity make it your slave. For making call, checking social media, emails and transactions all will need mobile device. Device failure could be an issue in case of battery drain. You will not be able to do any transaction until your phone is charged.

**4. Phone is prone to be theft**

Since mobile payments gives you the ability to make the transaction in your convenience. Mobile devices are prone to theft which may subject to lose their card and personal account information.

**5. Difficult to read terms and conditions**

With the small size of mobile device you can easily carry it all the way. Before making any payment it is always recommended to go through the terms and condition thoroughly but because of the small physical appearance it can often too difficult to read terms and conditions. It may also possible to make payments without reading invoices.

## 4.4. MOBILE TICKETING

**Q22. What is meant by mobile ticketing?**

*Ans:*

Mobile ticketing is the purchase of admission to events through a mobile device, including the delivery of digital tickets to a smartphone for use in place of traditional paper tickets.

Many event-organizing groups now choose to sell tickets via smartphone to improve convenience and accessibility, while also reducing infrastructure costs.

For example, the National Football League (NFL) moved entirely to using mobile tickets in 2018 and no longer takes PDF or "Print at Home" tickets. Besides sporting events, other industries such as airlines, museums, tourist attractions and movie theaters are implementing mobile ticketing for their customers.

Mobile tickets can be purchased via apps and SMS messaging, along with more traditional avenues like over the phone or through a vendor website. Next, the user chooses 'mobile delivery' for the delivery method. After the user provides a cell number, phone model and mobile carrier, the vendor sends an e-ticket. Depending on the mobile device and purchasing avenue, the ticket can be delivered through a traditional text message, a specific mobile application, MMS or WAP push notifications. The provision of the model number helps to determine whether to text and send an image barcode or alphanumeric code that is saved by the user as their digital ticket. The user then presents this message at the events admission where it is scanned, the record of the purchase is confirmed and the user is allowed access.

**Q23. What are the advantages of Mobile ticketing?**

*Ans:*

**(i) Environmentally friendly**

Encouraging event attendees to go paperless is a great way to show that the venue is committed to being environmentally friendly.

**(ii) Ease of Access**

Mobile ticketing's biggest strength is in its simplicity. All tickets can be located in one place and there are no tickets or emails that need to be printed the user just needs their phone. The user journey for mobile ticketing is significantly simpler than a paper ticket option.

**(iii) Priority queuing:**

Priority app lanes can be incorporated into venues for customers using mobile ticketing within the app. This queue should give the user quicker access into the arena than regular lines.

**(iv) User incentives**

Venues can help drive uptake for mobile ticketing by offering incentives to users. Whether it's simply priority queuing as mentioned above, or more elaborate campaigns involving app credit and rewards, users can access a range of exclusive benefits when they have the ticket on their phone.

**Q24. Describe the various privacy and security issues mobile ticketing.**

*Ans :* **(Imp.)**

Mobile ticketing together with mobile payments are the two most used applications of mobile commerce. Survey reports show that around 4 billion mobile tickets have been delivered across the globe during the year 2011, and the number will more than quadruple to 23 billion by 2016. Mobile users find mobile tickets for airline, bus or rail transport or for any sporting or entertainment events very convenient and user-friendly, and have gradually started to adopt it as an integrated part of their mobile lifestyle. However, as the mobile ticketing applications are integrated with mobile payment systems, such as mobile wallets, the security and reliability of the system are of major concern. In order to gain consumer confidence, the user interface of the ticketing system must be simple and stringent security measure must be undertaken to prevent any fraudulent attempts to hijack and misuse of private and confidential customer data.

**1. Security issues**

The biggest challenge of mobile ticketing is to maintain the security of the ticketing system. As the ticketing process includes mobile payment for the tickets, security arrangements in the form of encryption and digital signatures is a must. Most mobile ticketing vendors employ SSL 128 encryption system to protect the payment transactions performed through mobile devices. All the data travelling to and from the user devices are always encrypted (coded) in order to prevent misuse during transit by unwanted users. A password authentication procedure is imposed in order to prevent unauthorized access. Each user is provided with a unique combination of user ID and password, and at the time of accessing any of the ticketing processes, the user is asked to enter the correct password. The passwords are stored in the system servers in encrypted form to prevent tampering. The ticketing system servers holding private and confidential user data are kept in secured locations and are protected with biometric access controls, constant surveillance, monitoring and redundant power backups. In order to ensure the reliability, and 24×7 availability of the ticketing system, the server data must be backed up daily to multiple secured locations on different networks. Proper load balancing techniques must be adopted to ensure availability under load and also to ensure quick response time.

**2. Privacy issues**

Another important issue related to mobile ticketing system is to maintain the privacy and confidentiality of user data stored in mobile devices. Mobile devices are used to purchase and store mobile tickets and at the venue, scanners and card readers are used to check the ticket data for validation purpose. In case of NFC tickets, card readers are used to read ticket data stored in the mobile devices. The card readers can read private user data apart from ticket data from the mobile devices, if proper security arrangements are not adopted. Thus, card readers impose a serious threat to the privacy of mobile users and various confidential user data ranging from user travel history, current location information, credit card details, user preferences and purchase history, etc., can be leaked through electronic card readers to

unwanted third parties. Proper security arrangements must be undertaken in various levels of mobile ticketing infrastructure in order to protect privacy of mobile users. Important actors in privacy implementation of mobile ticketing systems are public transport operators, financial institutions, mobile network operators and mobile handset manufacturers. Public transport operators must provide adequate security arrangements in installation of card readers so that any attempt of unauthorized access to card readers by unwanted users are prevented. Financial institutions must provide proper security measures to protect financial transactions across mobile networks. Mobile network operators must provide network security over mobile internet operations. Similarly, mobile device manufacturers must provide NFC device security against location, preference and other information leaks. NFC devices must be protected with encrypted PIN and password so that at the time of validity checking by card readers, the PIN/Password can be exchanged to prevent any unauthorized access. NFC device guards are available that protect NFC devices from privacy leaks. Another way to protect NFC devices from unwanted card readers is to keep them in sleep mode, so that only valid card readers can awake them up, and can read data from them. Such security arrangements enhance the privacy of user data and also improve customer confidence in mobile tickets.

**Q25. What are the uses of mobile ticketing applications?**

*Ans :*

Mobile ticketing app comes with a set of benefits for the passengers traveling frequently to different cities or countries or daily commuting to work. Let's have a glimpse over the key reasons for using the mobile ticketing:

- **Effective And Efficient Process**

  Effective and efficient process of mobile ticketing system benefits daily passengers and the ones who are planning or scheduling trips frequently.

- **Growing Demand**

  With the top-notch and updated features the software provides, it has been a steady growth in the number of commuters looking for a mobile ticketing platform to reserve their online tickets.

- **Customer-Centric Functionality**

  Mobile ticketing solutions are turning into a reliable and trustworthy ticket booking medium as it targets exactly what customers want and need. With its customer-centric functionality, mobile ticketing is becoming an ideal solution for the general public.

- **Save Time And Money**

  Customers no longer have to look for a change or reach the counter before time to get the tickets or worry about tickets getting sold out. Mobile ticketing allows users to purchase tickets for single or multiple fares. This feature saves time & cost and provides great convenience during special events and long journeys.

**Q26. List out the benefits of Mobile ticketing.**

*Ans :*

Following are the benefits of mobile ticketing.

- **Passenger Satisfaction**

  Commuters love using mobile ticketing. As they can avoid standing in line at the booking counter or ticket machine. They can just use their phone anytime, anywhere and purchase their tickets with just a tap and take a ride.

- **Faster Time-to-market**

  Another advantage of using a mobile ticketing platform is a faster time-to-market. The required step is for users to download the mobile ticketing application in contrast to, let's say, travel smart cards that need more time and effort to be made available for use.

- **Reduced Boarding Time**

  One of the key advantages of a mobile ticketing system is reduced boarding time. Commuters save a lot of time with mobile ticketing app and experience lower stress levels. One of the leading bus operators from the UK, First Bus conducted an experiment to analyze the boarding time difference

between manual ticket booking and m-ticket booking. This experiment showed some fascinating results as boarding 25 passengers with m-tickets took almost 75% less time than boarding the same number of passengers with a manual ticket system.

- **Reduction in Cash-handling Procedures**

  Cash-handling is an expenses issue when transportation is involved, the costs aligned with managing cash is comparatively high. The mobile ticketing system assures a huge reduction in the prices combined with handling cash, a benefit, every transport operator looks forward to.

- **Pay As You Go**

  Mobile ticketing solutions work on a Software as a Service (SaaS) basis, users only have to pay for what they use & when they use it.

- **No (or low) Upfront Costs**

  Unlike other ticket collection systems, the capital expense for mobile ticketing is either nothing or comparatively very low, based on how you validate a ticket.

- **Environment Friendly**

  Mobile ticketing encourages paperless tickets, aka e-tickets, which reduce paper utilization in the manufacturing of paper tickets. Encouraging passengers to go paperless is a great way to show that the transport authority is committed to being environmental friendly.

- **Future-proof**

  Technology continues to expand, there's no doubt about that. Just in the past ten years, we've witnessed dramatic advancement in technology with respect to communication, payment gateways, receiving information, and even in our daily lives.

  By implementing a mobile ticketing solution on a large scale, transportation authorities can secure their position in today's smartphone era and also retain and improve their ability to remain flexible with upcoming technological advancements.

- **Better Customer Service**

  By helping consumers save their time and reducing the stress levels associated with traveling, mobile ticketing solution helps transport authorities provide much better consumer service. This leads to consumer delight and retention leading to better revenues and growth.

**Q27. Explain various mobile ticket providers.**

*Ans:*

**1. Mobiqa**

Mobiqa is an Edinburg, UK-based mobile ticketing service provider that specializes in mobile content optimization and delivery of bar-coded mobile tickets and coupons. It offers wide range of airline, rail, cinema, live events and retail tickets and coupons that are purchased and delivered in user mobile devices, thus saving time and improving customer convenience. It offers mobi-ticket which is a bar-coded mobile ticket that can be received in user mobile phones through SMS or MMS and can be validated using scanners at the venue. It offers mobi-web which is a mobile website service that is optimized for access through mobile web browsers. It offers last-minute travel or event information to the mobile users on-the-go, and also provides a range of transactions including food and drink pre-purchase, ticket pre-purchase as well as ticket retrieval. Mobi-kiosk offers a dashboard of useful services related to travel, retail or events, all displayed in user mobile phones.

**2. mTicket**

mTicket is an online mobile ticketing service that allows event organizers to market, sell and distribute mobile tickets of an event using SMS technology. It offers promotional service to event organizers, whereby short SMS-based promotional messages are sent to a list of guest mobile numbers indicating event details and other information. For selling of event tickets, mTicket offers online payment gateway service that takes payment from the customers through online means and

forwards the money to the event organizers at a cost much lower than the printed tickets. After receiving the payment, mobile tickets (containing an unique guest code) are delivered to the guest mobile devices. For redemption, mTicket offers an redemption application that allows redemption of guest tickets through an internet-enabled mobile device. mTicket has a tie-up with renowned online payment service provider PayPal, and it receives online payment from the customers through PayPal payment gateway.

**3. Masabi**

Masabi is the well-known mobile ticketing solution provider that develops mobile ticketing technology for transport sector. It is based in London and its client list includes Atos, thetrainline, VirginTrains, Crosscountry Trains, First TransPennine Express, First Hull Trains and others. Masabi mobile ticketing applications signal the end of long ticketing queues and allow passengers to purchase and display mobile tickets in almost any mobile phone, not just smartphones. The mobile ticketing technology enables leading transportation providers to offer hassle-free travel experience to their passengers and at the same time drastically improve sales volume without significantly increasing costs.

**Q28. What are the new trends in mobile ticketing?**

*Ans:*

Following are the new trends in mobile ticketing

**1. Smart Tickets**

Ticketing system is getting smarter, more accessible, and personal. It would be safe to say that few technology-oriented trends will comprise an expedited adoption of mobile tickets thanks to a series of new technologies, the usage of the paper tickets will effectively decrease. With the emergence of smart tickets, we are likely to see an improvement in cross-selling services & products, a marketing tactic used by big brands to enhance their customer success rate.

**2. Biometric**

Biometric refers to the automatic recognition of a person based on their physiological and behavioral characteristics. This system in mobile ticketing helps you by relieving the stress you get in case your smartphone breaks down or you face a network issue. It removes the need to carry your digital or physical ticket. Passengers can use biometric recognition systems right from purchasing their tickets to authenticating them on their fleet. Let's have a look at some key biometric systems:

- **Fingerprint Recognition**

  Having a mobile ticketing solution will help you schedule your weekly or monthly rides by simply punching in and out after a one-time registration of your fingerprint through the app. The system is well known for its reliability and easy operability. Current fingerprint recognition methods operate on optical sensors using CMOS image sensors or charge-coupled device (CCD).

- **Face Recognition**

  It identifies the travelers by the digital snap of their face. Current facial recognition systems use face prints and biometric systems that can identify 80 nodal points on a human face.

- **Iris Recognition**

  This is a new biometric technology that is getting adopted gradually across the globe, trusted for its easy accessibility and high security. In mobile ticketing, iris recognition is used to recognize the passengers based on their pupil scan.

**3. Account-Based Ticketing**

Account-based ticketing (ABT) eliminates the need for passengers to purchase a ticket in advance. They can simply punch in and out on every journey and then get charged for their trip afterward, at the best possible price. Account-based ticketing is already operational in metro cities; the initiation of cloud-based software indicates that ABT will soon be open

to transport operators & authorities of all shapes & sizes.

**4. NFC & HCE Based Mobile Ticketing**

Host card emulation (HCE) for mobile ticketing is an architecture that follows a traditional smart card on smartphones with NFC. HCE simply lets smartphones work as a pragmatic representation of a contactless, transport smart card. This enables the consumers to securely use their phones as a travel smart card as well as a virtual ticket wallet.

## 4.5 Mobile Product location and Shopping

**Q29. What is M-Shopping? What are the uses of location based services in M-Shopping.**

*Ans:*

M-Shopping is Mostly similar to ecommerce, but accessible via a mobile device. Mobile shopping is now possible through mobile optimized websites, dedicated apps, and even social media platforms.

- Location-based services rely on consumers' smartphones to provide interactive opportunities and targeted advertisements.
- Location tracking is conducted with GPS data, Wi-Fi data, cellular tower pings, QR codes and RFID technology.

Location-based services (LBS) use real-time geodata from a smartphone to provide information, entertainment or security. Some services allow consumers to "check in" at restaurants, coffee shops, stores, concerts, and other places or events. Often, businesses offer a reward – prizes, coupons or discounts – to people who check in at their locations. Google Maps, Foursquare, Yelp and Facebook Places are among the more popular services.

Location-based services use a smartphone's GPS technology to track a person's location, if that person has opted in to allow it. After a smartphone user opts in, the service can identify their location down to the street address without the need for manual data entry.

**Q30. How does location technology track your movements?**

*Ans:*

There are several mechanisms inside a typical mobile device that can provide location information. The most common are GPS, RFID, Wi-Fi and cellular technology. We'll explain these in more detail in the next section, but they all operate on similar principles.

A mobile device communicates with other devices and hubs – such as satellites, routers and towers – to function. Because the mobile device is pinging off of multiple communication hubs, its precise location can be triangulated.

**Q31. List out the uses of Location based services.**

*Ans:*

Companies have found several ways to use a device's location.

**1. Store locators**

Using location-based intelligence, retail customers can quickly find the nearest store location.

**2. Proximity-based marketing**

Local companies can push ads only to individuals within the same geographic location. Location-based mobile data can improve local marketing efforts to potential customers within that city who might actually act on the information.

**3. Travel information**

An LBS can deliver real-time information, such as traffic updates or weather reports, to the smartphone so the user can plan accordingly.

**4. Roadside assistance**

Many roadside assistance companies provide an app that allows them to track your exact location in the event of a blown tire or car accident without the need for you to give directions.

**5. Mobile workforce management**

For logistics-dependent companies that employ individuals out in the field or at multiple locations, an LBS allows employees to check in at a location using their mobile devices. Businesses with remote work forces often rely on geographic data to ensure workers are where they need to be.

**6. Fraud prevention**

An LBS creates another level of security by matching a customer's location to a credit card transaction. Tying the smartphone's location to a credit card allows you to flag transactions made across several geographic locations over a short time.

## 4.6 MOBILE BUSINESS SERVICES

**Q32. What is mean by Mobile Business Services? And Explain how mobile business services helps to increase more no of customers ?**

*Ans:* **(Imp.)**

Mobile Business Services Inc can help you use your computer or mobile device to Get Customers with websites, advertising and lead capture; Increase Sales with digital proposals and contracts; and Manage Business with other digital tools to maintain oversight and control of your business while on the go.

Mobile Business Services Inc can make sure your website is mobile-ready and working to bring you customers through the right forms of mobile advertising and marketing, and that new customers are sent right to your mobile device.

**1. Mobile Websites**

Mobile Business Services Inc can quickly and efficiently create a mobile-ready website, convert your current site to be mobile-friendly, or otherwise make sure your website will be useful to your mobile customers.

**2. Internet Advertising**

Mobile Business Services Inc has been using internet advertising almost since it was invented and has generated over 25,000 leads for small businesses. Don't pay for "seo" or "impressions"; let us set up an internet advertising program that produces REAL results and customers.

**3. Mobile Marketing**

Marketing can be complicated and involve multiple purposes for your business. Mobile Business Services Inc has the experience to craft creative and effective mobile marketing strategies to reach people on the move at the right time and the right place to become your customer.

**4. Mobile Advertising**

Mobile advertising is only as old as mobile devices but despite being new, it is one of the most effective forms of advertising available. Someone responding to a mobile advertisement for your business has a higher likelihood of becoming your customer.

**5. Mobile Lead Capture**

Leads are what keep your business going, and you can receive them anywhere directly on your mobile device. Never miss a potential customer who is looking for your service on a mobile device, and never miss a lead that goes to somewhere you are not. Mobile lead capture means less lost leads and more sales.

**6. Website Recovery**

For business owners, it can be a struggle to fix broken websites or get them live if they have gone down due to a hack or other issue. Mobile Business Services Inc can help you get your lost, hacked, or stolen website live again so your website is working to represent your company and bring you customers.

**Q33. How mobile business services are helpful to increase sales of a business?**

*Ans:*

Winning a new customer means making an informative sales pitch, having quick follow-up with your prospect, and getting a commitment. Mobile Business Services Inc can help increase the speed

and efficiency of your sales process with beautiful and effective sales tools on your mobile device.

**1. Mobile Presentations**

Why are you still carrying around that binder of photos and that folder of papers to show your potential customers? Let Mobile Business Services create beautiful mobile presentations to show your customers. Scrolling through some pictures on your phone isn't impressive, but a comprehensive mobile presentation is and will close more sales.

**2. Mobile Estimates**

Are you still hand-writing estimates on paper forms Wouldn't you rather fill out a form on your tablet or phone that was custom made for your business and then immediately email the estimate to your potential customer. Maybe you need a special pricing tool built into the estimate form… no problem! Let Mobile Business Services Inc help convert all your estimate forms to be mobile ready for you and your sales team. To talk about making your estimate process mobile-friendly.

**3. Mobile Proposals**

A proposal can make or break a new customer relationship. A proposal can be factual AND beautiful; it can be concise AND interactive. Let Mobile Business Services Inc create proposals and proposal generating tools that can help you wow your prospects and win more customers.

**4. Mobile Contracts**

The customer said yes and now needs a contract. When a customer says "yes", making it official makes it real… if time passes, that "yes" turns into "maybe" or "I've been thinking" or "I went with someone else". Don't let a "yes" turn into something else because your contract process is using paper, fax, email, or anything that doesn't close the deal NOW.

**5. Mobile Signatures**

The thing that finalizes a contract is a signature. email a contract that can be signed by the customer easily and Electronically and then get a notice sent back. Or if you are with the customer, have them sign right on your mobile device. Finalize your sales process rather than have it fall down right before the finish line.

**Q34. How can we manage Business with the help of Mobile business services.**

*Ans:* **(Imp.)**

For business owner, it can be a struggle to manage people, paperwork, and property. But Mobile Business Services can help you maintain the organization and oversight you need to be aware and in control of your business, wherever you are, with your mobile device.

**1. Manage Customers With Mobile**

Keeping track of leads, prospective customers, and existing customers is one of the hardest things about business, and it's common for things to "fall through the cracks". Leads get lost so they never turn into quotes; quotes get lost so they never turn into customers; customers call but you are too busy to call back. Wouldn't it be better if all your leads, prospects and customers could be managed on your mobile device using a CRM like Salesforce .Mobile Business Services can make sure you never drop a lead, lose a deal, or disappoint a customer.

**2. Manage "Paperwork" With Mobile**

Are you still hand-writing estimates on paper forms. Do you have post-it notes on your desk and an important message from a customer you wrote on Paper gets lost, misplaced, ruined and buried under other paper. Whether it's a contract, message, time sheet, inventory list or anything else, Mobile Business Services can make sure it's on your mobile device and available anywhere you are. Your time is valuable so never spend it looking for that important piece of paper.

**3. Manage Employees With Mobile**

Do you ever wonder what your employees really do during their paid hours. Productive employees are profitable employees. Let Mobile Business Services make your employees more productive (and profitable)

by letting you know on your mobile device where they are and what they are doing with their paid time.

**4. Manage Locations With Mobile**

Maybe you have a "bricks & mortar" physical location. Whether you sell items, rent equipment or need to better keep track of what is going on at your location, Mobile Business Services Inc has solutions. Track all sales, rentals, and activity at your place of business on your mobile device.

## 4.7 MOBILE AUCTION

**Q35. What is an Auction?**

*Ans:*

An auction is a sales event wherein potential buyers place competitive bids on assets or services either in an open or closed format. Auctions are popular because buyers and sellers believe they will get a good deal buying or selling assets.

- An auction is a sale in which buyers compete for an asset by placing bids.
- Auctions are conducted both live and online.
- In a closed auction, for example, the sale of a company, bidders are not aware of competing bids.
- In an open auction, such as a livestock auction, bidders are aware of the other bids.
- Examples of auctions include livestock markets where farmers buy and sell animals, car auctions, or an auction room at Sotheby's or Christie's where collectors bid on works of art.

In an open format, all bidders are aware of the bids submitted. In a closed format, bidders are not aware of other bids. Auctions can be live, or they can be conducted on an online platform. The asset or service in question is sold to the party that places the highest bid in an open auction and usually to the highest bidder in a closed auction.

**Q36. Discuss examples of open auction and closed auction.**

*Ans:* **(Imp.)**

**(i) Open Auctions**

In an open auction, parties come together at a physical venue or online exchange to bid on assets. An interested party is aware of the competing bid amounts and continues to raise their bid until they are either declared the winner of the auction (i.e., they submitted the last highest bid within the auction time limit) or until they decide to drop out of the bidding.

Examples of auctions include livestock markets where farmers buy and sell animals, car auctions.

**(ii) Closed Format Auctions**

In many business transactions, including the sale of company assets or an entire company, auctions are conducted in a closed format whereby interested parties submit sealed bids to the seller. These bid amounts are only known by the seller. The seller may choose to hold just one round of bidding, or the seller may select two or more bidders for an additional auction round.

In a situation wherein a division of a company or the whole company is up for sale, price is not the only consideration. The seller, for example, may want to preserve as many jobs as possible for its employees. If a bidder does not submit the highest price but can offer the best terms for continuity for employees, the seller may select that bidder.

**Q37. Discuss the advantages and disadvantages of Auctions.**

*Ans:*

There are both advantages and disadvantages of auctions. Sometimes people can find rare items at auctions. And there is always the possibility that a buyer can purchase an item at a discount at an auction.

In the case of purchasing property through an auction, this process can deter some potential buyers because of its competitive nature.

When it is the sale of company assets or an entire company, there are many advantages for the

seller because they control the entire auction process. They can create a competitive environment in order to maximize their bargaining power, and, ultimately, achieve a higher price.

On the other hand, the price of running an auction sale can be significant. The seller must have a strategy for the auction process, and this requires the service of both financial and legal advisers.

While securing a bargain is always a possibility, if there are multiple bidders, it is also possible that the buyer in an auction will actually pay more because of the potential competition of other bidders.

**Pros of Auctions**

- Seller controls process
- Find rare items
- Buy at a discount
- Seller can maximize bargaining power

**Cons of Auctions**

- Competitive process can deter some buyers
- Cost of running an auction is significant
- Competitive bidding process can drive up price

## 4.8 Mobile Entertainment

**Q38. What is Mobile entertainment?**

*Ans:*

Mobile entertainment comprises a range of activities associated with mobile electronics. The definition is both somewhat subjective and in continual development, but can include purely leisure activities (music, playing games), communications (social media, instant messaging, Twitter), and activities which could also be defined as commerce (shopping).

From news updates to live streaming, entertainment apps have got everything a person needs to sit back, relax and enjoy. All the things you need at the touch of your fingertip

Mobile applications are being used in every industry but the entertainment industry is taking advantage of this technology the most. The entertainment sector is all about engagement, content, and a massive audience.

It is very clear that the entertainment industry majorly depends on mobile applications and thus many mobile app development companies are focusing on entertainment app development.

**Q39. How are mobile apps revolutionizing the entertainment sector.**

*Ans:* **(Imp.)**

Following are the major reasons that make mobile entertainment apps a right move for the media and entertainment industry.

**1. Tracking the trends**

The primary way mobile apps transforming entertainment is through making trends tracking easy. When social media wasn't around, tracking the trends was quite difficult. But ever since social media got a grip on society, there is a new trend every day. Multiple social media applications have one complete section dedicated to the most trending topics on the application.

When it comes to the latest movies, games, music, and series, entertainment apps keep them on the top or trending section of the app so that users can learn what's liked by the majority.

Entertainment is no more limited to time slots and closed doors. It is now available anywhere, anytime, and for anyone. Media software development companies are working progressively to improve the user experience by optimizing the applications.

**2. Spreading and gathering information**

Applications like Facebook, Instagram, Twitter, etc. have become a great source of authentic and detailed information. From the latest news to life hacks, everything is available on these applications.

Entertainment app development is done keeping in mind that the users can exchange every form of media and information on the platform that is authentic and useful.

Youtube is another platform for sharing information through creative videos. There are multiple Youtube-based news channels, travel vlogs, and classes for the audience.

**3. A Complete platform**

Entertainment applications are capable of forming a whole new platform for movies, music, gaming, live streaming, etc. This opportunity has given rise to many artists to showcase their talent and create a follower base.

Earlier making videos, music, or developing games was only done by professionals because they had access to platforms that launched these products but now application development is not as complicated as it used to be. Many platforms even pay the real talents for the influencing work they do.

**4. Promotion Capabilities**

A mobile app for entertainment industry can prove to be an efficient method of promotion of an entertainment agency or of influencers looking to make it big in the sector. The fact that the majority of the people are always on their smartphones, the chances of high engagement with the app and in turn the brand is very high. Entertainment marketing is one of the easiest ones in the app industry to make popular – especially since the celebrities who are a part of the content on your application do half of the work of making your app popular among their fanbase.

**Q40. List out the advantages of Mobile Entertainment.**

*Ans:*

1. It educates people. Through television and radio programs, people get to learn about health matters, environmental conservation, and much more.
2. People get the latest news in a very short time. Distance is not a barrier. People get news daily through the media and this keeps them updated on the happenings around the world.
3. People get to bring out their hidden talents. Through media showcase their talents such as comedy, acting and singing.
4. Children's knowledge increases. Children can learn from quiz programs, animal programs and so on.
5. Radio is convenient as people do get short news and with a mobile phone one can access it.
6. Great in promoting mass consumer products. This can in turn increase sales of the product.
7. Serves as a good source of entertainment. People get entertained through music and television programs.
8. Television allows electronic duplication of information. This reduces the production cost making mass education possible.
9. Media leads to diffusion of different cultures. Media showcases different cultural practices.
10. It helps people around the world to understand each other and embrace their differences.

**Q41. What are the disadvantages of Mobile entertainment?**

*Ans:*

1. It leads to individualism. People spend too much time on the internet and watching television. As a result, socialization with friends, family and neighbors is affected.
2. Some media contents are not suitable for children. Limiting children's access to such content can be difficult.
3. Newspaper is geographically selective.
4. Increase in advertisements in television and radio is making them less attractive.
5. Internet as a form of media opens up possibilities of imposters, fraud and hacking.
6. Media can be addictive, e.g. some television programs and internet. This can lead to decrease in people's productivity.

7. Health problems. Prolonged watching of television can lead to eyesight problems and radio listening using earphones exposes one to possible hearing defects.
8. It glamorize drugs and alcohol. Some programs make the use of these things appear cool'.
9. It can lead to personal injury. Some people decide to follow the stunts that are showcased in the media. This can lead to injuries.
10. It can lead to ruin of reputation. It is possible for one to create an anonymous account. Such accounts can be used to for malicious reasons such as spreading rumours. This can lead to ruin of reputation of an individual or a company.

## 4.9 MOBILE OFFICE

**Q42. What is Mobile Office? What are the major benefits of Mobile Office ?**

*Ans:*

It often makes sense to run a small business from home, because it keeps costs down and helps you reduce the time lost to commuting. It can put hundreds of hours back into your year. Technology has made this a practical option. Mobile devices and online business tools have helped drive the change in working practices.

For some types of business, an office is no longer essential. It could work for you too, if:

1. you mostly do business by phone, email, messaging and social media.
2. you run a service business or online business.
3. you rarely see your clients in person.
4. you don't need large equipment to do your job.
5. you're happy working alone (or at least collaborating online).

People run businesses without offices for a variety of reasons. Here are three of the most common:

**1. Not having an office can save you money**

Office space is expensive, especially for a new business. Furniture, electricity and internet access must all be paid for too. That money could be better spent in areas that directly affect the bottom line, such as marketing or hiring more employees.

**2. Without a commute you'll save time**

If you don't have to commute to an office you could gain an hour or more every day. Whether you use that time for work or relaxation, it's a big benefit.

**3. Less distractions increases productivity**

If you manage your environment properly, remote working can increase your productivity. There will be fewer distractions and fewer meetings – making it easier to concentrate and think clearly about your work.

**Q43. What are the devices or hardware components required to setup a Mobile Office.**

*Ans:* **(Imp.)**

A mobile office can be anywhere. You can share spaces with other businesses, including suppliers or customers. Plenty of business owners treat their car or van as an office, and pop into a cafe when they want to stretch out over a coffee. Most commonly, mobile business owners base operations out of their home.

So long as you have an internet connection, you have an office. Just be aware that public wifi is not always secure, so you should be cautious about what type of work you're doing. Think about using a virtual private network (VPN) to protect your privacy and anonymity. And don't leave your laptop or phone unattended.

You can't work properly without the right equipment. But for many office-free workers that's a relatively small investment:

- **Laptop computer**

  Unless you need a lot of processing power, a basic one will be sufficient. As long as it has a reliable internet connection, you can work

collaboratively with people all over the world. It's a good idea to get one with a webcam, so you can participate in video calls.

- **Computer and data protection**

  Protect yourself and your customers with internet security software on all your internet-connected devices. You don't want malware or security breaches affecting your business.

- **A back-up strategy**

  Save work somewhere other than just your laptop. Keeping files online gives you the added benefit of accessing them from anywhere.

- **Headset**

  Invest in a good quality headset for online calls and meetings. It will help you communicate clearly even when there's background noise.

- **Mobile phone**

  Make sure your clients can reach you easily. You can also use this for internet access if you can't get free wireless internet.

- **A proper workstation**

  If you spend long periods of time seated at a computer, invest in the right furniture. Cramming yourself into a bad kitchen chair or bean bag can take a toll.

Mobile office is also included with following softwares

- Software for producing word documents, spreadsheets and slide decks.
- Drives for storing and accessing the documents you produce.
- Calendars for managing meetings and schedules.
- Call and video conferencing tools.
- Chat-based apps for working in groups
- Project management tools for big organizations.
- Online accounting software with dash boards showing the financial state of the business.

**Q44. What are the issues of mobile office.**

*Ans:* **(Imp.)**

Working without an office has its disadvantages, but you can overcome them if you're prepared. Here are some of the issues you may face, with tips on how to cope.

- **Avoiding loneliness**

  The first few weeks may feel liberating – you're free from office politics, commuting and unnecessary meetings. But humans are social creatures, so make sure you hang out with real people from time to time.

- **Staying in the loop**

  Office chit-chat can lead to the exchange of important business information, new ideas and new projects. Try to make time for unstructured interactions, where conversations can drift across topics.

- **Getting new work**

  One of the best ways to pick up new work is to be physically present. Meet when you can. And when you can't, try to stay present in your clients' lives by communicating on topics other than work from time to time.

- **Maintaining motivation**

  It can be hard to stay motivated if you're not in an office full of working people. To avoid procrastination, learn to plan and schedule your work sensibly. And build up your willpower – it will help you succeed.

- **Meeting clients at the office isn't an option**

  When you don't have an office, you'll need to utilize other spaces to catch up with clients. Some cafes will have relatively quiet areas for you to meet with clients – but bear in mind that you won't always have complete privacy

- **Finding the right balance**

  Office workers have clearly defined working days. They start when they arrive in the office and stop when they leave. If you don't have an office then it can be hard to know when to switch off. Be disciplined about this. You'll work better and more creatively if you find a good work-life balance.

## 4.10 Mobile Distance Education

**Q45. What is Mobile Distance education?**

*Ans:*

Mobile distance education, also known as M-learning, is a new way to access learning content using mobile devices. It's possible to learn whenever and wherever you want, as long as you have a modern mobile device connected to the Internet.

Mobile learning provides a way for educational institutions to deliver knowledge and educational content to students on any platform, anyplace and at the time of need. Students use mobile apps and tools to complete and upload assignments to teachers, download course instruction and work in online social groups to complete tasks.

Many schools and colleges are supporting the concept of eLearning and mobile learning. They distribute mobile phones and laptops to students and encourage them to use them for educational purposes. Although mobile learning may be fun for the children if it's used in the right way, it can be very beneficial for the students and adults.

There are many educational apps available online, and they are also gaining huge popularity among the school and college students. It is even useful for teachers/professors/instructors, they can learn a topic or provide notes, examples, and also refer these apps to the students when or if needed.

The best part of mobile learning is that many sources are present online. So, if you don't get it from one place, you can search for it from some other site. Even while using the app; if you do not understand you can easily send your feedback and discuss your query or suggestion with the app developer or app developing company.

**Q46. What are the advantages of Mobile distance education.**

*Ans:*

Mobile learning is very popular and in the past few years, its use has increased extensively. Mentioned below are 5 advantages of mobile learning and why it should be used:

**1. Access anywhere and anytime**

Since mobile learning is all about studying through mobile using the internet, it can be accessed from anywhere in the world and anytime.

**2. Covers a huge distance**

The main benefit of mobile learning is that it covers a huge distance, so even if you are in Canberra, Australia or in California, United States of America, you can access the same content or tests at the same or different times. Distance is not an issue in mobile learning.

**3. Variety of content**

A lot of content is present online. Due to its huge variety, it becomes very easy for people to access it; and also, a huge amount of people from different corners of the world can access it for different topics or related to different subjects.

**4. Encourages students**

There are many educational apps that use online quizzes to keep track of your progress (daily, weekly or monthly, depending on firm to firm). The study is presented in such a way that it attracts the students; hence, there are game quizzes that encourage students to perform better from their previous score.

**5. Tests your knowledge**

As discussed in the above point, online quizzes are made and solving these quizzes, puzzles or riddles helps you expand your knowledge. Apart from just study material, there are different types of other quizzes, puzzles, multiple-choice questions, etc. that are available on the internet; playing these games you can test your knowledge and even increase your IQ level.

**Q47. What are the disadvantages of M Learning?**

*Ans:*

As good and alluring as the advantages sound, there are also disadvantages of mobile learning. Every coin has two sides, so, here are 5 disadvantages of mobile learning, listed below:

**1. Software issues**

Software is an application that runs on a device according to the instructions embedded in the software at the time of coding. Even though it seems like the life of software is smooth, there are other external factors that hinder its smooth life span. These external factors are changing trends in the field of IT. Software compatibility issues, not upgrading to a new version, regular system crashes, etc. are some of the issues that hinder the working of the software, thereby interrupting your smooth mobile learning experience.

**2. Hardware issues**

Unlike the software, hardware uses physical devices. The physical devices used can wear out after a period of time. They can wear out due to overuse, dust, using the device roughly, etc. These are some factors that interrupt the smooth working of the mobile or other devices.

**3. Distraction**

Using mobile learning, also, creates a lot of distraction. Many students open the mobile to learn something and end up using social media websites, chatting, sharing pictures or playing video games. These types of distractions waste one's time, which could have been used to perform a meaningful task.

**4. Misuse**

Many students also misuse the device for different purposes. Some misuse it just for fun, and some have secret, evil intentions which are definitely not good and need to be prevented.

**5. Lack of internet connection or electricity**

This can be a problem in rural areas and in areas where the usage of the internet and electricity is not yet prevalent. When you have a device, but you do not have the electricity or the internet required for you to run the device and avail the facility of mobile learning, then what's the fun? In order to enjoy your experience of mobile learning, make sure you have met all the requirements needed to have the best experience for mobile learning.

# Short Question and Answers

**1. Mobile financial services.**

*Ans:*

The use of a mobile phone to access financial services and execute financial transactions. This includes both transactional and non-transactional services, such as viewing financial information on a user's mobile phone. Mobile financial services include both mobile banking (m-banking) and mobile payments (m-payments).

Mobile Financial Services fall into one of three categories:

1. Mobile payments (P2P, P2M, or M2M)
2. Mobile microfinance(loan disbursement and payments),
3. Mobile banking (bill pay or account information, e.g. balances or alerts).

**1. Mobile Payments**

A mobile-based transactional service that can be transferred electronically using mobile networks. A mobile money issuer may, depending on local law and the business model. Finally payments are done using mobiles.

**2. Mobile Microfinance**

Mobile banking has facilitated a new approach to microfinance by using the mobile phone, customer usage data and agents for loan applications, customer due diligence, and credit decision-making. The microfinance culture has begun to merge with the m-payments culture to provide much more than what microfinance services or m-payment services can offer alone.

**3. Mobile Banking**

The use of a mobile phone to access banking services and execute financial transactions. This covers both transactional and non-transactional services, such as viewing financial information on a bank customer's mobile phone.

Mobile banking is a type of electronic banking, or e-banking, which includes a broad array of electronic banking instruments and channels like the internet, POS terminals, and ATMs.

**2. What is mobile banking?**

*Ans:*

Mobile banking refers to the use of a mobile device to carry out financial transactions. The service is provided by some financial institutions, especially banks. Mobile banking enables clients and users to carry out various transactions, which may vary depending on the institution.

- Mobile banking refers to the use of a mobile device to carry out transactions. The service is provided by some financial institutions, especially banks.
- Mobile banking services can be categorized into the following: account information access, transactions, investments, support services, and content and news.
- To date, many financial institutions and banks make use of both SMS and apps to keep their clients informed of their account activities or to send out alerts to clients regarding possible fraud and/or updates and maintenance of service.

**3. Describe various technologies used in mobile banking.**

*Ans:*

Mobile banking technologies are of two types, namely server side technologies and client side technologies. Server side technologies are stored in a secured server at a bank or at the service provider premises. Examples of server side technologies are SMS banking, WAP applications, IVR (Interactive Voice Response) and USSD2 (Unstructured Supplementary Service Data). Client side technologies are mobile applications stored in the

mobile handset or embedded inside the SIM card of the mobile handset. The client applications are usually built under J2ME (Java) environment and have different characteristics and processes depending on user requirements. In each of the above applications, the user first has to activate the service through a registration process. The registration process is defined and endorsed by the bank or the mobile banking service provider and provides an initial identification of the customer to ensure trust and security of the transaction. The consumer identification data such as personal details, credit card details etc. are stored in the server under strictly confidential environment. Each of the above technologies is discussed below:

**1. Interactive Voice Response (IVR)**

Interactive Voice Response is analogous to phone banking where a customer first dials a pre-defined IVR number from the mobile phone. Next, the customer is greeted by pre-recorded welcome message, followed by a menu of different banking options. The customer chooses a particular option by pressing the corresponding number from the keypad and the respective transactional information is announced through a pre-recorded speech. The mobile number of the customer (from which the IVR call is made) supplies the identity information for the customer and provides necessary authentication for making bank transactions. The customer account is identified and the requested information is provided through voice messages using a text-to-speech programme. The major limitation of IVR is that it can only be used for enquiry-based services, and is also more expensive as compared to other methods as it requires to make a phone call which is generally more expensive than sending an SMS or making data transfer through WAP services. IVR systems are usually implemented using PBX systems that hosts IVR dial plans and other information.

**2. SMS Banking**

In SMS banking, user sends a structured SMS code requesting some banking transaction to a pre-assigned number. The bank responds by sending a reply SMS containing the transaction information. SMS banking can be used for both financial and non-financial transactions, though SMS-based financial transactions are seldom used because of security concerns. For example, a customer of Punjab National Bank (PNB) can send an SMS code PNBBAL, requesting for account balance information. Similarly, a customer of SBI can send an SMS TRN (a/c No.) (PIN No.) (Amount), for making a fund transfer to the specified account number. The main advantage of SMS banking is that almost all mobile phones support SMS service and the cost of banking transaction is just the cost of an SMS which is affordable to all.

**4. Explain the advantages of Mobile banking.**

*Ans:*

**Advantages**

Mobile banking provides the following advantages :

**(a) Always on 24×7 Accesses**

Banks are able to provide services to the customers for 24 hours per day and 7 days per week. It enables the consumers to be transaction-ready much as cable access has facilitated online PC access and reduced consumer dialup delays.

**(b) Advanced Penetration of Mobile Networks**

The 2G networks already cover more than 90% of the population in the western world and this number is growing steadily.

**(c) Personalisation**

Through Subscriber Identify Module (SIM) cards, mobile customers have a specific profile that enables customised functionality to directly reflect the way they want to transact business over mobile devices. Through the convenient addition of a multi-application, relationship card, mobile customers will also have a built-in platform for a host of other application services, including security keys,

virtual credit cards and other customised payment instruments.

**(d) WAP**

Rapid evolution of global protocols such as Wireless Application Protocol (WAP) enables the communication channel between computers and mobile devices. The WAP component essentially provides the facility of reforming data for display in wireless handsets.

**(e) Faster Data Processing Speed**

Increase in bandwidth and data transmission speeds makes mobile data services efficient and cost-effective in a real time environment.

**(f) Security**

In addition to the above mentioned smart card, a private key stored on the SIM card can protect e-banking transactions. Effectively, the mobile phone can become a wireless wallet to protect proprietary purchase and financial information.

**5. What is micro finance?**

*Ans:*

Microfinance, also called microcredit , is a type of banking service provided to unemployed or low-income individuals or groups who otherwise would have no other access to financial services.

- Microfinance is a banking service provided to unemployed or low-income individuals or groups who otherwise would have no other access to financial services.
- Microfinance allows people to take on reasonable small business loans safely, and in a manner that is consistent with ethical lending practices.
- The majority of microfinancing operations occur in developing nations, such as Uganda, Indonesia, Serbia, and Honduras.
- Like conventional lenders, microfinanciers charge interest on loans and institute specific repayment plans.
- The World Bank estimates that more than 500 million people have benefited from micro-finance-related operations.

**6. Mobile advertising.**

*Ans:*

Mobile advertising is the communication of products or services to mobile device and smartphone consumers. The mobile advertising spectrum ranges from short message service (SMS) text to interactive advertisements. Mobile advertising is a subset of mobile marketing.

Mobile advertising targets users according to specified demographics. Mobile networks identify related mobile profiles and preferences and displays corresponding advertisements when consumers download and uses data services like games, applications (apps) or ring tones.

The Mobile Marketing Association (MMA) is a non-profit global trade association that fosters mobile marketing and advertising technologies. It regulates associated terms, specifications and best practices. MMA also oversees global mobile advertising units in messaging, applications, video, television and also on the Web.

**7. Mobile payments.**

*Ans:*

A mobile payment is a money payment made for a product or service through a portable electronic device such as a tablet or cell phone. Mobile payment technology can also be used to send money to friends or family members, such as with the applications PayPal and google pay.

- Initially more popular in Asia and Europe, mobile payments spread to North America and experienced considerable growth.
- Merchants unwilling to retool existing terminals have contributed to the slow growth of mobile pay compared to physical credit cards.
- Mobile payments offer additional privacy and security benefits compared to physical cards.
- There are mobile payment apps for both Apple and Android (Apple Pay and Google Pay).

**8. Discuss the Pros of Mobile Payments.**

*Ans:*

**1. Security**

One of the amazing and powerful features of Mobile Payment is security. While doing transaction with mobile you don't have to reveal your card information or any personal detail like it usually happens in case of credit cards. No one will get to know your personal data unless one is having your mobile device and PIN or your fingerprint.

**2. Privacy**

Mobile Payments provide you secure and confidential transactions. The truncation remains between you, bank and the receiver. Mobile payments companies doesn't store any information like whom you are sending money, how much transaction has been done and more.

**3. Speed**

No doubt mobile payments are very fast. There are some mobile payments companies which require PIN while some require fingerprint for your respective transactions.

**4. Nothing much in your pocket**

Keeping all credit cards in your pocket might be risky as you may loss it anywhere and anyone can steal it and make use of your money or personal information. With mobile payments, you don't have to play with this risk. You can put all your credit cards in your mobile wallet.

**5. Create Customer Loyalty Program**

Mobile payment options allow you to integrate loyalty and other incentive programs into the mobile payment application in order to add value to their customers. These will make customers happy and also motivate them to return back which increased revenue

**9. Discuss various disadvantages of Mobile Payments.**

*Ans:*

**1. Hardware Incompatibility**

Most of the old and low-end smartphones have some compatibility issues. There is a need of NFC reader (Near Field Communication) which is lack in old devices.

**2. Cost**

For accepting payments via mobile devices require some POS hardware which are extremely high in cost.

**3. Device Failure**

For using mobile in performing every activity make it your slave. For making call, checking social media, emails and transactions all will need mobile device. Device failure could be an issue in case of battery drain. You will not be able to do any transaction until your phone is charged.

**4. Phone is prone to be theft**

Since mobile payments gives you the ability to make the transaction in your convenience. Mobile devices are prone to theft which may subject to lose their card and personal account information.

**10. What is meant by mobile ticketing?**

*Ans:*

Mobile ticketing is the purchase of admission to events through a mobile device, including the delivery of digital tickets to a smartphone for use in place of traditional paper tickets.

Many event-organizing groups now choose to sell tickets via smartphone to improve convenience and accessibility, while also reducing infrastructure costs.

For example, the National Football League (NFL) moved entirely to using mobile tickets in 2018

and no longer takes PDF or "Print at Home" tickets. Besides sporting events, other industries such as airlines, museums, tourist attractions and movie theaters are implementing mobile ticketing for their customers.

**11. What is M-Shopping?**

*Ans:*

M-Shopping is Mostly similar to ecommerce, but accessible via a mobile device. Mobile shopping is now possible through mobile optimized websites, dedicated apps, and even social media platforms.

- Location-based services rely on consumers' smartphones to provide interactive opportunities and targeted advertisements.
- Location tracking is conducted with GPS data, Wi-Fi data, cellular tower pings, QR codes and RFID technology.

**12. What is an Auction?**

*Ans:*

An auction is a sales event wherein potential buyers place competitive bids on assets or services either in an open or closed format. Auctions are popular because buyers and sellers believe they will get a good deal buying or selling assets.

- An auction is a sale in which buyers compete for an asset by placing bids.
- Auctions are conducted both live and online.
- In a closed auction, for example, the sale of a company, bidders are not aware of competing bids.
- In an open auction, such as a livestock auction, bidders are aware of the other bids.
- Examples of auctions include livestock markets where farmers buy and sell animals, car auctions, or an auction room at Sotheby's or Christie's where collectors bid on works of art.

**13. What is Mobile entertainment?**

*Ans:*

Mobile entertainment comprises a range of activities associated with mobile electronics. The definition is both somewhat subjective and in continual development, but can include purely leisure activities (music, playing games), communications (social media, instant messaging, Twitter), and activities which could also be defined as commerce (shopping).

From news updates to live streaming, entertainment apps have got everything a person needs to sit back, relax and enjoy. All the things you need at the touch of your fingertip

**14. What is mobile office?**

*Ans:*

It often makes sense to run a small business from home, because it keeps costs down and helps you reduce the time lost to commuting. It can put hundreds of hours back into your year. Technology has made this a practical option. Mobile devices and online business tools have helped drive the change in working practices.

For some types of business, an office is no longer essential. It could work for you too, if:

1. you mostly do business by phone, email, messaging and social media.
2. you run a service business or online business.
3. you rarely see your clients in person.
4. you don't need large equipment to do your job.
5. you're happy working alone (or at least collaborating online).

**15. What is Mobile Distance education?**

*Ans:*

Mobile distance education, also known as M-learning, is a new way to access learning content using mobile devices. It's possible to learn whenever

and wherever you want, as long as you have a modern mobile device connected to the Internet.

Mobile learning provides a way for educational institutions to deliver knowledge and educational content to students on any platform, anyplace and at the time of need. Students use mobile apps and tools to complete and upload assignments to teachers, download course instruction and work in online social groups to complete tasks.

Many schools and colleges are supporting the concept of eLearning and mobile learning. They distribute mobile phones and laptops to students and encourage them to use them for educational purposes. Although mobile learning may be fun for the children if it's used in the right way, it can be very beneficial for the students and adults.

# Choose the Correct Answers

1. Mobile banking is also known as _____ [ a ]
   (a) SMS Banking (b) Mobile Accounting
   (c) Mobile Brokerage (d) Financial Service
2. Mobile transactions in mobile banking are _____ transactions. [ c ]
   (a) Push (b) Pull
   (c) Both (d) None
3. Enquiry based services on mobile banking is known as _____ . [ b ]
   (a) SMS (b) IVR
   (c) WAP (d) None
4. Mobile applications are developed by _____ software. [ b ]
   (a) Java (b) J2ME
   (c) C, C++ (d) None
5. Mobile Ticket format in mobile commerce is _____. [ b ]
   (a) SMS (b) PDF
   (c) word (d) app
6. The lowest value of amount is known as _____. [ b ]
   (a) Macro Payments (b) Micro Payments
   (c) Immediate Payments (d) None
7. Access to mobile data and information s known as _____. [ a ]
   (a) Mobile computing (b) Mobile communication
   (c) Mobile access (d) Mobile Technology
8. _____ is a term used to refer devices to access data and information. [ a ]
   (a) Mobile device (b) ATMs
   (c) Mobile software (d) Mobile Hardware
9. Mobile computing is a technology that allow transmission of _____ [ d ]
   (a) Data (b) Voice
   (c) Video (d) All
10. Mobile Tickets can be used in _____ barcodes. [ c ]
   (a) 1 D (b) 2 D
   (c) Both (d) None

# Fill in the blanks

1. _____ is the cut of doing financial transactions.
2. Mobile banking is also know as _____.
3. Mobile bnaking transactions are _____ and _____ transation.
4. WAP stands for _____.
5. ATM stands for _____.
6. Enquiry based services in mobile banking is known as _____.
7. _____ is mobile application based banking.
8. Mobile ticketing is a process of _____ and _____ of tickets through a ticket channel.
9. MVAS stands for _____.
10. _____ is the actual program that runs on the mobile hardware.

**ANSWERS**

1. Mobile Banking
2. SMS Banking
3. Push, Pull
4. Wireless Application Protocol
5. Automatic Teller Machines
6. IVR
7. SMS
8. Buying, Selling
9. Mobile value added services
10. Mobile software.

# One Mark Answers

**1. Mobile Banking.**

*Ans:*

Mobile banking refers to the use of a mobile device to carry out financial transactions. The service is provided by some financial institutions, especially banks.

**2. Expand USSD.**

*Ans:*

Unstructured Supplementary Service Data.

**3. Expand WAP.**

*Ans:*

Wireless Application Protocol

**4. Mobile advertising.**

*Ans:*

Mobile advertising is the communication of products or services to mobile device and smartphone consumers.

**5. Mobile payments.**

*Ans:*

A mobile payment is a money payment made for a product or service through a portable electronic device such as a tablet or cell phone.

**6. Expand MST.**

*Ans:*

Magnetic secure transmission payments.

**7. M-Shoping.**

*Ans:*

M-Shopping is Mostly similar to ecommerce, but accessible via a mobile device. Mobile shopping is now possible through mobile optimized websites, dedicated apps, and even social media platforms.

# FACULTY OF MANAGEMENT

## BBA III Year V-Semester(CBCS) Examination

## MODEL PAPER - I

## MOBILE COMMERCE

**Time : 3 Hours]** **[Max. Marks : 60**

### PART - A (4 × 3 = 12)

**Note:** Answer any **FOUR** questions.

**ANSWERS**

1. (a) Define Mobile Commerce. **(Unit - I, SQA-1)**

   (b) Payment Model. **(Unit - I, SQA-6)**

   (c) Location Tracking. **(Unit - II, SQA-4)**

   (d) What is meant by WAP? **(Unit - II, SQA-11)**

   (e) GPRS **(Unit - III, SQA-1)**

   (f) Wireless wide area network. **(Unit - III, SQA-6)**

   (g) What is mobile banking? **(Unit - IV, SQA-2)**

   (h) What is M-Shopping? **(Unit - IV, SQA-11)**

### PART - B (4 × 12 = 48)

**Note:** Answer all the questions.

2. (a) What are the benefits of Mobile Commerce? Describe in detail. **(Unit - I, Q.No.5)**

   OR

   (b) Compare and contrast E-commerce and M-Commerce. **(Unit - I, Q.No.12)**

3. (a) List out the major device limitations of mobile commerce technology. **(Unit - II, Q.No.3)**

   OR

   (b) Explain Working Procedure of WAP Model. **(Unit - II, Q.No.23)**

4. (a) What is CDMA one? Describe the features and applications of CDMAone. **(Unit - III, Q.No.5)**

   OR

(b) 'CDMA 2000 incorporated a number of advanced features that are crucial for enhancing the channel capacity as well as data speed'. Explain. **(Unit - III, Q.No.28)**

5. (a) What is Mobile Banking? List out various mobile banking services. **(Unit - IV, Q.No.2)**

OR

(b) Discuss various major mobile payment models with examples. **(Unit - IV, Q.No.17)**

# FACULTY OF MANAGEMENT

## BBA III Year V-Semester(CBCS) Examination

## MODEL PAPER - II

## MOBILE COMMERCE

**Time : 3 Hours]** **[Max. Marks : 60**

### PART - A (4 × 3 = 12)

**Note:** Answer any **FOUR** questions.

**ANSWERS**

1. (a) Wireless Communication Technology? **(Unit - I, SQA-2)**

   (b) Mobile Banking. **(Unit - I, SQA-11)**

   (c) Triangulation. **(Unit - II, SQA-8)**

   (d) Hybrid Devices **(Unit - II, SQA-2)**

   (e) List out the features of EDGE. **(Unit - III, SQA-9)**

   (f) What is WiFi? **(Unit - III, SQA-15)**

   (g) Mobile advertising. **(Unit - IV, SQA-6)**

   (h) What is micro finance? **(Unit - IV, SQA-5)**

### PART - B (4 × 12 = 48)

**Note:** Answer all the questions.

2. (a) Describe the Limitations of Mobile Commerce. **(Unit - I, Q.No.6)**

   OR

   (b) What are the applications of mobile commerce? **(Unit - I, Q.No.14)**

3. (a) Explain in detail about Page description languages. **(Unit - II, Q.No.30)**

   OR

   (b) List and explain various types of Mobile Clients. **(Unit - II, Q.No.2)**

4. (a) What is 4G ? List out the features of 4G wireless technology. **(Unit - III, Q.No.29)**

   OR

(b) What is WiFi ? What are its uses? **(Unit - III, Q.No.40)**

5. (a) What are the characteristics of mobile payment systems? **(Unit - IV, Q.No.16)**

OR

(b) What are the new trends in mobile ticketing? **(Unit - IV, Q.No.28)**

# FACULTY OF MANAGEMENT

## BBA III Year V-Semester(CBCS) Examination

## MODEL PAPER - III

## MOBILE COMMERCE

**Time : 3 Hours]** **[Max. Marks : 60**

### PART - A (4 × 3 = 12)

**Note:** Answer any **FOUR** questions.

**ANSWERS**

1. (a) Advertiser Model **(Unit - I, SQA-7)**

   (b) Define E-Commerce. **(Unit - I, SQA-9)**

   (c) Wi-Fi **(Unit - II, SQA-6)**

   (d) What is a mobile client. **(Unit - II, SQA-1)**

   (e) Define 3G Systems. **(Unit - III, SQA-10)**

   (f) What is GSM Technology? **(Unit - III, SQA-5)**

   (g) What is meant by mobile ticketing? **(Unit - IV, SQA-10)**

   (h) Mobile financial services. **(Unit - IV, SQA-1)**

### PART - B (4 × 12 = 48)

**Note:** Answer all the questions.

2. (a) Describe the briefly about various mobile commerce business models. **(Unit - I, Q.No.8)**

   OR

   (b) Describe the conceptual framework of mobile commerce. **(Unit - I, Q.No.7)**

3. (a) How does Location Technology Track the Movements? **(Unit - II, Q.No.7)**

   OR

   (b) What are the basic protocols used in Mobile communication. **(Unit - II, Q.No.18)**

4. (a) Define Wireless Personal Area Network mean? List out the basic characteristics of WPAN. **(Unit - III, Q.No.47)**

   OR

(b) List out various major applications and features of GSM Technology. **(Unit - III, Q.No.12)**

5. (a) What is mean by Mobile Business Services? And Explain how mobile business services helps to increase more no of customers ? **(Unit - IV, Q.No.32)**

OR

(b) What is M-Shopping? What are the uses of location based services in M-Shopping. **(Unit - IV, Q.No.29)**