Unit IV: General Packet Radio Service (GPRS): Introduction – GPRS and Packet Data Network – GPRS Network Architecture - GPRS Network Operations – Data Services in GPRS – Application for GPRS – Limitation of GPRS - Enhanced data rates for GSM Evolution (EDGE). Wireless Application Protocol (WAP): WAP – MMS – GPRS applications.

Chapter 8

General Packet Radio Service (GPRS):

8.1 General Packet Radio Service (GPRS):

- GPRS is an expansion Global System for Mobile Communication. It is basically a packet-oriented mobile data standard on the 2G and 3G cellular communication network's global system for mobile communication. GPRS was built up by European Telecommunications Standards Institute (ETSI) because of the prior CDPD, and I-mode packet switched cell advances.

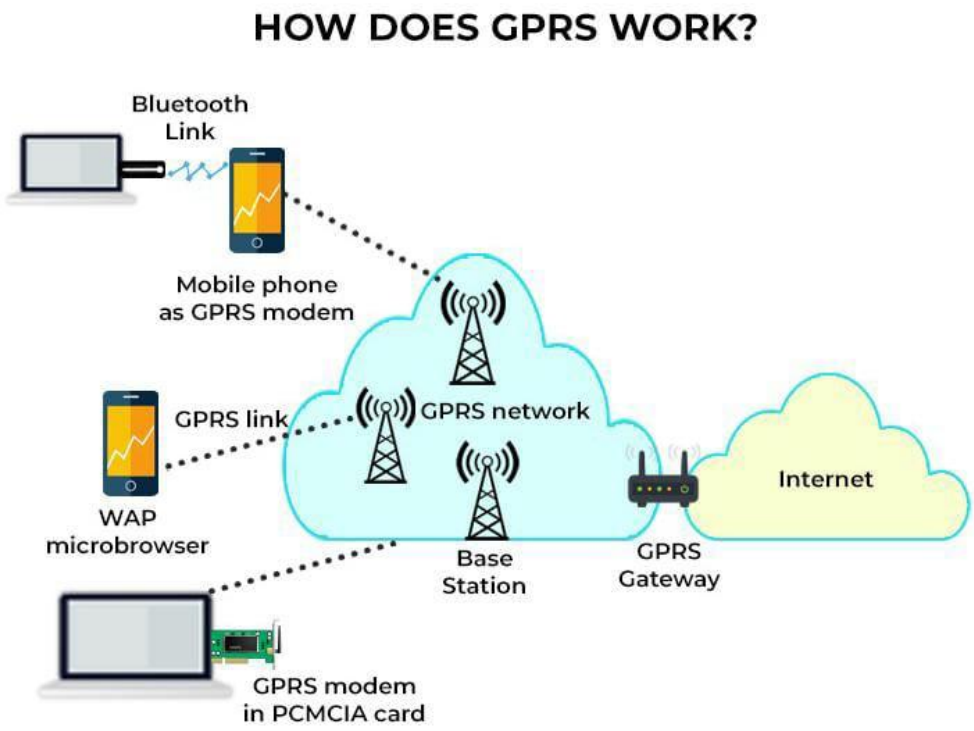
- GPRS overrides the wired associations, as this framework has streamlined access to the packet information's network like the web. The packet radio standard is utilized by GPRS to transport client information packets in a structured route between GSM versatile stations and external packet information networks. These packets can be straightforwardly directed to the packet changed systems from the GPRS portable stations.

History Of GPRS:

- GPRS was one of the main advances that empowered a cell system to interface with Internet Protocol systems, accomplishing across the board reception in the mid-2000s. The capacity to peruse the web from a telephone whenever through "dependably on" data networking, while underestimated in a great part of the world today, was as yet an oddity when it was introduced.

- Indeed, even now, GPRS keeps on being utilized in parts of the world where it has been too expensive even to consider upgrading cell organize framework to move up to newer alternatives.

- According to a study on the history of GPRS development Bernhard Walke and his student, Peter Decker, are the inventors of GPRS – the first system providing universal mobile Internet access.



Goals Of GPRS:

- Consistent IP services
- Leverage industry investment in IP
- Open Architecture
- Service innovation independent of infrastructure

Services Offered:

- SMS messaging and broadcasting
- Push-to-talk over cellular
- Instant messaging and presence
- Multimedia messaging service
- Point-to-Point and Point-to-Multipoint services

Protocols supported:

- Internet Protocol (IP)

- Point-To-Point Protocol (PPP)
- Benefits Of GPRS:

Mobility:

The capacity to keep up consistent voice and information interchanges while moving.

Cost Efficient:

Communication via GPRS is cheaper than through the regular GSM network.

Immediacy:

Allows customers to obtain connectivity when needed, regardless of location and without a lengthy login session.

Localization:

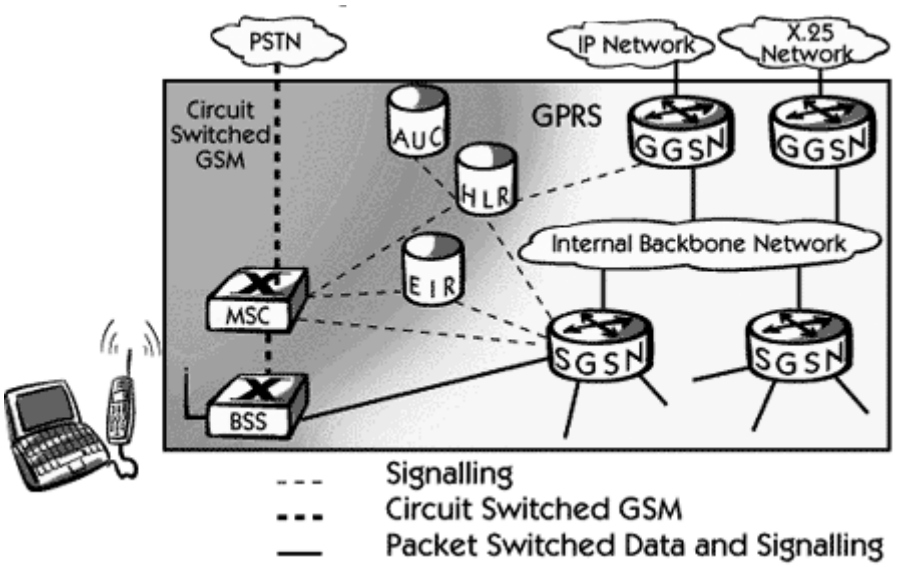
- Enables customers to acquire data applicable to their present area.
- Easy Billing:
- GPRS packet transmission offers an easier to use billing than that offered by circuit switched administrations.

GPRS is an innovation that numerous GPS beacons are using to get up to the minute data with tracking. When the GPS gadget records the information, it would then be able to be transmitted through GPRS to another central location, for example, a PC or through an email. It is the GPRS innovation that takes into consideration ongoing updates to GPS following frameworks. It is this direct GPRS association that gives the client of the GPS system the most reliable information available today.

8.2 GPRS - Architecture

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.

How GPRS Establishes a Connected Mobile Environment for IoT Applications

General packet radio service (GPRS) is essentially a packet-switching technology that allows information to be transmitted via mobile networks. This is utilized for internet connectivity, multimedia messaging service, and other types of data transmission. GPRS is supported by GPRS cellphones, as well as laptops and handheld devices equipped with GPRS modems. Subscribers have reported downstream bandwidths of up to 80 Kbps.

GPRS could be employed to facilitate connections related to Internet protocols which provide a set of functions including commercial and enterprise applications. Before the transmission, the information is split into individual packets and routed through the core network and radio. At the receiver's end, the data is reattached.

The global system for mobile communications (GSM) is the primary standard for the second generation (2G) cellular network, while GPRS is an improved version. GPRS is not like GSM's short messaging service (GSM-SMS), which has a message length limit of 160 bytes. GPRS has a theoretical maximum speed of 115 kbps, although most networks operate at roughly 35 kbps. GPRS is sometimes known as 2.5G unofficially. It's a third-generation route to gain availability on the internet.

GPRS can operate from either symmetric or asymmetric configuration, whereas frequency for either direction is determined by which one of the 12 multislot provider classes are chosen. The number of time slots for every path is determined by the multislot service class, for every time slot propping up a theoretical connection speed of 21.4 kbps. One of the most basic is service class 1, which allows a one-time slot for each path. Service class 12 is by far the most proficient, with four-time slots in every direction.

GSM-IP stands for global-system mobile communications internet protocol and is also another name for GPRS. It ensures that customers are connected, making audio calls and browsing the internet. This method enables packet radio access to even time division multiple access (TDMA) customers. GPRS also allows network operators to deploy an IP-based core architecture for integrated audio and data applications, which can be used and improved for 3G networks.

GPRS used to be the fastest network-accessible option – this has, however, changed in terms of speed and dependability, as both 3G and 4G networks surpass it. However, it is still used in several areas, particularly rural regions and emerging nations that have not ventured into other more sophisticated technology. When a GPRS network is available, most smartphones might use it, albeit those used to better connections will notice the considerably slower bandwidth and long waits.

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.

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.

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.

When 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.

GPRS Support Nodes

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

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.

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.

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.

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

There are two Network Operation Nodes in GPRS

1. GGSN:

- The first is the access point for an external data network and is known as the gateway GPRS support node (GGSN). It contains the routing for GPRS-attached users. With this information, GGSN is capable of delivering the packet data units (PDU) to the user's current access point.
- The location information can be obtained from the HLR via the optional Gc interface, The Gateway GPRS Support Node (GGSN) is a main component of the GPRS network. The GGSN is responsible for the interworking between the GPRS network and external packet switched networks, like the Internet and X.25networks.
- From the external networks' point of view, the GGSN is a router to a sub-network, because the GGSN 'hides' the GPRS infrastructure from the external network. When the GGSN receives data addressed to a specific user, it checks if the user is active.
- If it is, the GGSN forwards the data to the SGSN serving the mobile user, but if the mobile user is inactive, the data are discarded. On the other hand, mobile-originated packets are routed to the right network by the GGSN. To do all this, the GGSN keeps a record of active mobile users and the SGSN the mobile users are attached to. It allocates IP addresses to mobile users and last but not least, the GGSN is responsible for the billing.

2.SGSN:

- The second is the SGSN that serves the need of mobile users. When a user is GPRS-attached, the SGSN establishes a mobility management (MM) context containing information pertaining to routing, security and mobility, such as the identity of RA and LA where the MS is residing, and the MS's MM states, etc. The SGSN also ciphers PS traffic, given that the base transceiver station (BTS, in GPRS, BTS replaces the BS in GSM.) is only responsible to cipher CS traffic
- The Serving GPRS Support Node (SGSN) is a main component of the GPRS network, which handles all packet switched data within the network, e.g. the mobility management and authentication of the users. The SGSN performs the same functions as the MSC for voice traffic.
- The SGSN and the MSC are often co-located. The SGSN is connected to the BSC. The SGSN is the service access point to the GPRS network for the mobile user. On

the other side the SGSN relays the data between the SGSN and relevant GGSN (and vice versa). The SGSN handles the protocol conversion from the IP used in the backbone network to the sub-network-dependent convergence protocol (SNDCP) and logical link control (LLC) protocols used between the SGSN and the mobile users. These protocols handle compression and ciphering.

- The SGSN is also responsible for the authentication of GPRS mobiles. When the authentication is successful, the SGSN handles the registration of the mobile to the GPRS network and takes care of its mobility management.

GPRS Services

The GPRS provides a set of GSM services for data transmission in packet mode within a PLMN. In packet-switched mode, no permanent connection is established between the mobile and the external network during data transfer. Instead, in circuit-switched mode, a connection is established during the transfer duration between the calling entity and the called entity. In packet-switched mode, data is transferred in data blocks, called packets. When the transmission of packets is needed, a channel is allocated, but it is released immediately after. This method increases the network capacity. Indeed, several users can share a given channel, since it is not allocated to a single user during an entire call period.

One of the main purposes of GPRS is to facilitate the interconnection between a mobile and the other packet-switched networks, which opens the doors to the world of the Internet. With the introduction of packet mode, mobile telephony and Internet converge to become mobile Internet technology. This technology introduced in mobile phones allows users to have access to new value-added services, including:

- Client-server services, which enable access to data stored in databases. The most famous example of this is access to the World Wide Web (WWW) through a browser.
- Messaging services, intended for user-to-user communication between individual users via storage servers for message handling. Multimedia Messaging Service (MMS) is an example of a well-known messaging application.
- Real-time conversational services, which provide bidirectional communication in real-time. A number of Internet and multimedia applications require this scheme such as voice over IP and video conferencing.
- Tele-action services, which are characterized by short transactions and are required for services such as SMS, electronic monitoring, surveillance systems, and lottery transactions.

GPRS allows for radio resource optimization by using packet switching for data applications that may present the following transmission characteristics:

- Infrequent data transmission, as when the time between two transmissions exceeds the average transfer delay (e.g., messaging services);
- Frequent transmission of small data blocks, in processes of several transactions of less than 500 octets per minute (e.g., downloading of several HTML pages from a browsing application);
- Infrequent transmission of larger data blocks, in processes of several transactions per hour (e.g., access of information stored in database centers);

- Asymmetrical throughput between uplink and downlink, such as for data retrieval in a server where the uplink is used to send signaling commands and the downlink is used to receive data as a response of the request (e.g., WEB/WAP browser).

As the GPRS operator optimizes radio resources by sharing them between several users, he is able to propose more attractive fees for data transmission in GPRS mode than in circuit-switched mode. Indeed, the invoicing in circuit-switched mode takes into account the connection time between the calling user and the called user. Studies on data transmission show that data are exchanged from end to end during 20% of a circuit-switched connection time. For example, a user browses the WWW, downloads an HTML page identified by a uniform resource locator (URL), reads the content of the HTML page, then downloads a new HTML page to read. In this example no data is exchanged from end to end between the two HTML page downloads. For this type of application, a more appropriate invoicing would take into account the volume of data exchanged instead of the circuit-switched connection time. In packet mode, the GPRS user may be invoiced according to the requested service type, the volume of data exchanged.

8.3 GPRS - Applications

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 advertisements 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).

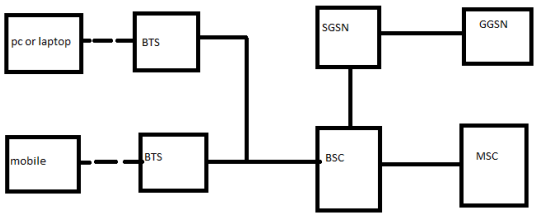
8.4 Enhanced data rates for GSM Evolution (EDGE)

What is EDGE(Enhanced Data Rate for GSM Evolution)?

EDGE (Enhanced Data Rate For GSM Evolution) provides a higher rate of data transmission than normal GSM. It uses a backward-compatible extension of GSM of digital mobile technology.EDGE has a pre-3G radio technology and uses part of ITU's 3G definition. It can work on any network deployed with GPRS (with necessary upgrades).

Working

It uses 8PSK modulation in order to achieve a higher data transmission rate. The modulation format is changed to 8PSK from GMSK.



EDGE In GSM Network

Features

- It provides an evolutionary migration path from GPRS to UMTS.
- It is standardized by 3GPP.
- EDGE is used for any packet switched application,like an Internet connection.
- EDGE delivers higher bit-rates per radio channel and it increase the capacity and performance.

Advantage

- It has higher speed.
- It is an "always-on" connection
- It is more reliable and efficient
- It is cost efficient

Disadvantage

- It consumes more battery.
- hardware needs upgradation.

Chapter 9

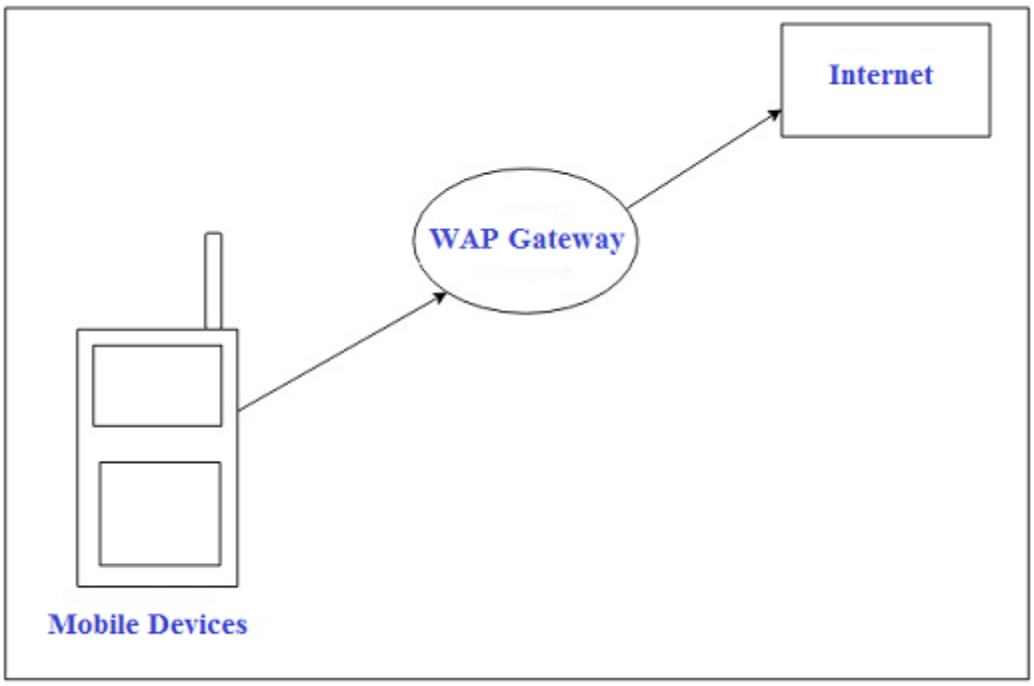
Wireless Application Protocol (WAP)

9.1 Wireless Application Protocol (WAP)

What is WAP?

WAP is a protocol that is introduced in 1999, which stands for Wireless application protocol. It offers Internet communications over wireless devices, such as mobile phones. In the early 2000s, it accomplished some popularity and was mainly superseded by more recent standards by the 2010s. Also, it offers a way of creating web applications for mobile devices, and it is designed for micro-browsers.

Most of the wireless networks are supported by WAP, as well as TDMA, CDMA, and GSM. Also, all operating systems can support a wireless application protocol. It enables access to the internet in mobile devices and uses the mark-up language like WML, which stands for Wireless Markup Language that is referred to as XML 1.0 application. WAP offers the facility to connect interactive wireless devices (like mobile phones) to the internet and enhances wireless specification interoperability.



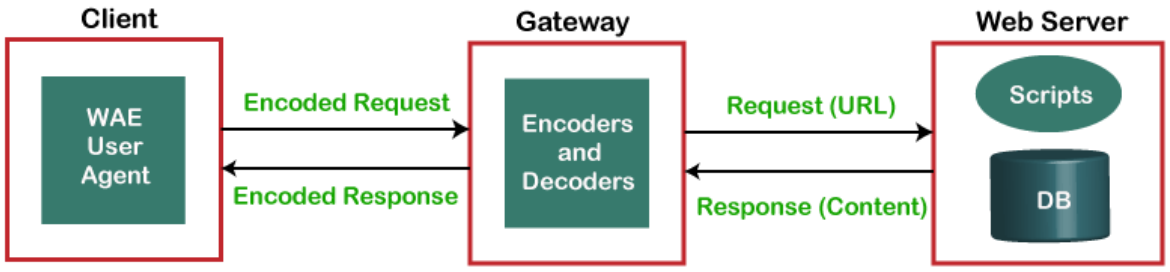
WAP may be created on any kind of operating system, and it acts in an open application environment. It is more beneficial for mobile users as it has the ability to deliver electronic information efficiently. In 1998, Nokia, Motorola, Ericson, and Unwired Planet founded the WAP Forum, whose objective was to standardize several wireless technologies with the help of protocols.

The WAP CSS (cascading style sheet) makes capable of developers to format screen sizes in order to mobile device adaptability. When the WAP CSS content is used, then reformatting is not required. It controls page layout compatibility with different mobile device's display screens.

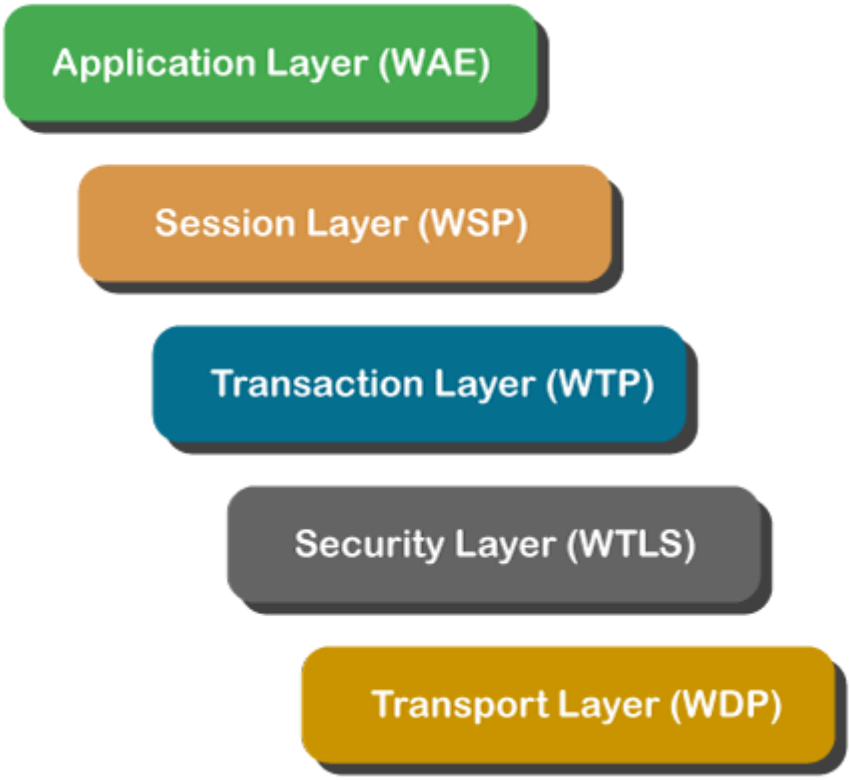
The transport layer handles the physical network issues, by which wireless gateways can be easily accessed by global wireless operations. A WAP gateway is a server, which provides the facility to access the wireless network. The WAP Forum offers specification development, WAP tool testing and also provides support for all mobile services. Now, the WAP Forum is referred to as the Open Mobile Alliance.

WAP Model

In the mobile device, the user opens the web browser and access the website and visit webpages accordingly. The mobile device forwards the URL request to a WAP gateway through the network using the WAP protocol. Then, the WAP gateway refers to this request over the internet after translating it into a conventional HTTP URL request. The specified Web server accepts the request and processes the request. Then, it returns the response to the mobile device in the WML file through the WAP gateway that will be displayed in the web browser on the device.



WAP Protocol stack



1. **Application Layer** (WAE)

The Wireless Application Environment contains content development programming languages like WML and mobile device specifications. It functions much like a JavaScript and holds the tools that wireless Internet content developers use. It includes scripting languages such as WML and WMLScript that are used in conjunction with WML.

2. **Session Layer** (WSP)

It determines the session will be connection-oriented or connectionless between the device and the network and offers a reconnection and fast connection suspension. The data is passed both ways between the network and the device in the connection-oriented session. Then, WSP forwards the packet to the next layer WTP (Wireless Transaction Protocol). When the information is being streamed or broadcast from the network to the device, commonly, the connectionless session is used. Then, WSP forwards the packet to the WDP (Wireless Datagram Protocol) layer.

3. Transaction Layer (WTP)

The Wireless Transaction Protocol offers transaction support. It is a part of TCP/IP and runs on top of UDP, which stands for User Datagram Protocol.

4. Security Layer (WTLS)

The Wireless Transport Layer Security provides security in terms of data integrity, privacy and authentication that help to save your data. It also has the ability to work like Transport Layer Security. Also, it contains security features that have Transport Layer Security.

5. Transport Layer **(WDP)**

With the network carrier layer, the Wireless Datagram Protocol functions in conjunction and presents a constant data format to higher layers of WAP protocol stack.

Components of WAP

There are three major components of the WAP, which are as follows:

1. Protocol Support

- IP networks: Protocols supported contains the HTTP (known as WP-HTTP), TLS, and the wireless "profiled" versions of TCP (known as WP-TCP).
- Non-IP networks: It includes four layers: Wireless Transport Layer Security, Wireless Datagram Protocol, Wireless Session Protocol, and Wireless Transaction Protocol.

2. Application Environment

- WML Specification: WML stands for Wireless Markup Language, based on XML and XHTML.
- WMLScript Specification: A scripting language that is used for running code on clients.
- WAP Micro Browser: Especially, it is designed to control the WAP device. WAP devices make capable of operating in a limited resource environment with the help of a WAP micro-browser.

3. Services and Capabilities

- Customization of User Profile: On the basis of client device capabilities and user preferences, WAP enables servers to customize content delivered to users.
- Telephony Support: Wireless application protocol allows telephone services to be operated from within a data environment. As a result, WAP phones can function as web devices and integrated voice.

Advantages of WAP

There are various advantages using WAP; such are as follows:

Portability

The primary use of WAP is to write applications using proprietary protocols. When you are porting applications to a different kind of network, it will need substantial code rewriting. For

example, a different type of networks like GSM and CDMA, and bearer protocol like CSD (circuit-switched data) or SMS (short message service).

User Experience

- The devices with limited processing power, small screens, limited memory, and limited battery.
- Provide a narrow bandwidth connection.

Cost and Application Development Time Reduction

WAP helps to add new services at a lower cost and quickly. It could be done by the WAP tools and platforms like WAP devices, WAP gateways, and WAP software development tool kits.

Some of the other advantages of WAP are:

- No hardware obsolescence
- Real-time send/receive data
- Most modern mobile telephone devices support WAP
- Implementation near to the Internet model
- Time-saving
- Increased sales for devices, infrastructure & gateway manufacturer.
- Personalized

Disadvantages of WAP

- Not very familiar to the users
- The third party is included
- The business model is expensive
- Low speeds, security, and very small user interface
- Small display screens
- Limited bandwidth
- Speed of access and limited availability

Applications for WAP

Corporate Applications: The WAP has used incorporation applications where salespeople want to use their WAP for allowing direct access to the latest pricing, handsets to get instant, competitive information any time, latest news.

Mobile Banking:

It is used in the banking sector for different purposes, such as provide details of user account balance, last four transactions, overdraft limits and so on. The elements such as WAP, private information services, security and various different other elements are included in it. Additionally, it has numerous ways to provide Users' information. On the other hand, the user

can get information by sending a request via message, or the service can be push-based, which means it can be automatically generated on the basis of events or set intervals.

All mobile phones are able to run mobile banking services, or services can be tailored for a protocol-compliant phone or particular branded phone, e.g., WAP. Furthermore, the WAP is not only beneficial for information provision, but it can also secure electronic commerce and mobile transactions.

Games:

Games are a huge service that is most widely used by people in terms of applications or software in mobile devices. Similarly, as music distribution will increase electronically, games will also increase. You can download games or videos from an internet site rather than go to a video store to rent a game or video.

Mobile Commerce: It is required to use a mobile phone for transactions in mobile commerce applications. Usually, it means transferring funds electronically or making a payment for goods. Electronic commerce applications offer services for transferring money between accounts and paying the amount for purchasing something.

Ringtones: It is another emerging service to download ringtones. When someone calls on the phone, it plays tunes. The phone users can change their phone ringtone to make different it from others. Usually, phones come with different inbuilt ringtones into its internal memory, which users can select from them to set on the phone ringtone. However, in moderns times, it is more common to download the ringtones from an internet site to the phone. Additionally, there are also many ringtone composers available that help users to compose their own unique ringtones according to their requirements.

Unified Messaging: It is an emerging value-added network service that elevates communication above the technology used to communicate. People get different kinds of messages that are difficult to manage. For accessing different types of messaging, unified messaging offers users a single interface. Typically, it helps to notify people when they get a new message with the help of alerting them through a unified messaging box. The short message commonly includes an indication to specify the new message. Furthermore, with WAP, users can access and manage their unified messaging box accordingly.

Positioning: The meaning of positioning in terms of mobile context can include several things: the location of phones or vehicles or people. The GPS (Global Positioning System) is a global network of 24 satellites. A receiver with GPS can get their satellite position and find out the location. The SMS is standard for sending GPS information like latitude, longitude, bearing, and latitude. Generally, the length of GPS information is around 60 characters, which can leave room for other vehicle-specific information.

Qualitative Information:

The different variety of content can be delivered to mobile phone users, such as share prices, flight information, lottery results, sports scores, weather, jokes, news headlines, and more. This information may be in the form of any kind of visual information, graphs or maps.

9.2 MMS :

What is MMS(Multimedia Messaging Service)

- MMS stands for Multimedia Messaging Service. It is the standard way to send messages from one device to another through a network.
- As the name Multimedia, we can suggest from here that it is not only for sending text messages, we can also send multimedia like images, audio clips and video clips, and many more things.
- It is the extension used for SMS(Short Message Service) where we send and receive text messages only with the limitation of only 160 characters in one SMS.
- Most of the smartphones support MMS messaging nowadays. Basically it is the advanced version of the text messaging with the additional feature of multimedia.

For Example:

- If you type a text-only message it will deliver as an SMS but if you include images and other media you want then it will be delivered as an MMS and vice-versa.
- If your device is not capable of receiving MMS messaging then it will be shown to you as a text-messages with a URL where you can view the media from the Web-Browser.

History

- MMS was developed in 1984. It is the advanced version of SMS(SHORT MESSAGE SERVICE) where you can send only text messages. Earlier MMS services were not easily used as it is used nowadays. The customers have to suffer multiple technical issues. So, many companies have resolved this issue by methods like handset detection, content optimization, and increased throughput.

- China is the first country that introduced MMS service in a commercial way. In 2009, the chairman and CEO of China Mobile said that MMS service in China is now a mature service in place of the SMS service.

- Norway is the most advanced MMS market in Europe. In 2008, Norwegian MMS usage level passed 84% of all the mobile subscribers.

As the usage of smartphones increased in 2010-2013. In the same way, the usage of MMS services is widely increased due to the increased usage of smartphones.

Modes of sending MMS

There are basically six modes which are as follows:

- Sending messages to an MMS mobile phone via an MMS mobile phone.
- It can be sent in the same way as we send SMS messages, except that MMS messages include multimedia contents.
- Sending messages to a non-MMS mobile phone via an MMS mobile phone.

Since the non-MMS mobile phones can't receive a multimedia message, the MMS system automatically forwards the messages to the receiver's corresponding email box and then sends a notification to his mobile phone.

- Sending messages to email boxes via an MMS mobile phone Multimedia messages can be sent via an MMS mobile phone to an email box, and the receiver logs on the email box to read the messages. However, most email boxes don't support multimedia messages yet.
- Sending messages to an MMS mobile phone via an email box
- A user logs on to his email box, selects multimedia messages to sent, inputs a receiver's MMS mobile phone number, and send the messages as an attachment.
- Downloading multimedia messages from the internet to an MMS mobile phone
- A user can customize and order multimedia messages on websites that provide MMSs and then send MMS to an MMS mobile phone.
- Sending messages from an MMS mobile phone to personal e-albums.
- A user can send MMS messages to his personal e-album via an MMS mobile phone. User writes MMS messages in mobile phones, inputs the album website number, and then sends the messages.

Advantages

- We can easily send and deliver MMS messages.
- The MMS messages which we received, we can store them (save them) and also we can forward messages.
- Users are using these services as they are user-friendly.
- These services are interactive.
- Image, video, and other media-rich content allows for better branding.

Disadvantages

- MMS service is not available on all mobile phones. So, we cannot use this service in all the phones.
- Some multimedia content has some resolution issues due to the varied display sizes of different phones.
- As it a service provided to us but there are also extra charges associated with it. If we have to use this service we have to pay extra charges for this service.

Users who have opted in to an MMS database don't necessarily have an MMS enabled phone. Sending bulk MMS messages is often only available through a dedicated messaging platform rather than a network.

9.3 GPRS Applications :

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 advertisements 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).