WAP (Wireless App protocol)

- In a mobile network wireless data are delivered with several constraints. As mobile devices are of small size and weight, it has smaller display and keyboard, less powerful CPU and small memory capacity. It has limited bandwidth, low danger of reliability. Hence the protocol used for internet is not suitable for mobile network.
- In order to address above mention problem Ericson, Motorola, Nokia and Phone.com founded wireless app protocol (WAP) forum. The WAP forum has drafted a set of global wireless protocol specification for many wireless network. Most handset manufacturers have committed to WAP enable devices.
- To converge wireless data and internet WAP integrate a light weight web browser into handheld device with limited computing and memory capacities.
- The WAP implemented on both the WAP gateway and WAP handsets enable a mobile user to access internet web application through client server model.

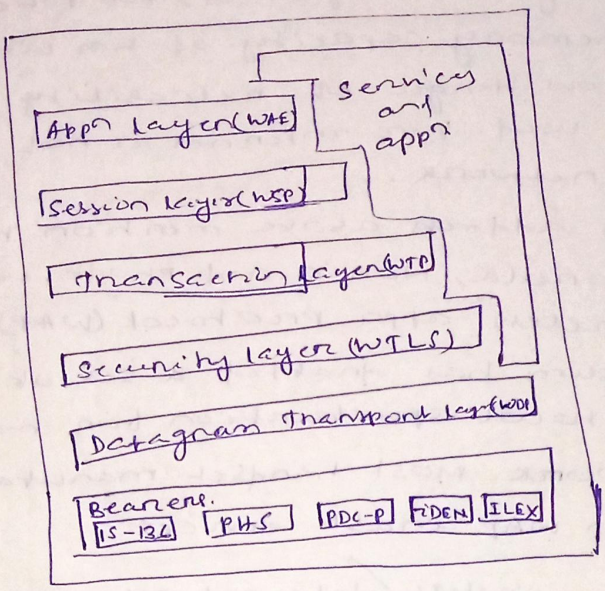
WIRELESS APPLICATION PROTOCOL:

- WAP is an universal open standard developed by the WAP forum to provide web browser mobile users of wireless phones and other wireless terminals.
- WAP standard represents the first successful attempt to establish a broadly accepted environment for delivering information, data and service to both enterprise and consumer users over wireless network.

→ WAP is based on existing internet standard such as IP, XML, HTML and HTTP.

→ It also include security features

WAP Architecture:



WAP standard is a set of standard which together define

(1) how wireless data handset communicates with the wireless network and how content and services are delivered and execute to their handsets

→ Using these standards the handset can establish a connection to a WAP data infrastructure request content, and service from infrastructure

(2) WAP is based on layered architecture The WAP stack is similar to the OSI network model. The architecture consists of a set of service encompassing network protocol, security and application environment

→ The WAP standard is layered i.e one layer rests on top of another and therefore depend on another to provide service

→ Each layer on the network infrastructure are exposed to the interface layer above it

→ Layer are symmetric i.e they run both on the client device and network infrastructure.

Advantage:

→ Layering allows the design of each protocol to evolve independently of the other protocol. Each layer assumes that the layer below it has a particular set of capabilities and provides a particular set of capabilities to the layer above it.
→ Layering allow subset of the standard to be implemented
→ Layering permits effective bridging to internet protocol used over both internet and WWW are layered
→ Layering support the principle of separability.

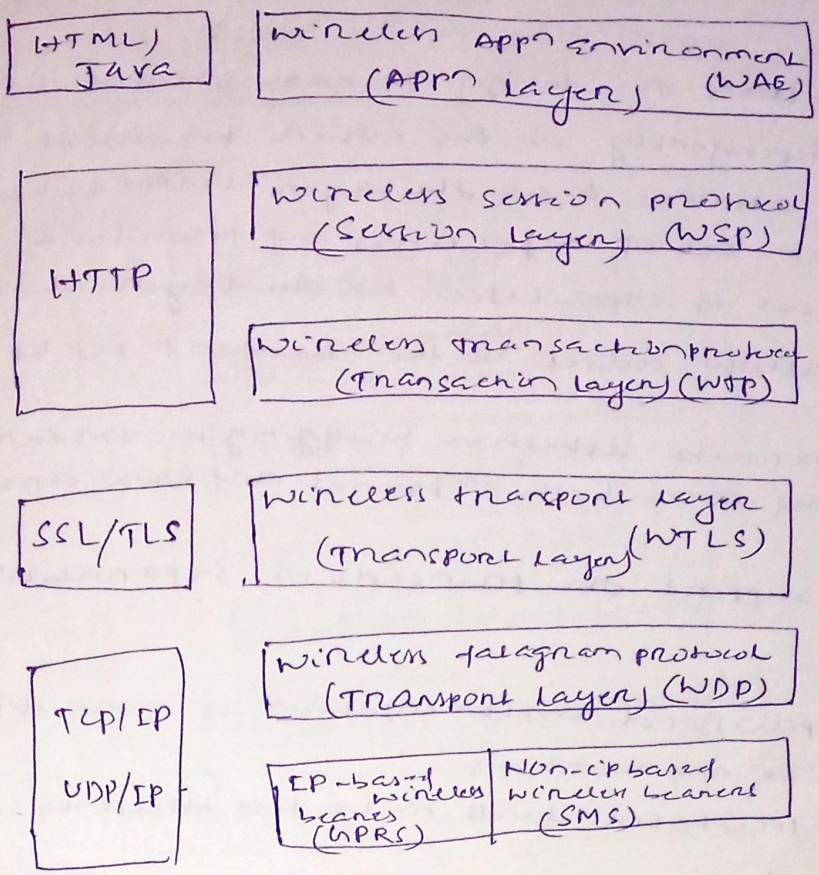
Disadvantage:

→ Layered protocol implementation is more difficult to optimize and maintain
→ Layered protocol tends to be less efficient.

WAP gateway:

→ WAP gateway is located b/w the origin service and mobile network
→ WAP gateway utilize web proxy technology to provide efficient wireless access to the internet
→ A proxy plays role of both server and client
→ WAP ~~gateway~~ handset can't directly communicate with the origin server
→ On the internet side, WAP gateway translate request from the WAP protocol stack to the internet protocol stack
→ WAP gateway support the DNS service to resolve the domain name used in URL.
→ It also provide quick response to the WAP handset by aggregating data from different origin server.

WAP protocol:



WDP (Wireless datagram protocol)

→ The transport layer protocol in WAP is called WDP

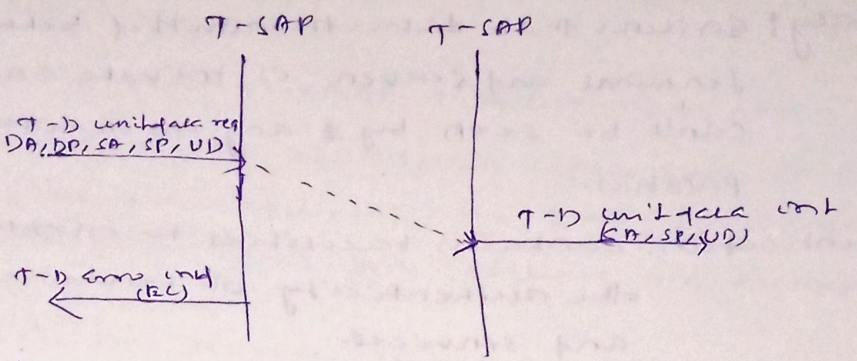
→ It operates above bearer service and offers a consistent service to upper layer

→ WDP offer similar function like UDP and T-SAP

→ UDP provides port addressing for IP based bearer service

→ WDP offers source and destination port number used for multiplexing and demultiplexing of data

→ The service is initiated by sending a datagram



→ T-D unitdata req with destination address (DA), Destination Port (DP), source Address (SA), source Port and user data (UD)

→ DA and SA are unique address of receiver and sender which can be IP-address or PSTN number

→ T-D unitdata. ind service indicates the reception of data. Here DA, DP are optional

→ If that request can't be fulfilled by WDP then an error is indicated with T-D Error ind service

→ An error code (EC) is returned indicating reason for the error to higher layers.

WTLS (Wireless transport layer security)

→ WTLS is a security protocol based on TLS

→ If request by an app, a security service can be integrated on the WAP architecture on top of WDP.

→ WTLS can provide diff. level of security for privacy, authentication and data integrity.

→ WTLS takes into account the low processing power and very limited memory capacity and it is useful for cryptographic algorithm

→ WTLS support datagram and connection oriented transport layer protocol

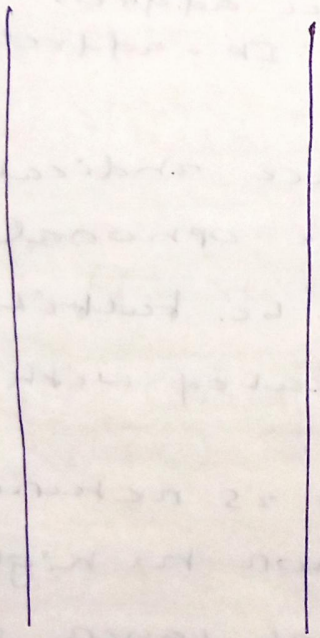
→ WTLS provides

* Data integrity: ensure that data sent between terminal and server is unchanged

* privacy: ensure that data transmitted between terminal and server is private and can't be seen by any intermediate parties.

* Authentication: contains facilities to establish the authenticity of terminal and services.

→ WTLS divide the whole transaction by 2 sections
→ originator
→ peer.



Wireless transaction protocol:

WTP run on top of a datagram service and provides transaction oriented protocol that is suitable for implementation in thin client such as mobile phone WTP offer following advantage

→ improve reliability over datagram service
→ improve efficiency over connection oriented service
→ support for transaction oriented service.

WTP support three class of transaction service

- class 0: unreliable with no result message
- class 1: Reliable with no result message
- class 2: Reliable with one result message.

WTP achieved reliability using duplicate removal, retransmission, acknowledgement and unique transaction identifier.

- WTP allows for asynchronous transaction, abort of transaction, concatenation of message and can support report success or failure of reliable message
- For reliable transmission of message three service primitives are obtained by WTP are as follows
  - TR-invoke: it is used to initiate a transaction
  - TR-result: this used to send back a result of previously initiated transaction
  - TR-abort: it is used to abort a normal transaction

WSP: (Wireless session protocol)

- WSP provides connection oriented service on top of WTP.
- it provides a consistent interface between two session service.

- WSP protocol is based on concept of request and a reply
- Each WSP protocol data unit consist of a body and header.
- WSP provides application with an interface to two session services.
- The connection oriented session service operates above WTP and connectionless operates above WDP.
- WSP offers following general features needed for content exchange.

i) Session management: WSP introduce a session that can be established from a client to a server and may exist for a long time.

ii) Capability negotiation: Client and server can agree upon a common level of functionality to set upon a common level of functionality to set the capacity of a mobile depending upon parameter such as client size, server size and maximum request it handle.

iii) Content encoding: It defines encoding for transferring the content.

WAE (Wireless App Environment)

The objective of WAE is to provide an interoperable environment to build wireless service among operator and service provider. It offers a framework for the integration of different world wide web and mobile telephony app. The major element of WAE are

a) Wireless telephony app: A collection of telephony feature for call mechanism.

b) Content generator: Appn on origin server that produce standard content format on network to request

c) User Agent: User agent signifies an agent who work on behalf on user

d) WML: It is a markup language optimize for use on wireless device to HTML.

WML: (Wireless markup language)

- WML was designed to describe the content and format for presenting data on devices with limited bandwidth, limited screen size, limited user input capability.
- It is designed to work with telephone keypads, styles and other input device common to mobile wireless communication
- WML permits the scaling of displays for use on two line screen found on small devices as well as the large screen found in smart phone.

- For an ordinary PC a web browser provides the contents in the format of web coded with HTML
- To translate an HTML coded webpage into WML such content and format suitable for wireless device much of the information especially graphics and animation must be stripped away. WML provides mainly text based information that attempt to capture the essence of webpage and that is organized for easy access by users of mobile devices.

Important features:

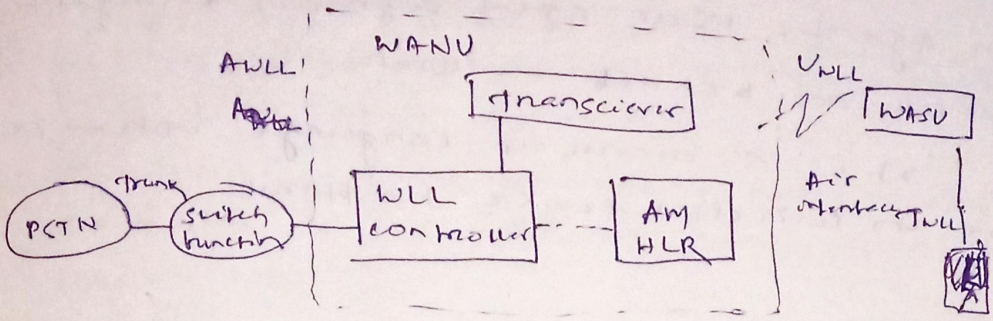
- Text and image support: Formating and layout command are provided for text and limited image capability
- Deck/card organisation: WML documents are subdivided into small, well defined unit of user interaction called cards. User navigate by moving back and forth b/t card. A card specifies one or more unit of interaction. A WML deck is similar to an HTML page in that it is identified by a web address (URL) and is the unit of content transmission.
- Support for navigation among card:
  WML include provision for event handling.
- WML is tagged language similar to HTML in which individual language elements are designed by lowercase tag, enclosed in angle brackets
- Typically WML definition of a card begin with non visible portion which contain executable element followed the visible content

```
<WML> <card id = 'card1'>
  <P>
  Hello WAP World
  </P>
</card></WML>
```

WLL:

- It provides two way calling service to the stationary or fixed user which is intended to replace its wireless counterpart
- It is a system that connect a subscriber to PSTN using wireless technology and use radio signal to provide standard telephone service.
- It is a broadcast connection system that uses high frequency radio link to deliver voice and data without fibre optic cables.
- In telephony loop is defined as the circuit connecting a subscriber station with the line terminating equipment in a central office.
- The trunk start from the central office on the loop and are broken down into several smaller bundle of circuit after some distance from the central office
- These circuit are eventually separated into individual drops for the residence houses.
- The central office switch is typically the first point of traffic concentration in the PSTN
- New installation use fibre optics to connect residential neighbourhood or business campus to the central office.

Architecture:



In this fig. the wireless access network unit consists of base station Transceiver (BTS) or radio port (RP), the radio controller (RPCU) an access manager (AM) and HLR as required.

- The interface betn WANU and switch is called AWLL
- The air interface between WANU and the user side is called VWLL.
- The WANU should provide for the authenticity and privacy of the air interface, radio resource management, limited mobility management and over-the-air registration of subscriber units(SU)
- It may also be required to provide operation and maintenance (OAMP), routing, billing and switching function as necessary.
- The WANU also provide protocol conversion and transcoding of voice and data.
- The wireless access subscribe unit (WASU) provide an air interface towards the network and a traditional interface TWLL to the subscriber.
- The interface include protocol conversion, and transcoding, authentication function, local power, OAMP, dual tone multi frequency (DTMF)

WCDMA:

-> The international telecommunication unit (ITU) identified 230MHz of spectrum in the 2GHz band to implement the IMT-2000 system on a worldwide basis for satellite and terrestrial components.

Aim - is to provide universe coverage enabling terminals to have seamless roaming across multiple network.

-> network using WCDMA is called UMTS.

-> UMTS (universal mobile telecom service) uses WCDMA as radio access technology.

-> This network started evolving from GSM network

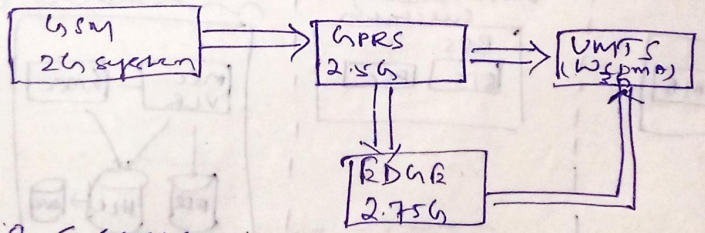
-> The entire network is divided into two subnet
(1) Radio access network.
(2) core network

-> The first release of UMTS is focused to change the radio access network

-> The network for radio access is called as universal terrestrial radio access network (UTRAN)

-> The next release change the core network to make it all IP network

-> Evolution path of UMTS



-> Radio access is based on direct spread (DS) technique with chiprate of 3.84MHz

-> DL uses a PN sequence to spread the user traffic over the same frequency band of 5MHz

→ On the receiver side the same PN code is used to demodulate the data.

→ As it is wider than the conventional CDMA one system so it is referred as wideband CDMA (W-CDMA)

→ W-CDMA supports two modes of duplexing

- FDD
- TDD

→ For uplink FDD was 1920 - 1980 MHz

→ For downlink " " 2110 - 2170 MHz.

→ In TDD different timeslot for uplink and downlink are assigned in same frequency band. It supports asynchronous data transfer.

→ **UMTS network Architecture:**

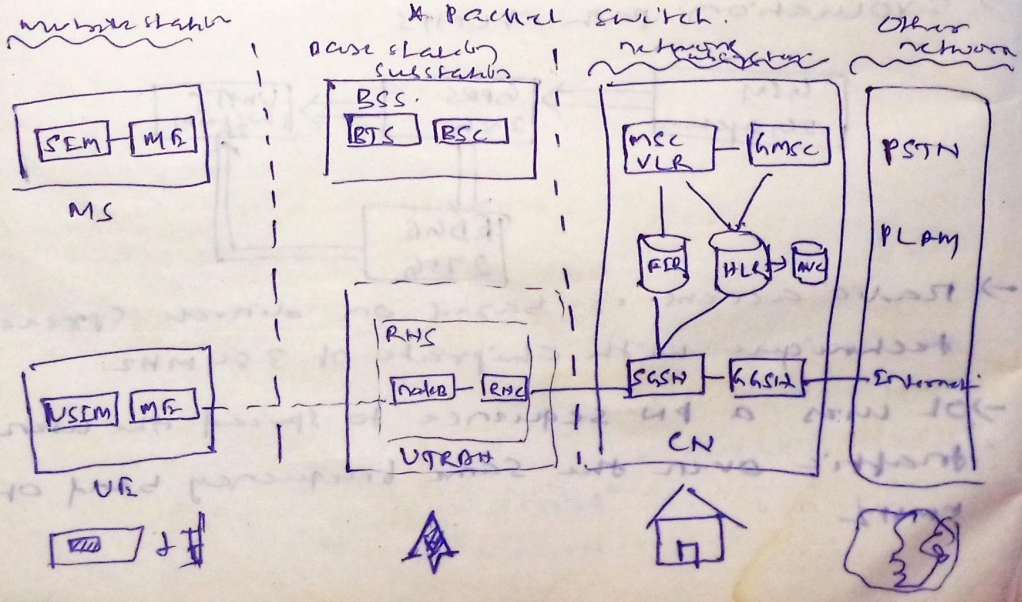
→ The major change is made in radio access network which is based on WCDMA and ATM

→ UMT architecture has 3 main functional entities

(i) User equipments.

(ii) UMTS

(iii) Core network (CN) which is also divided into
* circuit switch
* Packet switch.



UE: (User equipment)

-> UE replaces MS used in GSM/GPRS network
-> Every UE contains one or more USIM which is a user subscription to UMTS mobile network
-> It contains all relevant data that enable access onto subscripted network
-> USIM is downloadable and can be accessed via air interface and modified by network
-> It can also store Java application

Node B:

-> The base station used in UMTS is known as Node-B which replaces BTS
-> It provides the physical radio link between the UE and the network
-> The access technique used by Node B is CDMA and support high data rate
-> It perform following tasks.
  i) power control
  ii) report to RNC.
  iii) combine the receive signal coming from multiple section of the antenna
-> three types of Node-B are possible
  I) UTRA-FDD NodeB
  II) UTRA-TDD
  III) Dual mode

RNC: (Radio network controller)

-> It replace BSC of GSM/GPRS network. It is interfaced with CS of a GSM core network to handled circuit switched calls and with SGSN for packet data transport.

→ It is also interconnect to other RNCs which is a new features in UMTS.

→ It segrigates the packet switched and circuit switched call and routes to appropriate location

→ RNC performs the task as admission control radio bearer management, power control and general management.

3G MSC: It is much superior than 2G MSC it has to handle speech across the ATM over the interface for circuit switch connection with adaptive multirate.

→ So a newnode is connected to RNC and MSC called interworking function which is responsible for transcoding speech into 64 kbps