Question Paper Pattern and samples

UNIT-01

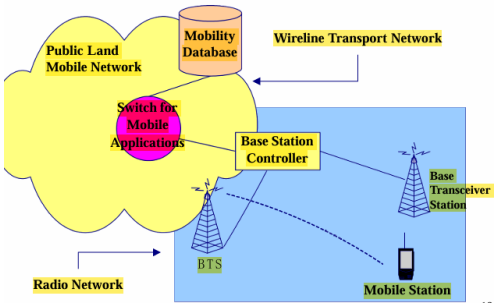
1 Compare & contrast between Advanced Mobile Phone Service and Global system for Mobile Communication.

Aspect	AMPS (Advanced Mobile Phone Service)	GSM (Global System for Mobile Communications)
Technology	Analog system, uses FDMA (Frequency Division Multiple Access)	Digital system, uses TDMA (Time Division Multiple Access)
Geographical Usage	Primarily used in North America	Global standard, used in Europe, Asia, Africa, and parts of North America
Call Quality	Poorer call quality, prone to noise and interference	Better call quality, clearer calls due to digital encoding
Capacity & Efficiency	Less efficient, uses fixed bandwidth per user (FDMA)	More efficient, time slots allow multiple users on the same frequency (TDMA)
Security	Minimal security, vulnerable to interception	Strong security with encryption for calls and data
Data Services	Does not support data services (only voice calls)	Supports SMS, MMS, GPRS for internet access, and more
International Roaming	Limited international roaming, mostly in North America	Supports global roaming in countries with GSM networks
Network Infrastructure	Simpler, analog switches and base stations	Complex, with digital Mobile Switching Centers (MSCs) and Base Station Controllers (BSCs)
Development and Lifespan	Decommissioned by 2008, obsolete after 2000s	Continues to be used, foundation for 3G, 4G, and future networks
Conclusion	Early mobile system in North America, replaced by digital tech	Global mobile standard, widely used, scalable and efficient

2. Define Personal Communication Service. With a neat diagram explain the basic PCS network architecture.

- Personal Communications Services (PCS) refers to a wide variety of wireless access and personal mobility services.
- PCS systems can connected to Public Switched Telephone Network (PSTN).
- Goal of PCS：enabling communications with a person at anytime, at any place and in any terminal form.

The Basic PCS Architecture



- Each PCS technology has similar architectures which consists two parts：
  - Radio Network
    - ✓MS (Mobile Station)
    - ✓BS (Base Station) System
  - Wireline Transport Network
    - ✓MSC (Mobile Switching Center)
    - ✓The Mobility Database connected to MSC is used to track the locations of mobile station.

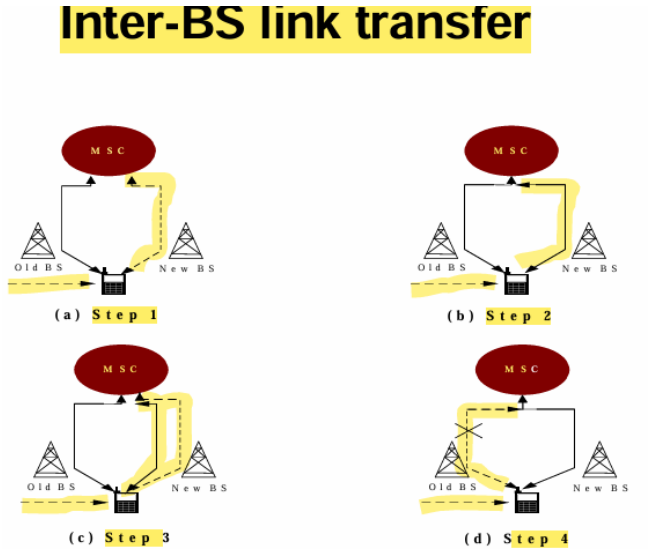
Mobile Station (MS)

- Handset, mobile phone, subscriber unit, portable
- Multi-mode handset

Base Station (BS)

- The radio coverage of a BS is called a Cell.
- The BS system is partitioned into
  - a controller
  - radio transmitters/receivers
- The BSs usually reach the wireline core network via land links or dedicated microwave links

3. Explain Inter-BS Hand-off with a neat diagram and also steps involved in the same.



Inter-BS Handoff (1/3)

- The new and old BSs are connected to the same MSC. Assume that MCHO is adopted here.
- **Step 1.** The MS momentarily suspends conversation and initiates the handoff procedure by signaling on an idle channel in the new BS. Then it resumes the conversation on the old BS.
- Step 2.
- **Step 2.** Upon receipt of the signal, the MSC transfers the encryption information to the selected idle channel of the new BS and sets up the new conversation path to the MS through that channel. The switch bridges the new path with the old path and informs the MS to transfer from the old channel to the new channel.
- **Step 3.** After the MS has been transferred to the new BS, it signals the network, and resumes conversation using the new channel.
- **Step 4.** Upon receipt of the handoff completion signal, the network removes the bridge from the path and releases resources associated with the old channel

- For NCHO, all handoff signaling messages are exchanged between the MS and the old BS through the failing link. Thus, the whole process must be completed as quickly as possible.
- If the new BS does not have an idle channel, the handoff call may be dropped (forced to terminate).
- Forced termination of an ongoing call is considered less desirable than blocking a new call attempt.

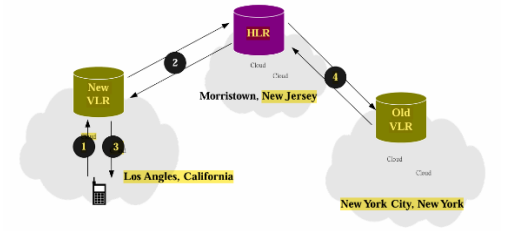
4. Define Roaming. Explain MS registration Process with a neat diagram.

- Roaming.
  - When a mobile user moves from one PCS system (e.g., the system in Taipei) to another (e.g., the system in Tainan), the system should be informed of the current location of the user.

Roaming Management

- Two basic operations in roaming management are
  - Registration (or Location Update): the process whereby an MS informs the system of its current location
  - Location Tracking: the process during which the system locates the MS (this process is required when the network attempts to deliver a call to the mobile user)
- The roaming management schemes proposed in IS-41 and GSM MAP are two-level strategies
- They use a two-tier system of home and visited databases that are
  - Home Location Register (HLR), and
  - Visited Location Register (VLR).

MS Registration Process (1/3)



67

- **Step 1.**
  - Suppose that the home system of a mobile user is in Morristown. When the mobile user moves from one visited system (e.g., New York City) to another (e.g., Los Angeles), it must register in the VLR of the new visited system.
- **Step 2.**
  - Part I. The new VLR informs the mobile user's HLR of the person's current location-the address of the new VLR.
  - Part II. The The HLR sends an acknowledgement, which includes the MS's profile, to the new VLR.

Step 3.

- The new VLR informs the MS of the successful registration.

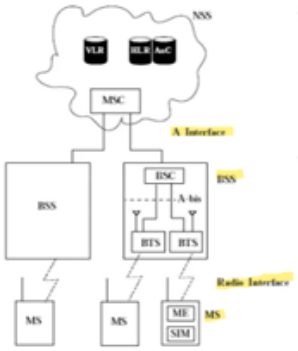
Step 4.

- After Step 2, the HLR also sends a deregistration message to cancel the obsolete location record of the MS in the old VLR.
- The old VLR acknowledges the deregistration.

UNIT-02

1. Explain GSM architecture with a neat diagram.

GSM Architecture



- Mobile station (MS) communicates with a base station system(BSS) through the radio interface.
- BSS is connected to the network and switching subsystem (NSS) by communicating with a mobile switching center (MSC) using the A

Mobile Station (MS)

- The MS consists of two parts : the subscriber identity module (SIM) and the mobile equipment (ME).
- A SIM can be a smart card, a smaller sized "plug-in SIM", a smart card that can be performed, which contains a plug-in SIM that can be broken out of it.
- The ME contains the non-customer-related hardware and software specific to the radio interface.
- When the SIM is removed from an MS, the remaining ME cannot be used for reaching the service except for emergency calls.

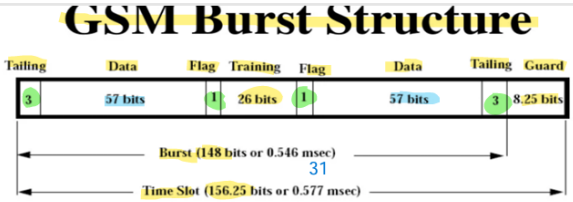
Base Station System (BSS)

- The BSS connects the MS and the NSS.
- The BSS consists of two parts : the base transceiver station (BTS) and the base station controller(BSC).
- The BTS contains transmitter, receiver, and signaling equipment specific to the radio interface in order to contact the MSs.
- The BSC is responsible for the switching functions in the BSS, and is in turn connected to an MSC in the NSS.
- The BSC supports radio channel allocation/ release and handoff management.

Network and Switching Subsystem (NSS)

- The NSS supports the switching functions, subscriber profiles, and mobility management.
- The basic switching function in the NSS is performed by the MSC.
- An incoming call is routed to an MSC, unless thefixed network is able to interrogate the HLR directly. That MSC is called the gateway MSC (GMSC).

2. Explain GSM Burst Structure with Header format.

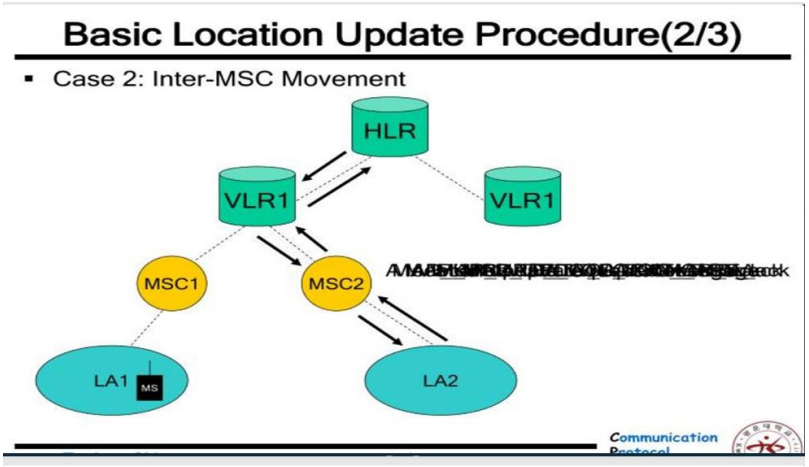


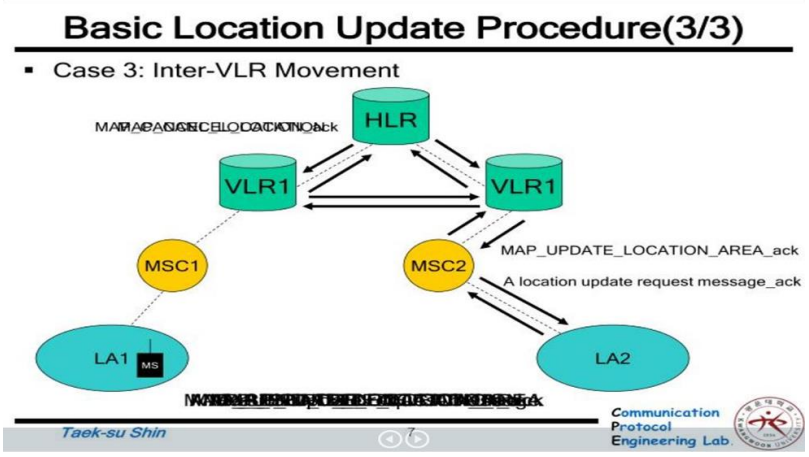
- The length of a GSM frame in a frequency channel is 4.615 msec. 0.577*8 = 4.615
- The frame is divided in to 8 bursts (timeslots) of length 0.577 msec.

3. Analyze The Following with a neat diagram in context of GSM Basic Location Update Procedure.

a) Inter-MSC Movement

b) Inter-VLR Movement

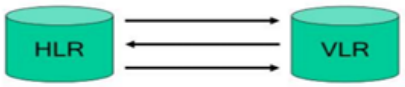




4. Explain with a Neat diagram HLR Restoration Procedure with all steps involved in the same.

HLR Failure Restoration

- Uncovered period
- HLR restoration procedure



MAP_RESTORE_DATA ack

Communication Protocol

HLR Restoration Procedure (1/3)

- After an HLR failure, the data in the backup are reloaded into the HLR.
- An Uncovered Period = the time interval after **the last backup operation** and **before the restart of the HLR**.
- Data that have been changed in the uncovered period can not be recovered.

HLR Restoration Procedure (2/3)

- **Step 1.** The HLR sends an SS7 TCAP message **MAP_RESET** to the VLRs where its MSs are located.
- **Step 2.** All the VLRs derive all MSs of the HLR. For each MS, they send an SS7 TCAP message, **MAP_UPDATE_LOCATION**, to the HLR.

HLR Restoration Procedure (3/3)

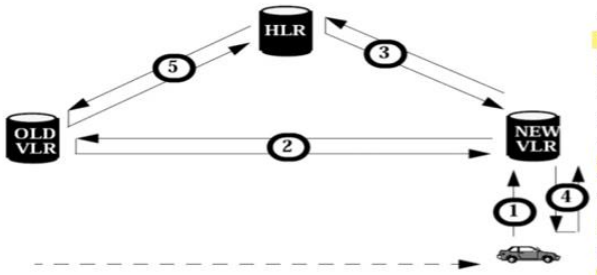
- The HLR restoration procedure is not robust.
  - **An MS may move into a VLR (which does not have any other MSs from the given HLR residing) during the uncovered period.**
  - **The new location is not known to the HLR at the last check- pointing time.**
  - **If so, the HLR will not be locate the VLR of the MS during Step 1 of HLR restoration.**
- VLR Identification Algorithm is to solve the problem.

5. Explain the following with respect to GSM

i)MS Registration Process ii)Mobile Call Delivery Procedure

Location Tracking and Call Setup

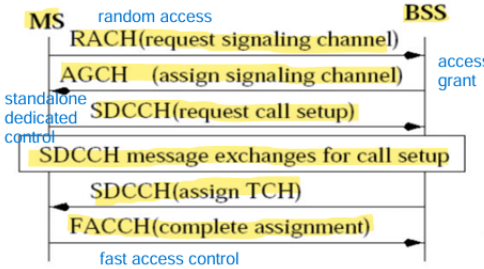
- **The MS Registration Process**



•**Step1.** The MS periodically listens to the BCCH broad cast from the BSS. broadcast control channel
•**Step2.**The new VLR communicates with the old VLR tofind the HLR of the MS.
•**Step3.** After the MS is authenticated, the new VLR sends a registration message to the HLR.

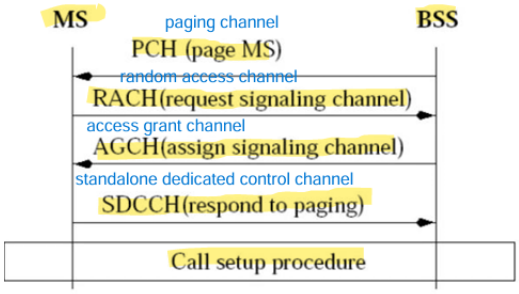
•**Step4.** The new VLR informs the MS of the successful registration.
•**Step5.** After Step3, the HLR sends a deregistration (cancellation) message to the old VLR.

GSM Call Origination (Radio Aspect)



- To initiate the call setup, the MS sends a signaling channel request to the network through RACH.
- The BSC informs the MS of the allocated signaling channel (SDCCH) through AGCH.
- Then the MS sends the call origination request via SDCCH. The MSC instructs the BSC to allocate a TCH for this call.
- Finally, both the MS and the

GSM Call Termination (Radio Aspect)



- In this case the MSC requests the BSS to page the MS.
- The BSCs instruct the BTSs in the desired LA to page the MS by using PCH.
- When the destination MS receives the paging message, it requests for a SDCCH.
- The BTS assigns the SDCCH, which is used to setup the call as in

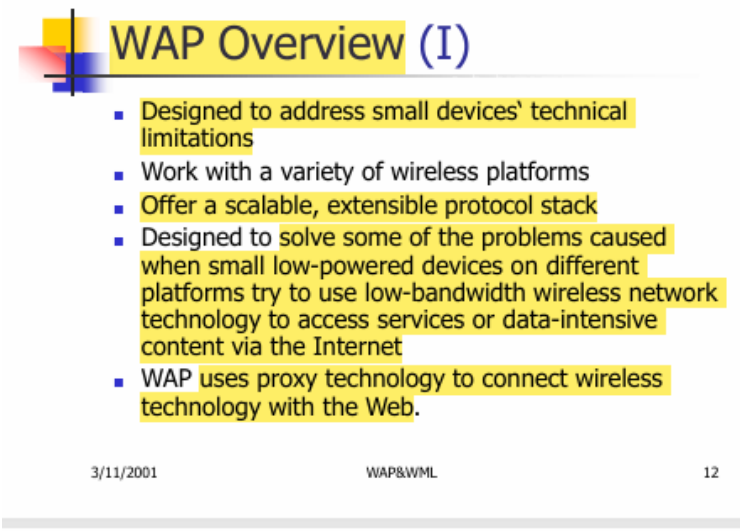
6. List and Explain Basic Requirements of GSM.

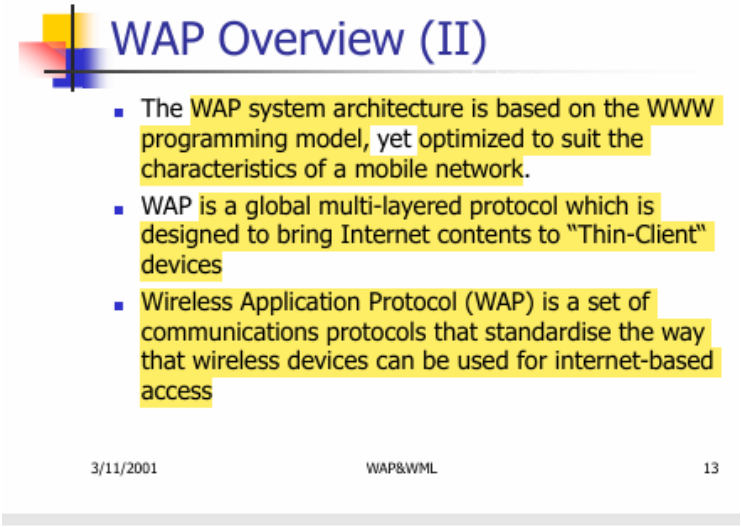
The basic requirements of GSM

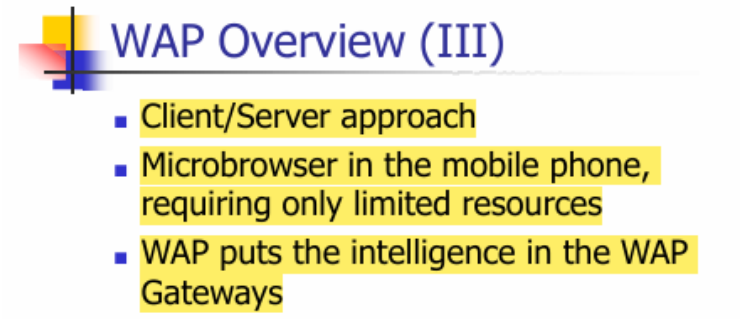
- **Services:** The system shall provide service portability
- **QoS and Security:** The quality for voice telephony of GSM shall beat least as good as the previous analog systems over the practical operating range.
- **Radio Frequency Utilization:** permit a high level of spectrum efficiency and state-of-the-art subscriber facilities
- **Network:** The identification and numbering plans shall be based on relevant ITU recommendations.
- **Cost:** The system parameters shall be chosen with a view to limiting the cost of the complete system, in particular the MSs.

UNIT-03

1. Briefly Explain the Architecture of Wireless Application Protocol Model (WAP) with neat diagram.







2.Explain the following w.r.t. WAP i)User Agent Profile ii)Caching Model

19.4.1 User Agent Profile

Existing markup language contents are designed for PCs with large displays and large memory capacities. Under the existing Internet technologies, WAP handsets may not be able to store and display the received contents. To resolve this issue, WAP specifies the User Agent Profile (UAProf), also known as Capability and Preference Information (CPI), that allows content generation to be tailored based on the WAP handset's capabilities. The CPI consists of information gathered from the device hardware, active user agent software, and user preferences, which may include:

- Hardware characteristics, such as screen size, color capabilities, image capabilities, and manufacturer.
- Software characteristics, including operating system vendor and version, support for MExE (to be described in Section 19.7), and a list of audio and video encoders.
- Application/user preferences, such as browser manufacturer and version, markup languages and versions supported, and scripting languages supported.
- WAP characteristics, including WMLScript libraries, WAP version, and WML deck size.
- Network characteristics, such as device location, and bearer characteristics (e.g., latency and reliability).

CPI is likely to be preinstalled directly on the device. This information is initially conveyed when a WSP session is established with the WAP Gateway. The WAP handset then assumes that the WAP Gateway caches the CPI and will apply it to all requests initiated during the lifetime of the WSP session.

19.4.2 Caching Model

The WAP user agent caching model tailors the HTTP caching model to support WAP handsets with limited functions. For cached resources that will not be changed during user retrievals, the resources can be efficiently accessed by the WAP handsets without revalidation. A time-sensitive cached resource is set to "must-revalidate." If this cached resource is stale when the user tries to go back in the history, the user agent revalidates this cached source. In general, navigation and processing within a single cached resource does not require revalidation, except for the first fetch. Examples include function calls within a single WMLScript compilation unit and intradeck navigation within a single WML deck.

The HTTP caching model is sensitive to time synchronization. Since WAP follows this model, a reliable time-of-day clock should be maintained in the WAP Gateway. If a WAP user agent does not have access to a time-of-day clock, it should exchange the time-of-day request and response message with the WAP Gateway and synchronize with the clock value returned from the WAP Gateway.

Another important issue for caching is security. The private information in the user agent cache is protected from unintended or malicious access. WAP Gateways implementing a caching function must obey all security-related considerations defined in HTTP.

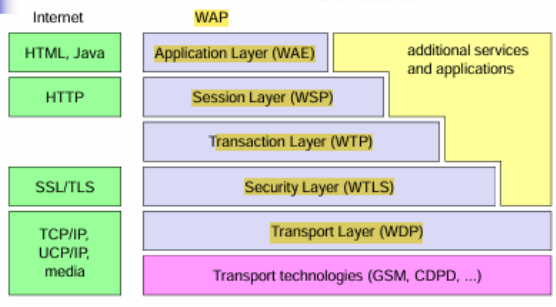
Several studies indicate that the

3. Draw a neat diagram for Wireless Application Protocol Model (WAP) protocol stack & Explain the following protocols

i)Wireless Datagram Protocols(WDP) ii)Wireless Transport Layer Security(WTLS)

PROTOCOL STACK

WAP Reference Model



WAE comprises WML (Wireless Markup Language), WMLScript, WTAI etc.

3/11/2001 WAP&WML 19

WDP - Wireless Datagram Protocol

- Protocol of the transport layer within the WAP architecture
  - Uses directly transport mechanisms of different network technologies
  - Offers a common interface for higher layer protocols
  - Allows for transparent communication using different transport technologies
- Goals of WDP
  - Create a worldwide interoperable transport system with the help of WDP adapted to the different underlying technologies
  - Transmission services such as SMS in GSM might change, new services can replace the old ones

3/11/2001 WAP&WML 20

WTLS - Wireless Transport Layer Security

- Goals
  - Data integrity
    - prevention of changes in data
  - Privacy
    - prevention of tapping
  - Authentication
    - creation of authenticated relations between a mobile device and a server
  - Protection against denial-of-service attacks
    - protection against repetition of data and unverified data
- WTLS
  - Based on the TLS (Transport Layer Security) protocol (former SSL, Secure Sockets Layer)
  - Optimized for low-bandwidth communication channels

3/11/2001 WAP&WML 21

4. Briefly explain the following with a neat diagram related to WAP Developer Toolkits.
i)WAP Simulation Environment ii)WAP Application Trial Environment.

19.6 WAP Developer Toolkits

WAP developer toolkits assist developers to compose and test WAP application software that will run on origin servers. The toolkits can also be used for WAP application demonstrations. They provide convenient environments in which developers can write, test, and debug applications; on, for example, a PC-based simulator. Several WAP development tools are available. Ericsson's WapIDE (Integrated Developer's Environment) SDK (Software Developers Kit) is an integrated development environment for creating WAP services. It consists of three main components: a WAP browser, an application designer, and a server toolset. It can be used to design applications for Ericsson WAP handsets such as the R320, R380, and PDA such as MC218. The Ericsson WapIDE is free for download from the Web site www.ericsson.com/wap/developer/. The Motorola SDK includes a development environment for both WAP and VoxML applications. This SDK is available at www.motorola.com/MIMS/MSPG/mix/mix.html.

Phone.Com UP.SDK is another free WAP application development toolkit that can be downloaded from www.phone.com/developers/. UP.SDK enables Web developers to quickly and easily create HTML and WML information services and applications. The SDK includes UP.Simulator that simulates the behavior of an UP.Browser-enabled device. The simulator runs on either Windows 95 or Windows NT.

The Nokia WAP SDK software provides development tools similar to the Ericsson and Phone.Com products. The free Nokia WAP Toolkit is available from the Nokia Wireless Data Forum at www.forum.nokia.com. The Nokia SDK includes WML and WMLScript encoders, a WAP simulation client with a mobile phone user interface, and WAP application debugging support. The simulation client includes a WML browser (WMLScript interpreter and WMLScript libraries), WML and WMLScript editors, and debugging views. This simulator gives a real-time content depiction on a WAP-enabled handset.

Each of the WAP development tools described in this section provides a simulator. The simulator can run applications in local mode, which simulates a WAP handset, GSM network, and WAP Gateway, as shown

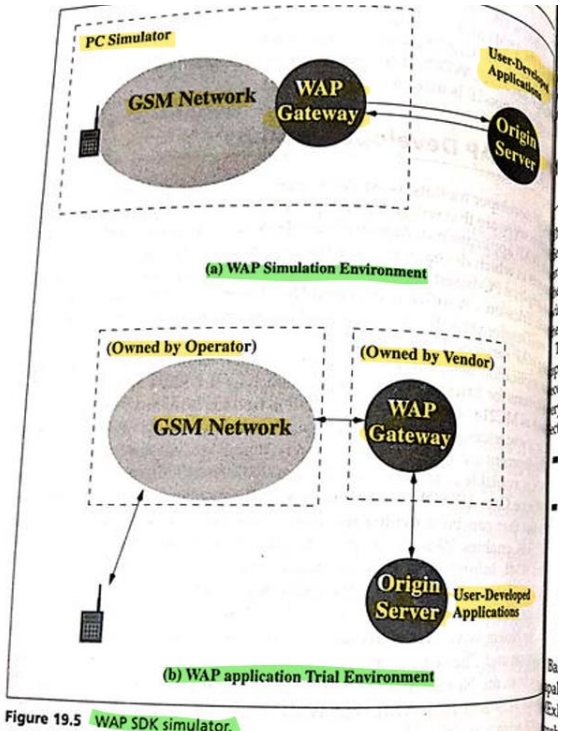


Figure 19.5 WAP SDK simulator.

in Figure 19.5(a). Furthermore, these vendors also provide free access of their WAP Gateways, so that WAP application developers are able to test a complete set of WAP-enabled services and APIs. As shown in Figure 19.5(b)