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**Internal Assessment Test –I, August 2024**

**Sub: Mobile Application Development**

**Code: 22MCA263**

**Answer Key**

**Marks**

**OBE**

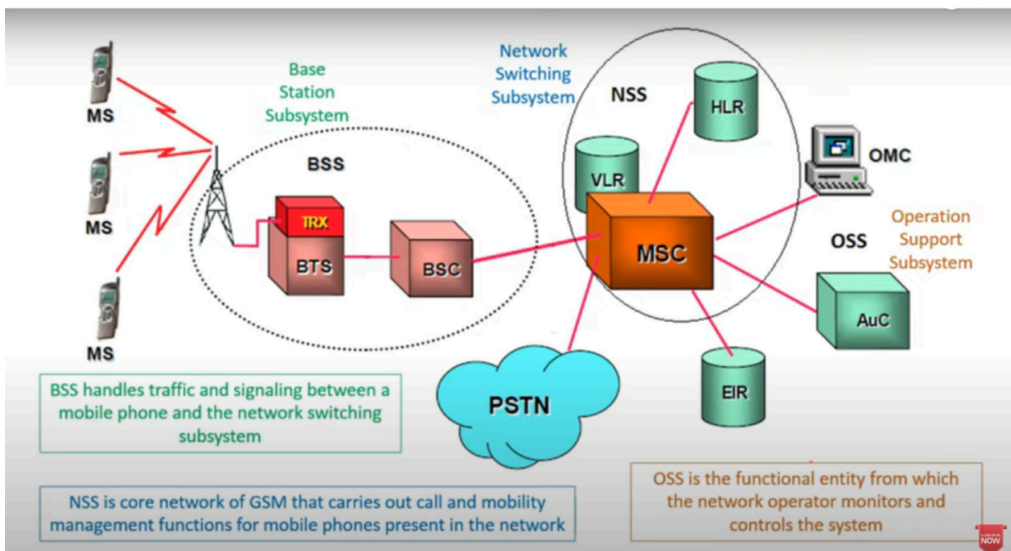
CO RBT

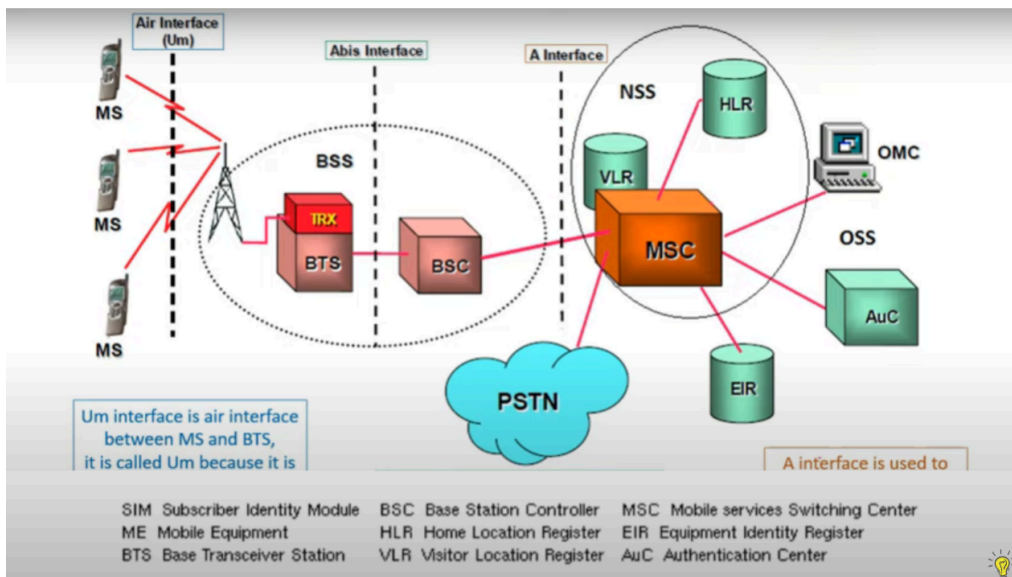
1 Explain GSM Architecture with a neat diagram.

10 CO1 L1

## GSM Architecture

- + Mobile Station (MS)
- + Base Station Sub-system (BSS)
- + Network Switching Sub-system (NSS)
- + Operation Support Sub-system (OSS)





## 1. Mobile Station

### + ME (Mobile Equipment)

- Hardware used by subscriber containing IMEI (International Mobile Equipment Identity)



### + SIM (Subscriber Identity Module)

- Detachable smartcard containing IMSI (International Mobile Subscriber Identity)
- Used to send & receive calls



## 2. Base Station Subsystem

### + BTS (Base Transceiver Station)

- Sends & receives signals from MS
- Encoding, Multiplexing, Encryption, Modulation



### + BSC (Base Station Controller)

- Controls group of BTS
- Allocation of radio channels
- Handover from one BTS to another



### 3. Network Switching Subsystem

#### + MSC (Mobile Switching Center)



- Heart of GSM network
- Management of mobile services like registration, authentication, etc
- Performs call routing, call setup & call switching
- Communicates with HLR, VLR, AUC & EIR



#### + HLR (Home Location Register)

- Master database of subscriber's current location & information

#### + VLR (Visitor Location Register)

- Subset of HLR
- Local database for user's visiting location in other domain



Chennai  
**HLR**

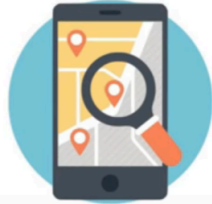


Delhi  
**VLR**



### + EIR (Equipment Identity Register)

- Database containing all valid handsets on network using IMEI number
- Marks IMEI as invalid, if handset is stolen

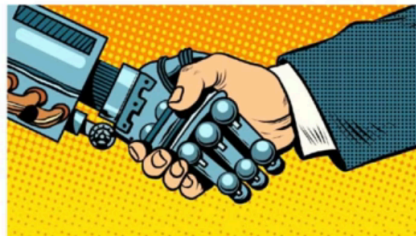


### + AUC (Authentication Center)

- Protected database that stores copy of IMSI number used for authentication and encryption task
- Protects from different types of frauds on network



## 4. Operation Support Subsystem



- Connected to all equipments in switching system
- Administration and commercial operation
- Security, Operation & Performance management
- Network configuration & Maintenance tasks



2 Explain GSM Security with a diagram.

- GSM offers several security services using confidential information stored in the AuC and in the individual SIM.
- The SIM stores personal, secret data and is protected with a PIN against unauthorized use.
- The security services offered by GSM are
  - **Access control and authentication:**
    - The first step includes the authentication of a valid user for the SIM.
    - The user needs a secret PIN to access the SIM.
    - The next step is the subscriber authentication.
    - This step is based on a challenge-response scheme
  - **Confidentiality:**
    - All user-related data is encrypted.
    - After authentication, BTS and MS apply encryption to voice, data, and signaling.
    - This confidentiality exists only between MS and BTS, but it does not exist end-to-end or within the whole fixed GSM/telephone network.

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CO1

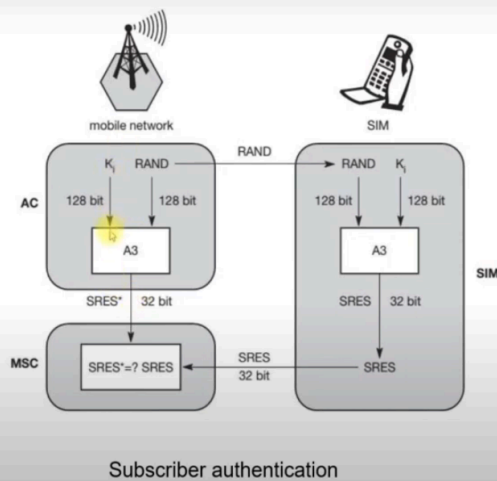
L1

**- Anonymity:**

- To provide user anonymity, all data is encrypted before transmission, and user identifiers (which would reveal an identity) are not used over the air.
- Instead, GSM transmits a temporary identifier (TMSI), which is newly assigned by the VLR after each location update.
- Additionally, the VLR can change the TMSI at any time.
- Three algorithms have been specified to provide security services in GSM.
- Algorithm **A3** is used for authentication, **A5** for encryption, and **A8** for the generation of a cipher key.

**Authentication**

- Before a subscriber can use any service from the GSM network, he or she must be authenticated.
- Authentication is based on the SIM, which stores the individual authentication key  $K_i$ , the user identification IMSI, and the algorithm used for authentication A3.
- Authentication uses a challenge-response method:  
- The access control AC generates a random number RAND as challenge, and the SIM within the MS answers with SRES (signed response) as response.



Subscriber authentication

3 What are the different protocols used in GSM?

10 CO1 L2

GSM (Global System for Mobile Communications) protocol encompasses a range of standardized protocols that enable mobile communication, covering the air interface, signaling, and network interfaces. Here's an overview of the main protocols and their functions in the GSM architecture:

**GSM Protocol Architecture**

The GSM protocol architecture is divided into three main layers, each with specific responsibilities:

**1. Physical Layer (Layer 1)**

**Responsibilities:** Defines the physical and electrical characteristics for data transmission over the air interface.

**Key Components:**

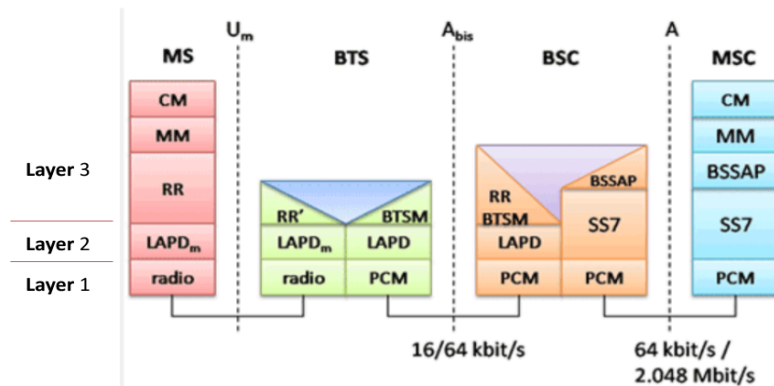
Synchronization with BTS, Detection of idle channel, Channel Quality measurement., Channel coding and error detection and correction,

**Frequency Bands:** GSM operates in different frequency bands (e.g., 900 MHz, 1800 MHz).

**Multiplexing:** Uses Time Division Multiple Access (TDMA) to divide frequency channels into time slots.

The Um interfaces use for modulation and perform encryption and decryption. **Data transmission** at the physical layer typically uses pulse code modulation (PCM) systems. LAPD is used for layer two at Abis, BTSM for BTS management.

## GSM Protocols



### 2. Data Link Layer (Layer 2)

**Responsibilities:** Ensures reliable data transfer over the physical layer.

**Key Components:**

**LAPD<sub>m</sub> (Link Access Protocol on the Dm channel):** A modified version of LAPD (Link Access Protocol for the D channel) used in ISDN. It handles frame delimitation, error detection, and correction.

**Functions:** Flow control, error recovery, and frame synchronization, Reliable data transfer.

### 3. Network Layer (Layer 3)

**Responsibilities:** Manages signaling and control functions required for establishing, maintaining, and terminating calls.

**Key Components:**

**Radio Resource (RR) Management:** Manages allocation and release of radio channels, handovers, and power control.

This is the lowest sub layer and it's a part of RR and RR' is implemented by BSC. The function of RR are Setup, Maintenance, Release of radio channels. RR directly access the physical layer

It supports BTS management. The function of RR' are supported by BSC via Bts.

**Mobility Management (MM):** Handles location updates, authentication, and registration of the mobile device within the network.

**Call management (CM) layer** contains three entities:-

**short message service (SMS),  
supplementary service (SS).**

- call forwarding.
- Barring of Outgoing Calls.
- Barring of Incoming Calls.
- Call Hold.
- Call Waiting.

**Call Control (CC):** Manages call setup, maintenance, and termination procedures.

4

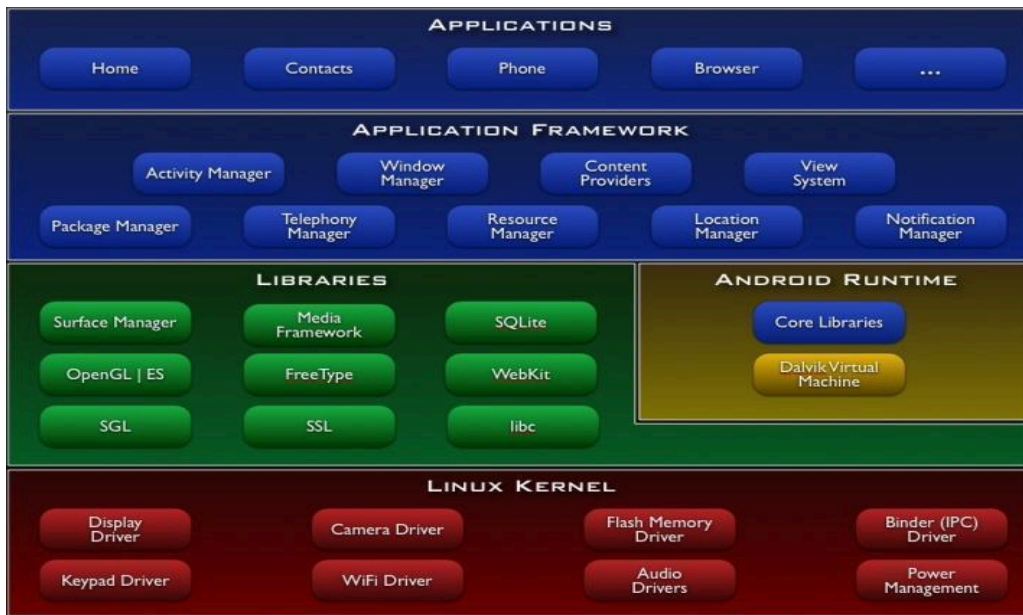
Explain the Android Software Stack in detail with a neat diagram.

Android is structured in the form of a software stack comprising applications, an operating system, run-time environment, middleware, services and libraries. Each layer of the stack, and the corresponding elements within each layer, are tightly integrated and carefully tuned to provide the optimal application development and execution environment for mobile devices.

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CO2

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### 1) Linux kernel

It is the heart of android architecture that exists at the root of android architecture.

Linux kernel is responsible for device drivers, power management, memory management, device management and resource access.

The kernel on which Android is based contains device drivers for various hardware components of an Android device, including Display, Camera, Keypad, Wifi, Memory, and Audio.

### 2) Native Libraries

The next layer on top of the Linux kernel is the libraries that implement different Android features. A few of these libraries are listed here:

- a. Freetype library-Responsible for font support.

- b. SQLite library-Provides database support
- c. Surface Manager library-Provides graphics libraries that include SGL and OpenGL.
- d. Open GL(graphics library):This cross-language, cross-platform application program interface (API) is used to produce 2D and 3D computer graphics.

### 3) Android Runtime

it provides a set of core Android libraries and a Dalvik virtual machine that enable developers to write Android applications using java and (the Android RunTime).

In android runtime, there are core libraries and DVM (Dalvik Virtual Machine) which is responsible to run android application. DVM is like JVM but it is optimized for mobile devices. It consumes less memory and provides fast performance.

### 4) Android Framework

On the top of Native libraries and android runtime, there is android framework. Android

framework includes Android API's such as UI (User Interface), telephony, resources,

locations, Content Providers (data) and package managers. It provides a lot of classes and interfaces for android application development.

provides the classes that enable application developers to develop[ android applications].

#### a. Activity Manager:

It manages the activity lifecycle and the activity stack.

#### B. Telephony Manager:

It provides access to telephony services as related subscriber information, such as phone numbers.

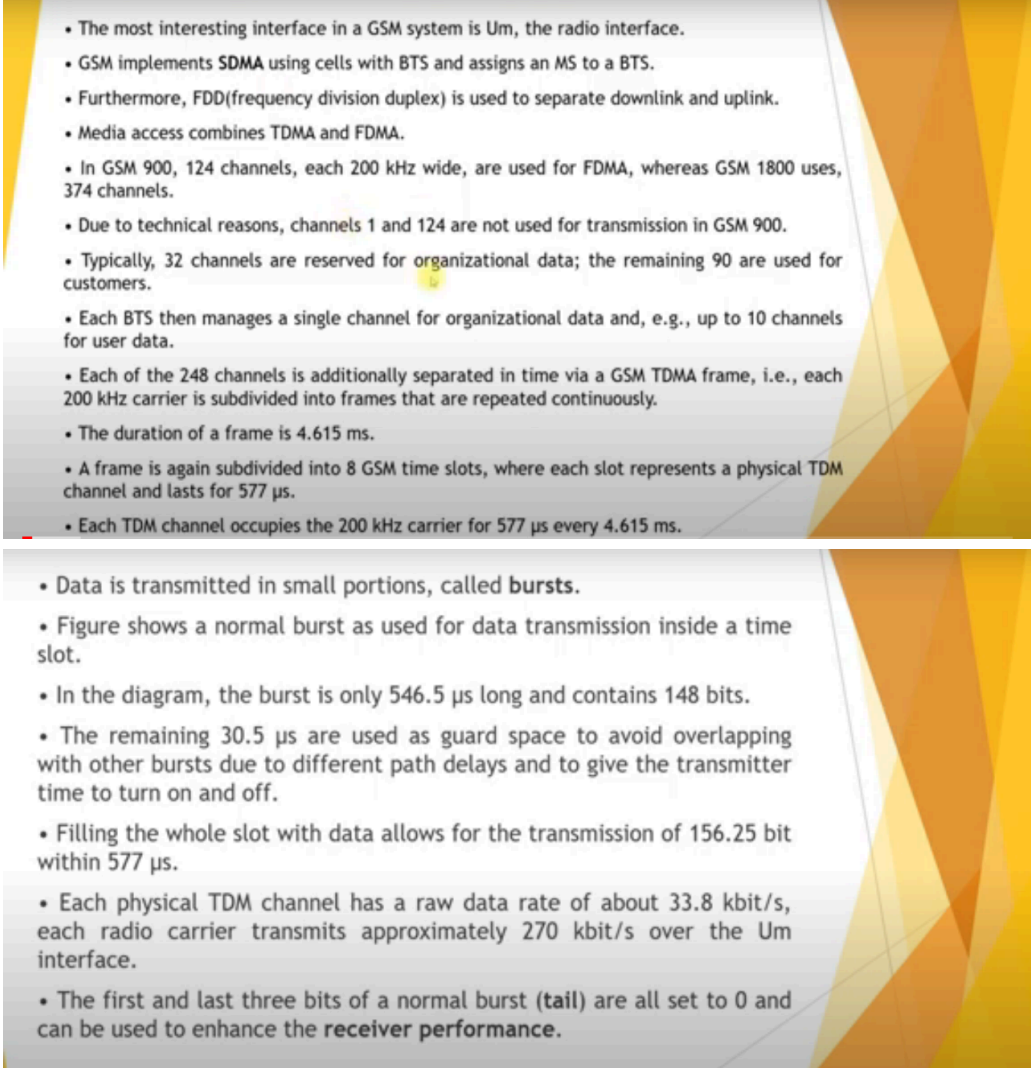
#### C. View System:

It builds the user interface by handling the views and layouts.

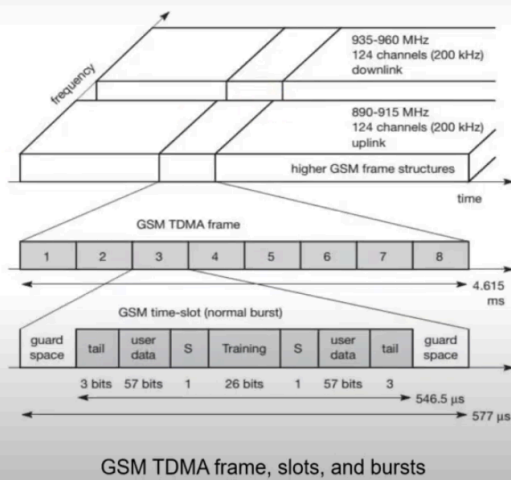
#### D. Location manager:

It finds the device's geographic location.



	<p><b>5). Application layer</b></p> <p>Displays the application developed and downloaded by users.</p> <p>On the top of android framework, there are applications.</p> <p>All applications such as home,contact, settings, games, browsers are using android framework that uses androidruntime and libraries.</p> <p>Android runtime and native libraries are using linux kernal.</p>			
5	<p><b>Discuss Radio Interface of GSM.</b></p>  <ul style="list-style-type: none"> <li>• The most interesting interface in a GSM system is Um, the radio interface.</li> <li>• GSM implements <b>SDMA</b> using cells with BTS and assigns an MS to a BTS.</li> <li>• Furthermore, <b>FDD</b>(frequency division duplex) is used to separate downlink and uplink.</li> <li>• Media access combines TDMA and FDMA.</li> <li>• In GSM 900, 124 channels, each 200 kHz wide, are used for FDMA, whereas GSM 1800 uses, 374 channels.</li> <li>• Due to technical reasons, channels 1 and 124 are not used for transmission in GSM 900.</li> <li>• Typically, 32 channels are reserved for organizational data; the remaining 90 are used for customers.</li> <li>• Each BTS then manages a single channel for organizational data and, e.g., up to 10 channels for user data.</li> <li>• Each of the 248 channels is additionally separated in time via a GSM TDMA frame, i.e., each 200 kHz carrier is subdivided into frames that are repeated continuously.</li> <li>• The duration of a frame is 4.615 ms.</li> <li>• A frame is again subdivided into 8 GSM time slots, where each slot represents a physical TDM channel and lasts for 577 <math>\mu</math>s.</li> <li>• Each TDM channel occupies the 200 kHz carrier for 577 <math>\mu</math>s every 4.615 ms.</li> </ul> <ul style="list-style-type: none"> <li>• Data is transmitted in small portions, called <b>bursts</b>.</li> <li>• Figure shows a normal burst as used for data transmission inside a time slot.</li> <li>• In the diagram, the burst is only 546.5 <math>\mu</math>s long and contains 148 bits.</li> <li>• The remaining 30.5 <math>\mu</math>s are used as guard space to avoid overlapping with other bursts due to different path delays and to give the transmitter time to turn on and off.</li> <li>• Filling the whole slot with data allows for the transmission of 156.25 bit within 577 <math>\mu</math>s.</li> <li>• Each physical TDM channel has a raw data rate of about 33.8 kbit/s, each radio carrier transmits approximately 270 kbit/s over the Um interface.</li> <li>• The first and last three bits of a normal burst (<b>tail</b>) are all set to 0 and can be used to enhance the <b>receiver performance</b>.</li> </ul>	10	CO1	L1

- The **training sequence** in the middle of a slot is used to adapt the parameters of the receiver to the current path propagation characteristics and to select the **strongest signal** in case of multipath propagation.
- A flag **S** indicates whether the data field contains **user** or **network control data**.
- Apart from the normal burst, ETSI defines four more bursts for data transmission:
  - A **frequency correction burst** allows the MS to correct the local oscillator to avoid interference with neighboring channels.
  - A **synchronization burst** with an extended training sequence synchronizes the MS with the BTS in time.
  - An **access burst** is used for the initial connection setup between MS and BTS.
  - A **dummy burst** is used if no data is available for a slot.



GSM TDMA frame, slots, and bursts

6

What is Android? Describe the features of Android 4.1 Jelly Bean?

The Android 4.1 Jelly Bean SDK was released with new features for developers in July 2012.

It improves the beauty and simplicity of Android 4.0 and is a major platform release that adds variety of new features for users and app developers.

**Features:-**

**1. Faster speech recognition**

Speech recognition is now faster and doesn't require any network to convert voice into text. user can dictate to the device without an internet connection.

**2. Improved notification system**

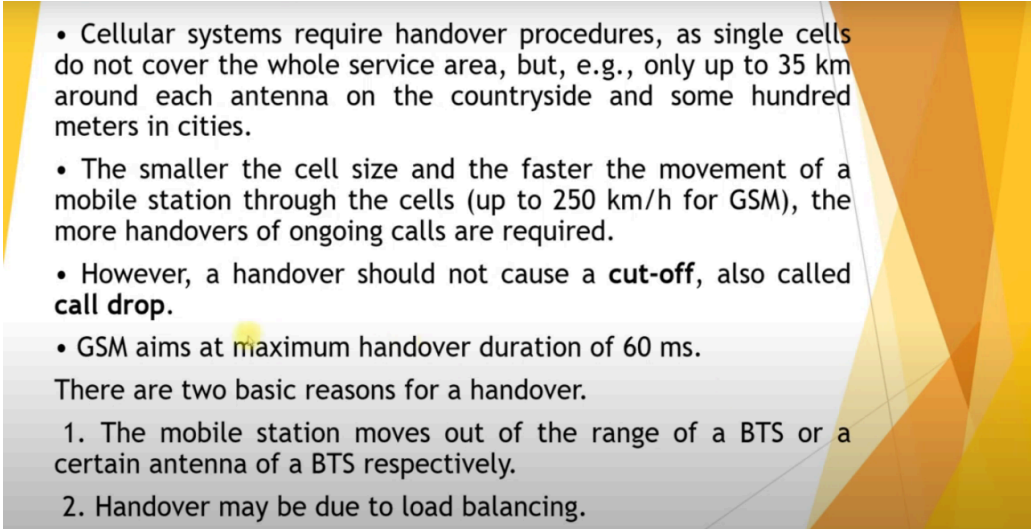
Notifications can be expanded or collapsed through a variety of gestures, and users can block notifications if desired.

**3. Supports new languages**

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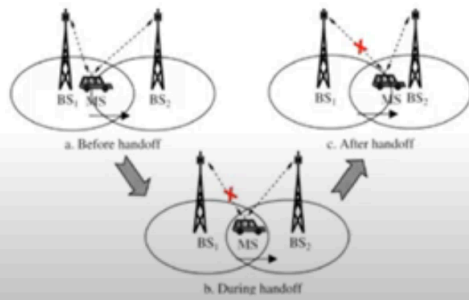
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L3

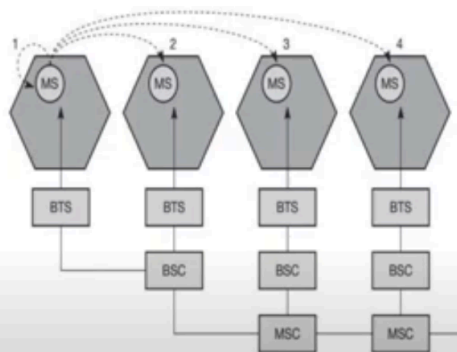
	<p>Jelly bean includes support for several languages including Arabic, Hebrew, Hindi and Thai.</p> <p><b>4. Predictive keyboard</b></p> <p>On the basis of the current context the next word of the message is automatically predicted.</p> <p><b>5. Auto arranging home screen</b></p> <p>Icons and widgets automatically resize and realign as per the existing space.</p> <p><b>6. Improved camera app</b></p> <p>The jelly bean camera app includes a new review mode of the captured photos. Users can swipe in from the right of the screen to quickly view the captured photos.</p> <p><b>7. Better Communication in Jelly Bean</b></p> <p>Android devices can be paired to Bluetooth devices that support the simple secure pairing standard by just tapping them together.</p> <p><b>8. Improved Google Voice Search</b></p> <p>Jelly Bean is equipped with a question and answer search method that helps in solving users queries similar to Apple’s popular Siri.</p> <p><b>9. Face Unlock</b></p> <p>Unlocks the device when the user looks at it. “Blink” can be used to confirm that a live person is unlocking the device instead of a photo.</p>			
7	<p>What is Handover ? Explain possible handover scenarios of GSM.</p>  <ul style="list-style-type: none"> <li>• Cellular systems require handover procedures, as single cells do not cover the whole service area, but, e.g., only up to 35 km around each antenna on the countryside and some hundred meters in cities.</li> <li>• The smaller the cell size and the faster the movement of a mobile station through the cells (up to 250 km/h for GSM), the more handovers of ongoing calls are required.</li> <li>• However, a handover should not cause a <b>cut-off</b>, also called <b>call drop</b>.</li> <li>• GSM aims at maximum handover duration of 60 ms.</li> </ul> <p>There are two basic reasons for a handover.</p> <ol style="list-style-type: none"> <li>1. The mobile station moves out of the range of a BTS or a certain antenna of a BTS respectively.</li> <li>2. Handover may be due to load balancing.</li> </ol>	10	CO1	L1

## GSM-Handover

**Hard handover** - The connection to the source is broken before or 'as' the connection to the target is made—for this reason such handovers are also known as *break-before-make*.



## GSM-Handover



Types of handover in GSM

## GSM-Handover

• Four possible handover scenarios in GSM:

• **Intra-cell handover:**

- Within a cell, narrow-band interference could make transmission at a certain frequency impossible.
- The BSC could then decide to change the carrier frequency.

• **Inter-cell, intra-BSC handover:**

- The mobile station moves from one cell to another, but stays within the control of the same BSC.
- The BSC then performs a handover, assigns a new radio channel in the new cell and releases the old one.

• **Inter-BSC, intra-MSC handover:**

- As a BSC only controls a limited number of cells; GSM also has to perform handovers between cells controlled by different BSCs. This handover then has to be controlled by the MSC.

• **Inter MSC handover:**

- A handover could be required between two cells belonging to different MSCs.
- Now both MSCs perform the handover together.

8

Create a mobile app to change textview attributes from XML and Java code.  
The text that you want to be displayed through the TextView control.

10

CO3

L3

You can assign text to the TextView in two ways.

1. Direct assignment to the TextView control as defined in the layout file activity\_hello\_word\_app.xml.
2. Indirectly through the java Activity file HelloWorldAppActivity.java.

From the package Explorer window, open activity\_hello\_world\_app.xml by double clicking it in the res/layout folder.

Remove the text from XML definition-

The first thing that you need to do is to remove the text that was assigned to the TextView control in the layout file activity.xml file. Open activity.xml file and remove the statement android:text="hello world!"

Assign an ID to the TextView control

To access the TextView control in the Activity file, you have to uniquely identify it by assigning it an ID.

```
android:id="@+id/message"
```

This statement declares that a constant called message is assigned as an ID to the TextView control and will be used to uniquely identify it from other views. the plus(+) in @+id/message means that the ID, message, must be created if it doesn't already exist.

1. Direct assignment to the TextView control as defined in the layout file activity\_hello\_word\_app.xml.

```
<TextView
```

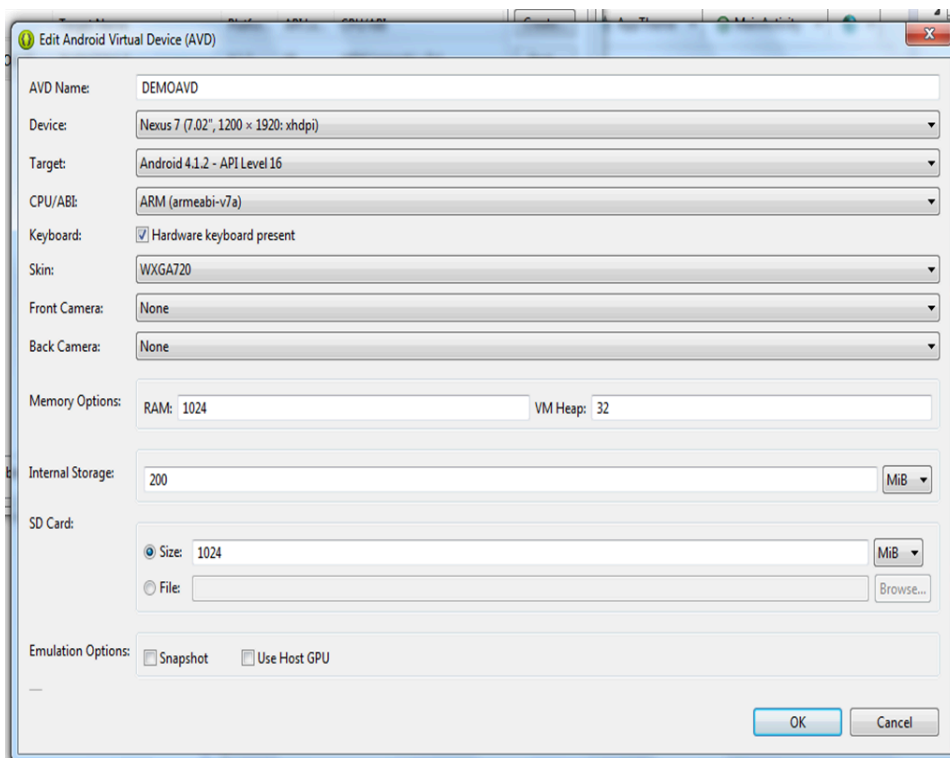
```
    android:id="@+id/textView1"  
    android:layout_width="wrap_content"  
    android:layout_height="wrap_content"  
    android:layout_alignParentLeft="true"  
    android:layout_centerVertical="true" />
```

2. Indirectly through the java Activity file HelloWorldAppActivity.java.

```
public class MainActivity extends Activity {  
  
    @Override  
  
    protected void onCreate(Bundle savedInstanceState) {
```

	<pre> super.onCreate(savedInstanceState);  setContentView(R.layout.activity_main);  TextView msg=(TextView)findViewById(R.id.textView1);  msg.setText("hello");  } </pre>			
9	<p>What is a smartphone operating system? Explain Smartphone os with examples.</p> <ol style="list-style-type: none"> <li><b>1. Android OS:</b> The <b>Android operating system</b> is the most popular <b>operating system</b> today. It is a mobile OS based on the <b>Linux Kernel</b> and <b>open-source software</b>. The android operating system was developed by <b>Google</b>. The first Android device was launched in <b>2008</b>.</li> <li><b>2. Bada (Samsung Electronics):</b> 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.</li> <li><b>3. BlackBerry OS:</b> The BlackBerry <b>operating system</b> is a mobile operating system developed by <b>Research In Motion (RIM)</b>. 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 GroupWise email, Lotus Domino, and other business software when used with the BlackBerry Enterprise Server.</li> <li><b>4. iPhone OS / iOS:</b> The iOS was developed by the Apple inc 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.</li> <li><b>5. Symbian OS:</b> 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 <b>Symbian Ltd</b> in <b>1998</b> for the use of mobile phones. <b>Nokia</b> was the first company to release Symbian OS on its mobile</li> </ol>	10	CO1	L2

	<p>phone at that time.</p> <p><b>6. Windows Mobile OS:</b> The window mobile OS is a mobile operating system that was developed by <b>Microsoft</b>. It was designed for the pocket PCs and smart mobiles.</p> <p><b>7. Harmony OS:</b> 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.</p> <p><b>8. Palm OS:</b> The palm operating system is a mobile operating system that was developed by <b>Palm Ltd</b> for use on personal digital assistants (PADs). It was introduced in <b>1996</b>. Palm OS is also known as the <b>Garnet OS</b>.</p> <p><b>9. WebOS (Palm/HP):</b> The WebOS is a mobile operating system that was developed by <b>Palm</b>. It is based on the <b>Linux Kernel</b>. HP uses this operating system in its mobile and touchpads.</p>			
10	<p>What is AVD? Illustrate creation of AVD by explaining fields of AVD.</p> <p><b>Creating Android Virtual Devices (AVD)</b></p> <p>An AVD is an emulator instance that enables you to model an actual device. Each AVD consists of a hardware profile, a mapping to a system image, as well as emulated storage, such as a secure digital (SD) card.</p> <p>One can create many AVDs in order to test your applications with several different configurations. This testing is important to confirm the behavior of your application when it is run on different devices with varying capabilities.</p> <p>To create an AVD, go to Windows Menu and choose “Android Virtual Device Manager”. Then give appropriate name, device, memory required etc. for the application. Once the new AVD is created, it can be used for different applications further.</p>	10	CO2	L2



## Fields of ADT

- Name-used to specify the name of AVD
- Target-used to specify target API
- CPU/ABI-determines the processor that we want to emulate on our device
- SD Card-used for extending the storage capacity of the device
- Snapshot-start it from the last saved snapshot
- Skin-used for setting screen size
- Hardware-used to set properties of hardware in target device.

1. You are now ready to test your application on the Android Emulator. Select the project name in Eclipse and press F11. You will be asked to select a way to debug the application. Select required Android Application and click OK.

2. The Android Emulator will now be started (if the emulator is locked, you need to slide the unlock button to unlock it first).

3. Click the Home button (the house icon in the lower-left corner above the keyboard) so that it now shows the Home screen.

4. Click the application Launcher icon to display the list of applications installed on the device. Note that the HelloWorld application is now installed in the application launcher.