**Chapter: 1 Introduction to mobile computing & Mobile Development**

**Lecture Notes: Introduction to Mobile Computing and Mobile Development**

**1. Introduction to Mobile Computing**

Mobile computing refers to the use of portable computing devices that allow users to access information, communicate, and perform computational tasks while on the move. It combines computer science, wireless communication, and embedded systems to offer seamless access to services and applications in a mobile context.

**Key Aspects of Mobile Computing:**

* **Portability**: Mobile computing devices, such as smartphones and tablets, are lightweight and easy to carry, enabling users to stay connected on the go.
* **Wireless Connectivity**: Devices rely on wireless technologies (Wi-Fi, Bluetooth, 3G/4G/5G networks) to communicate with servers, other devices, or the internet.
* **Location Awareness**: Mobile devices often include GPS and other sensors to provide location-based services.

**2. Applications of Mobile Computing**

Mobile computing has a vast array of applications across various fields:

* **Personal Use**: Communication through smartphones, email, and social media.
* **Business Applications**: Enterprise mobility for remote access to corporate data, customer relationship management (CRM) systems, and collaboration tools.
* **Entertainment**: Streaming media, mobile gaming, and online shopping.
* **Healthcare**: Mobile health apps, telemedicine, and remote monitoring.
* **Education**: E-learning platforms and mobile educational tools.

**3. Limitations of Mobile Computing**

Despite its advantages, mobile computing also has certain limitations:

* **Battery Life**: Portable devices often face limitations in battery capacity, requiring frequent recharging.
* **Network Coverage**: Mobile networks can be unstable, especially in remote or congested areas.
* **Security Concerns**: Mobile devices are vulnerable to data breaches, hacking, and malware.
* **Processing Power**: While mobile processors have advanced, they still can't match the performance of desktop systems, limiting the capability of certain applications.
* **Limited Storage**: Mobile devices tend to have less storage capacity compared to desktops and servers.

**4. Architecture of Mobile Computing**

Mobile computing architecture is generally built on three key components:

* **Mobile Devices**: These include smartphones, tablets, and laptops that are equipped with various sensors (e.g., GPS, accelerometers).
* **Communication Networks**: Mobile networks (such as cellular, Wi-Fi, and Bluetooth) facilitate data exchange between mobile devices and the internet or other devices.
* **Backend Servers**: Cloud computing and data servers store, process, and manage data. Mobile applications communicate with these servers to fetch or send data.

**5. Cellular Networks Overview**

Cellular networks are a key component of mobile computing. These networks are divided into geographic areas called cells, each served by a base station. Cellular technologies have evolved from 1G (analog signals) to 5G, offering faster data transfer rates and more reliable communication.

* **1G**: Analog cellular networks for voice communication.
* **2G**: Digital networks with support for SMS and basic data.
* **3G**: Enhanced data services, including mobile internet browsing.
* **4G**: High-speed internet and multimedia services.
* **5G**: Ultra-fast, low-latency networks enabling technologies like IoT, autonomous vehicles, and augmented reality.

**6. Mobile IP**

Mobile IP is a communication protocol designed to allow mobile devices to move across different networks without changing their IP address. It ensures that the device remains reachable, even when it switches from one network to another. Key components include:

* **Home Agent (HA)**: A router on the home network that tracks the device’s location.
* **Foreign Agent (FA)**: A router on the visited network that forwards data to the mobile device.
* **Care-of Address (CoA)**: The current IP address of the mobile device while visiting a foreign network.

**7. History of Mobile Software Development**

The history of mobile software development traces back to the introduction of mobile phones and handheld computing devices. The key milestones include:

* **Early Mobile Platforms**: Initially, mobile software was developed for devices like PDAs (Personal Digital Assistants) and early mobile phones (e.g., Nokia).
* **Symbian and Java ME**: In the late 1990s and early 2000s, mobile development saw platforms like Symbian and Java ME, which provided basic functionality for mobile devices.
* **Android and iOS**: In the late 2000s, Apple introduced iOS and Google introduced Android, both of which became dominant platforms for mobile application development.
* **App Stores**: The rise of the App Store (Apple) and Google Play allowed developers to distribute apps globally, accelerating the growth of mobile computing.

**8. The Open Handset Alliance (OHA)**

The Open Handset Alliance (OHA) is a consortium of companies that developed the Android operating system. The alliance aims to create open standards for mobile devices to foster innovation. Google leads the OHA, which includes prominent companies like HTC, Samsung, and Intel.

**9. The Android Platform**

Android is an open-source operating system for mobile devices, primarily developed by Google. It is based on the Linux kernel and is designed for touchscreen mobile devices like smartphones and tablets. Android supports a wide range of applications and is the most widely used mobile operating system globally.

**Key Features of Android:**

* **Java-based**: Android apps are primarily developed using Java (or Kotlin).
* **Rich User Interface**: Android provides a flexible UI framework with support for themes, layouts, and widgets.
* **Google Play**: The official app store for distributing Android applications.
* **Multitasking**: Android supports running multiple applications simultaneously.

**10. Android SDK (Software Development Kit)**

The Android SDK is a collection of tools that developers use to build Android applications. It includes:

* **Android Studio**: The official integrated development environment (IDE) for Android development.
* **Libraries**: Pre-built Android libraries that provide common functionality for Android apps.
* **Emulator**: A virtual device to test and debug applications without needing a physical device.
* **API Documentation**: Detailed documentation on Android APIs and classes.

**11. Building a Simple Android Application**

Building a basic Android application involves several steps:

1. **Set up Android Studio**: Install and configure Android Studio to start development.
2. **Create a New Project**: Choose a project template and name your project.
3. **Design the Layout**: Use XML to design the app's user interface (UI).
4. **Write Code**: Use Java or Kotlin to implement the app's functionality.
5. **Run the App**: Use an emulator or physical device to test the app.

Example of a simple "Hello World" app in Android:

* **XML Layout (activity\_main.xml)**:

xml

<TextView

android:id="@+id/helloWorldText"

android:layout\_width="match\_parent"

android:layout\_height="match\_parent"

android:text="Hello, World!"

android:textSize="24sp"

android:gravity="center" />

* **Java Activity (MainActivity.java)**:

java

package com.example.helloworld;

import android.os.Bundle;

import android.widget.TextView;

import androidx.appcompat.app.AppCompatActivity;

public class MainActivity extends AppCompatActivity {

@Override

protected void onCreate(Bundle savedInstanceState) {

super.onCreate(savedInstanceState);

setContentView(R.layout.activity\_main);

}

}