Week 1 Introduction Mobile Computing

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Learning Objectives

By the end of the session, students will be able to:

a. Define **mobile computing** and explain its **core components**.

b. Differentiate between **system software** and **application software**.

c. Discuss the importance and characteristics of **mobile applications**.

d. Describe the **Android operating system architecture** and its role in mobile computing.

e. Identify development tools used in creating Android applications.

Mobile Computing

Mobile Computing is a technology that allows transmission of data, voice and video via a computer or any other wireless enabled device without having to be connected to a fixed physical link. The main concept involves:

1. Mobile communication
2. Mobile hardware
3. Mobile software

Mobile communication

The mobile communication in this case, refers to the infrastructure put in place to ensure that seamless and reliable communication goes on. These would include devices such as protocols, services, bandwidth, and portals necessary to facilitate and support the stated services. The data format is also defined at this stage. This ensures that there is no collision with other existing systems which offer the same service. Since the media is unguided/unbounded, the overlaying infrastructure is basically radio wave-oriented. That is, the signals are carried over the air to intended devices that are capable of receiving and sending similar kinds of signals.

Mobile Hardware

Mobile hardware includes mobile devices or device components that receive or access the service of mobility. They would range from portable laptops, smartphones, tablet Pc's, Personal Digital Assistants.

These devices will have a receptor medium that is capable of sensing and receiving signals. These devices are configured to operate in full- duplex, whereby they are capable of sending and receiving signals at the same time. They don't have to wait until one device has finished communicating for the other device to initiate communications.

Above mentioned devices use an existing and established network to operate on. In most cases, it would be a wireless network.

Mobile software

Mobile software is the actual program that runs on the mobile hardware. It deals with the characteristics and requirements of mobile applications. This is the engine of the mobile device. In other terms, it is the operating system of the appliance. It's the essential component that operates the mobile device.

Since portability is the main factor, this type of computing ensures that users are not tied or pinned to a single physical location, but are able to operate from anywhere. It incorporates all aspects of wireless communications.

Mobile Computing and PDA Mobile Devices

1. **Emergence of Modern Computing Technologies**
   - Different technologies have evolved to support global computer networks.
   - Mobile computing has removed the need to be confined to one physical location.
   - Terms like telecommuting describe working remotely while accessing office resources.

2. Portable and Mobile Devices

Devices such as:

- Portable computers and laptops
- Personal Digital Assistants (PDAs)
- PC tablets and smartphones

•These devices make mobile computing convenient and accessible anywhere.

Mobile Computing and PDA Mobile Devices

3. Functions and Capabilities of Mobile Devices

- Update and edit documents
- Surf the internet
- Send and receive emails
- Stream live video files
- Take photographs
- Support video and voice conferencing

4. Market Competition and Innovation

The demand for advanced smart devices drives competition among manufacturers.

Each vendor aims to create unique, high-performance devices.

Examples of major competitors and operating systems:

- Apple's iPhone OS
- Google's Android
- Microsoft's Windows Mobile
- Research In Motion's BlackBerry OS

Mobile Computing and PDA Mobile Devices

5. Consumer Demand and Technological Advancement

- Users seek better, portable, affordable, and robust devices.
- This demand encourages continuous innovation and development.
- Market statistics show a steady increase in the use of mobile devices for both personal and professional purposes.

6. Impact on Service Providers

Cellular service providers must improve their offerings to attract subscribers.

Innovations include:

- High-speed internet access
- Enhanced voice and video services
- Adoption of advanced network generations (2G, 2.5G, 3G, 4G)

Mobile Computing and PDA Mobile Devices

7. Benefits and Applications of Mobile Computing

- Enables professionals to work from any location.
- Devices like iPads, tablets, smartphones, and notebooks support remote work.

  Features include:
  - Accessing and storing large volumes of data
  - Making executive decisions using real-time information
  - Conducting meetings via video or audio conferencing
  - Accessing sales reports, market forecasts, and other business data remotely

Mobile Computing and PDA Mobile Devices

8. Continuous Growth and Future of Mobile Computing

- Increasing demand for mobile services drives manufacturers to develop new applications.
- Focus remains on improving efficiency, connectivity, and user experience.

Mobile Communication

Mobile communication refers to the technology that enables people to communicate while moving, using wireless devices like smartphones, tablets, or IoT sensors.

Key Components:

- **Mobile Device (User Equipment - UE):**
  Phones, tablets, IoT modules that connect to the network.
- **SIM / eSIM:**
  Subscriber Identity Module that authenticates the user.
- **Base Station / Cell Tower (BTS / eNodeB / gNodeB):**
  Provides radio connectivity to users in its area (cell).
- **Mobile Switching Center (MSC) / Core Network:**
  Manages call routing, data sessions, handovers, billing, and security.

Generations of Mobile Communication

Generation	Era	Technology	Data Speed	Main Features
1G	1980s	Analog (AMPS)	2.4 Kbps	Voice only
2G	1990s	GSM, CDMA	64–384 Kbps	Digital voice, SMS
3G	2000s	UMTS, HSPA	384 Kbps–2 Mbps	Internet, video calls
4G	2010s	LTE	100 Mbps–1 Gbps	IP-based, HD streaming
5G	2020s	NR (New Radio)	1–20 Gbps	Ultra-fast, IoT, low latency

Network Infrastructure: Backbone of Mobile Communication

The **network infrastructure** is the physical and logical foundation that enables mobile communication to work efficiently.

Layers of Infrastructure:

Radio Access Network (RAN):

- Connects users to the core network via radio waves.
- Components:
  - **Base Transceiver Station (BTS)** – handles wireless links
  - **Base Station Controller (BSC) / NodeB / gNodeB** – manages multiple BTSs
  - **Antenna Systems** – transmit/receive signals

Network Infrastructure: Backbone of Mobile Communication

2. Core Network:

Handles switching, authentication, mobility, and data routing.

Components (for 4G/5G):

- **MME (Mobility Management Entity)**
- **SGW/PGW (Serving and Packet Gateways)**
- **AMF/SMF/UPF** in 5G (Access, Session, and User Plane Functions)

3. Backhaul Network:

Connects base stations to the core network via fiber optics, microwave links, or satellites.

Network Infrastructure: Backbone of Mobile Communication

4. Transport Network:

Manages data flow between different parts of the network.

5. Data Centers & Cloud Infrastructure:

Hosts services like subscriber data management, content delivery, IoT platforms, and AI analytics.

Emerging Trends in Mobile Network Infrastructure

- **5G Standalone Networks (SA):** Full 5G architecture without relying on 4G.
- **Edge Computing:** Data processing closer to users for faster response.
- **Network Slicing:** Virtual networks customized for different use cases (e.g., IoT, AR/VR, autonomous vehicles).
- **Open RAN (O-RAN):** Vendor-neutral and software-defined radio systems.
- **Private 5G Networks:** Enterprises deploying their own secure mobile networks.

What is Android

- Android is Linux based operating system designed primarily for mobile devices such as smartphones and tablets.
- Android was first developed as an ADVANCE OPERATING SYSTEM for digital cameras.
- There are more than 4,00,000 apps in android market
- And, android is an open source.

What is Operating System

- An operating system, or "OS," is software that communicates with the hardware and allows other programs to run..
- Common desktop operating systems include Windows, OS X, and Linux
- Common mobile OS include Android, iOS, and Windows Phone

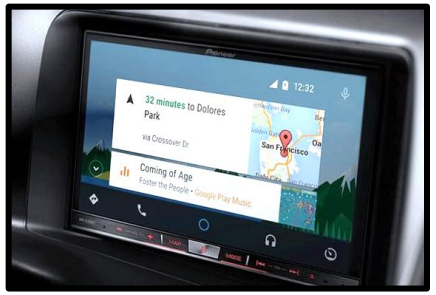
Android Devices

Mobile phones

Tablets

Smart TV

Wearable device



GPS device for automobiles

Origin of Android

- Android was founded in Palo Alto, California in October 2003 by
- **Andy Rubin, Rich Miner,**
- **Nick Sears and Chris White** who work at "Google" as developers.

Origin of Android

- Android was purchased by the Google in AUGUST, 2005 for 50 million $.
- HTC Dream was the first android device launched in September 2008
- Now, android covers 90% of the mobile OS market.

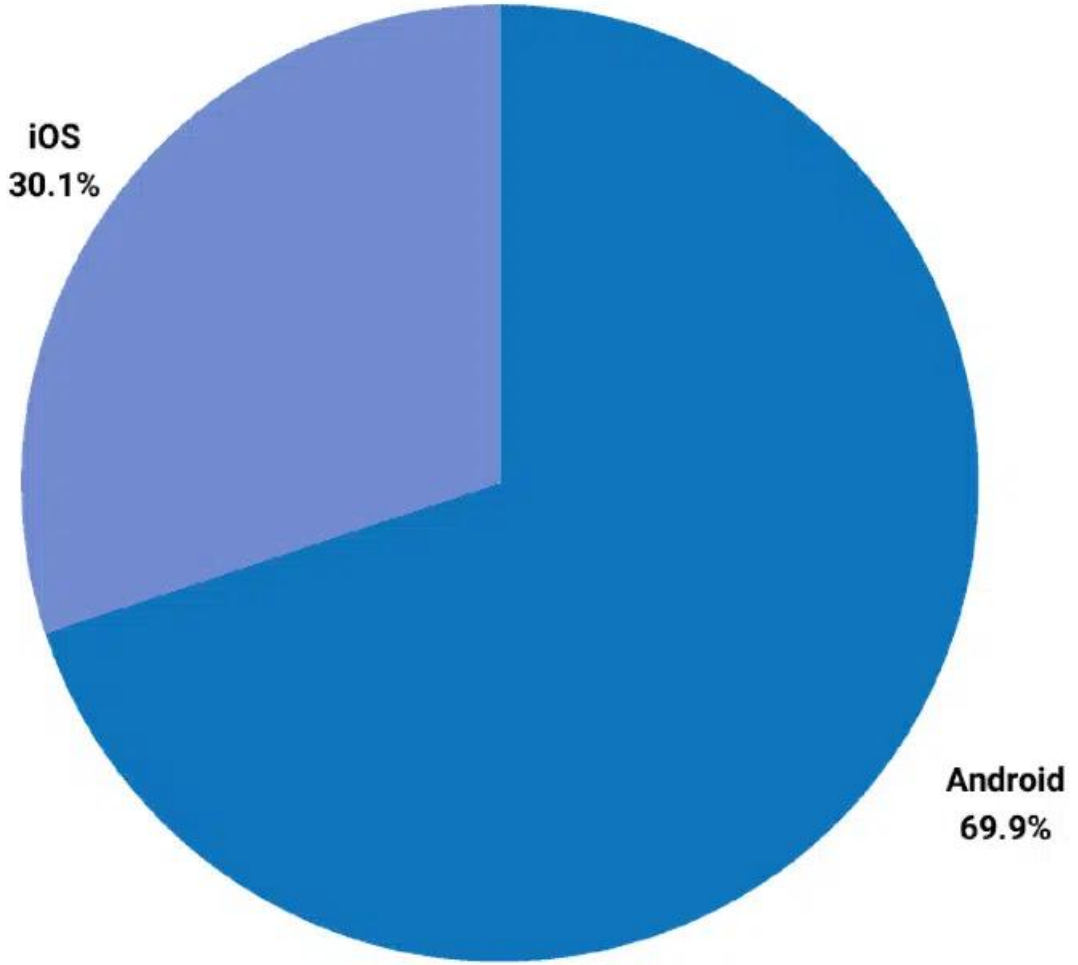
Open Handset Alliance (OHA)

- It’s consortium of several companies.
- OHA is a business alliance of firm to develop open standard for mobile device.
- OHA includes 84 firms to develop open standard for mobile devices, i.e.
  HTC, Sony, Dell, Intel, Motorola, QUALCOMM, Google, Samsung Electronics, LG Electronics, T-Mobile, NVidias
- Reason for Nokia not to develop Android Mobiles is Nokia is not part of OHA

Features

- Android supports wireless communication using:-
  1. 3G Networks, 4/5G Networks, 802.11 Wi-Fi Networks,
  2. Bluetooth Connectivity
- Developing an android application is not tough ,using SDK and java emulator we can easily develop applications that we want.
- Open source – Free development platform
- Built in services like GPS,SQL Database, browser and maps
- Portability across current and future hardware

Android vs. iOS Market Share: Which Mobile OS Has the Most Users Worldwide?



Latest versions of Android in 3 years

Version	Release Year	Key Features
Android 16	2025	* Real-time “Live Updates” notifications. Android Authority+2blog.google+2 * Power-button shortcut for wallet apps. Android Authority * Enhanced professional camera support (night-mode scene detection, hybrid auto-exposure). Android Developers Blog * Better multitasking / large-screen support and resizable app windows
Android 15	2024	* Theft-protection features (e.g., for SIM removal, setting changes) and stronger security/privacy. blog.google+2Android Developers+2 * App-archiving support (reduce unused app storage). Android Authority+1 * Performance & battery standby improvements; support for large screens/foldables.
Android 14	2023	* Lock-screen customisation (new clock/weather styles), monochrome theme, Ultra HDR support. WIRED+2Android Authority+2 * Support for large-screen form-factors (taskbar improvements for tablets). Wikipedia+1 * Non-linear font scaling & improved accessibility.

End-of-Presentations