

Limitations of Mobile Computing

1. Insufficient Bandwidth

- The user needs access to a network they must resort to slow wireless WAN systems primarily intended for telephone use. Higher speed wireless LANs is only available in specific sites.

2. Security concerns

- Dependent on public networks, requiring careful use of VPNs.
- Wi-Fi networks are a shared network that makes it easier for others to eavesdrop on your communication.
- Devices are Stolen and tampered.

3. Power consumption

- Short battery life.
- Mobile computers must rely entirely on battery power. Combined with compact size, this means unusually expensive batteries be used.

4. Transmission interferences (Quality of Connectivity)

- Weather and terrain problems as well as distance-limited connection exist with some technologies. Reception in tunnels and some buildings is poor.

5. Potential health hazards

- Potential health damage from cellular radio frequency emission is not known yet.
- Car accidents are related to drivers who were talking through a mobile device.
- Cell phones may interfere with sensitive medical devices.

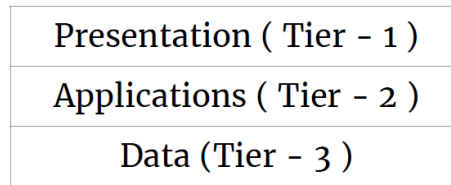
6. Human interface with mechanism

- Screens are often too small.
- Keyboards are impractical, especially one-handed.
- Alternate methods such as speech or handwriting recognition require training..

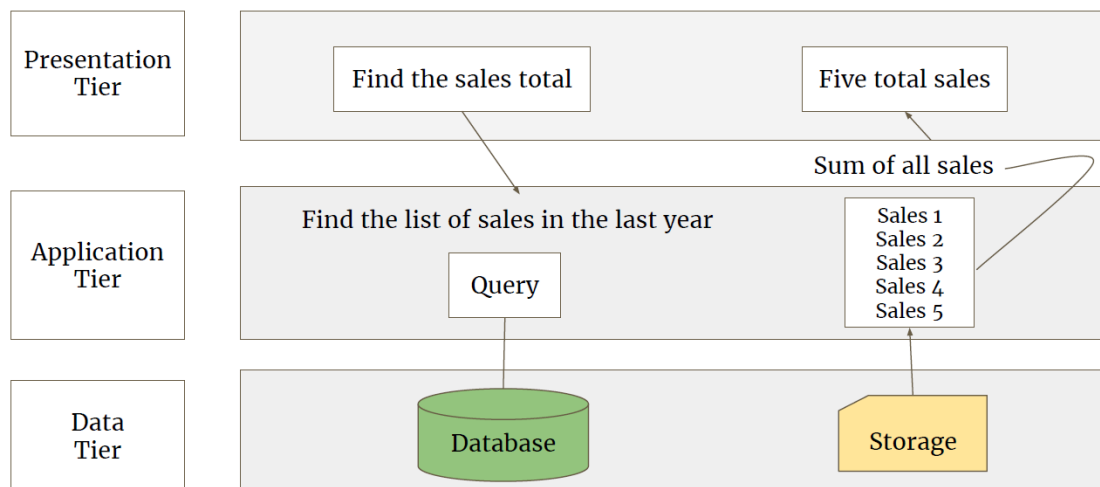


Structure of Mobile Computing Application

- It is structured based on the functionality implementations
- Most of them are 3 tier architecture.



View (Sales System example)



Presentation Tier (User Interface) (Presentation Layer)

- Top most level of mobile computing application.
- This layer presents data to the user and optionally permits data manipulation and data entry, also this layer requests the data form Application layer.
- **User Interface** that is responsible to produces the results in a meaningful manner.
- Runs on client side (client's Computer).
- This layer includes web browsers, Dynamic HTML and customized client applications.

Application Tier (Logic Layer)

- Responsibility of this layer is making **logical decisions** and **performing calculations**.
- It moves and processes the data between **presentation layers** and **data layers**.
- It is also considered **engine** of the application.
- It performs the processing of user input, obtaining information and then making decisions.
- It is implemented using the technology like **Java**, **.NET** services, etc....
- Implementation and functionality should be database independent.
- Implemented on a fixed server.

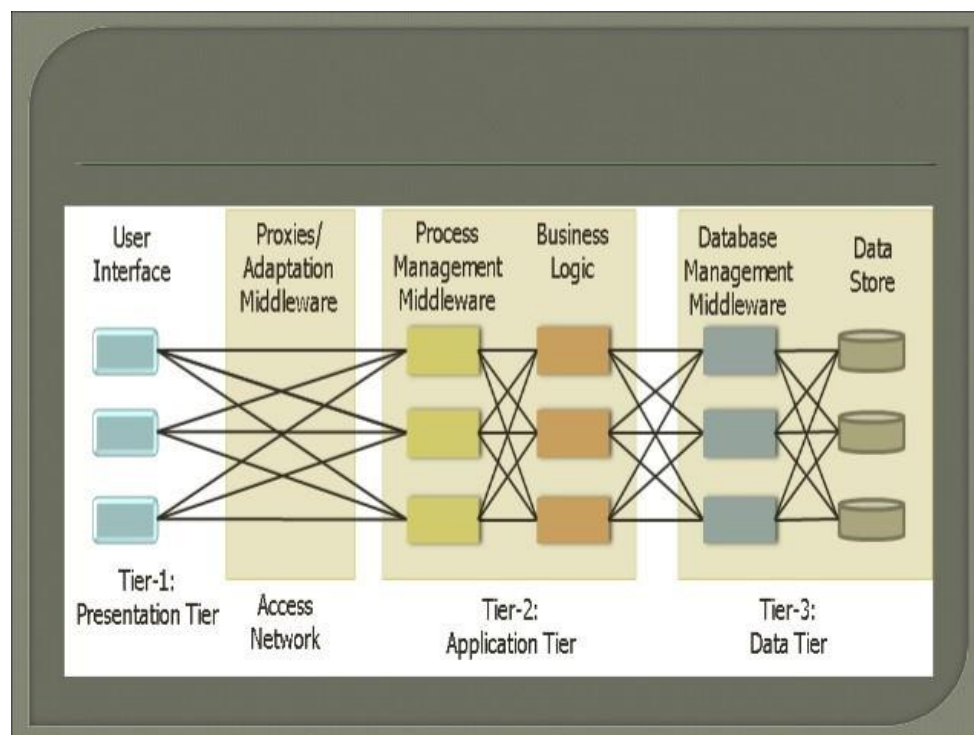
- Because these middle-tier components are not tied to a specific client, they can be used by all applications and can be moved to different locations, as response time and other rules require.

Data Tier (Data Access Layer)

- It provides the basic facilities of data.
 - Storage.
 - Access.
 - Manipulation.
- This layer contains **databases** and **Query processors** that provides all the data for the above two layers.
- Implemented on **affixed server**.
- Information is stored and retrieved from this database.

3-tier architecture is an **application program** that is organized into three major parts, comprising of:

- The **client layer (presentation)** at the top.
- The **application layer (business logic)** in the middle.
- The **data access layer tier** at the bottom.



Each tier is distributed to a different place or places in a network. These tiers do not necessarily correspond to physical locations on various computers on a network, but rather to logical layers of the application.

Mobile Device Operating Systems

- A **mobile operating system**, also called a mobile OS, is software that is specifically designed to run on mobile devices such as mobile phones, smartphones, PDAs, tablet computers and other handheld devices.
- Much like the Linux or Windows operating system controls your desktop or laptop computer.
- A mobile operating system is the software platform on top of which other programs can run on mobile devices. Which controls mobile devices is responsible for determining the functions and features available on mobile devices.

- A **mobile operating system** (or **mobile OS**) is an operating system for phones, tablets, smart watches, or other mobile devices.

- The mobile operating system is a set of data and programs that runs on a mobile device. It manages the hardware and makes it possible for smart phones, tablets, and wearables to run apps.
- A mobile OS also manages mobile multimedia functions, mobile and internet connectivity, the touch screen, Bluetooth connectivity, GPS navigation, cameras, speech recognition, and more in a mobile device.
- Most operating systems are not interchangeable among devices. If you have an Apple iOS phone, you can't load the Android OS on it and vice versa.

- Mobile operating systems combine features of a personal computer operating system with other features useful for mobile or handheld use; usually including, (modern mobile systems):-
 - Wireless inbuilt modem
 - SIM tray for telephony and data connection.
 - Touchscreen.
 - Bluetooth.
 - Wi-Fi Protected Access.
 - Wi-Fi, Global Positioning System (GPS) mobile navigation.
 - Video- and single-frame picture cameras.
 - Speech recognition.
 - Voice recorder.
 - Music player.
 - Near field communication.
 - Infrared blaster.

List out the features of Mobile Operating Systems.

1. Multitasking
2. Scheduling
3. Memory Allocation
4. File System Interface
5. Keypad Interface
6. I/O Interface
7. Protection and Security
8. Multimedia features

There are three **kinds** of **Windows Mobile operating system**:-

1. Windows **Mobile** Standard.
2. Windows **Mobile** Professional.
3. Windows **Mobile** Classic.

Architecture of Mobile OS.

A mobile OS is a software platform on top of which other programs called application programs can run on mobile devices such as PDA, cellular phones, smartphone and etc.

Applications
OS Libraries
Device Operating System Base, Kernel
Low-Level Hardware, Manufacturer Device Drivers

Commercial Mobile Operating Systems

9 Popular Mobile Operating Systems

- Android OS (Google Inc.)...
 - Bada (Samsung Electronics) ...
 - BlackBerry OS (Research In Motion) ...
 - iPhone OS / iOS (Apple) ...
 - MeeGo OS (Nokia and Intel) ...
 - Palm OS (Garnet OS) ...
 - Symbian OS (Nokia) ...
 - webOS (Palm/HP)
- **Apple's iOS:** Incredibly popular operating system from Apple, running devices such as the iPhone, iPad, iPod Touch, and Apple TV.
- **Google's Android:** Google's mobile device operating system, powering devices from several device manufacturers.
- **Nokia's Symbian:** Open-source operating system managed by Nokia. In 2011, Nokia announced that it would begin building devices based on the Microsoft Windows Phone operating system, rendering the future of Symbian questionable.

Structure of Mobile Computing Application

- **Programming languages** are used for mobile system software. Operating system functions to run the software components onto the hardware.
- **Middleware components deployment.**
- **Layered structure** arrangement of mobile computing components.
- **Protocols and layers** used for transmission and reception.

Programming Languages

The following are the programming languages used for Mobile Computing applications are:

- Java - J2SE.

- J2ME (Java2 Micro edition)
- JavaCard (Java for smart card)
- The Java enterprise edition (J2EE) used for web and enterprise server based applications of mobile services
- C and C++
- Visual C++
- Visual Basic

Middleware

- Software components that link the application components with the network-distributed components.
- It is used to discover the nearby device such as Bluetooth.
- It is used to discover the nearby hot spot for achieving device synchronization with the server or an enterprise server.
- It is used for retrieving data (which may be in Oracle or DB2) from a network database.
- It is used for service discovery at network.
- It is used for adaptation of the application to the platform and service availability.

Mobile Computing System Layers

1. Physical for sending and receiving signals (for example, TDMA or CDMA coding).
2. Data-link (for example, multiplexing).
3. Networking (for linking to the destination).
4. Wireless transport layer security (for establishing end-to-end connectivity).
5. Wireless transaction protocol.
6. Wireless session protocol.
7. Wireless application environment (for running a web application, for example, mobile e-business).

Software Development Kit: iOS, Android

- The **iOS SDK (Software Development Kit)** (formerly **iPhone SDK**) is a software development kit developed by Apple Inc. The kit allows for the development of mobile apps on Apple's iOS operating system.
- The iOS SDK helps developers write iOS apps using supported programming languages, including Swift, Java and Objective-C.
- Other companies have also created tools that allow for the development of native iOS apps using their respective programming languages.

Android SDK

- Android is a **software platform** and **Operating System** for mobile devices.
- Android is an operating system based on the Linux kernel, and designed primarily for touchscreen mobile devices such as smartphones and tablet computers.
- The Android SDK provides API libraries and developer tools necessary to build, test, and debug apps for Android.

- Android SDK is a software development kit that enables developers to create applications for the Android platform.

Advantages and Disadvantages of Android Mobile OS

Advantages	Disadvantages
Large number of devices using Android.	Some device manufacturers add alternative UI front-ends which reduces OS consistency.
Frequent Enhancement.	Updates are controlled by device manufacturers and may be slow or nonexistent.
Larger number of applications availability.	Applications are not validated.
Excellent UI.	
Multi-tasking.	
Free developer tools.	
No restrictions on applications.	
Phones are available from every service provider.	
Many devices can be unlocked with third-party applications.	

iOS platforms

- Apple **iOS** is a proprietary mobile operating system that runs on the **iPhone**, iPad and iPod Touch.
- Apple **iOS** is based on the Mac OS X operating system for desktop and laptop computers.
- The **iOS** developer kit provides tools that allow for **iOS** app development.

Advantages and Disadvantages of Apple IOS

Advantages	Disadvantages
Excellent UI.	Closed Architecture.
Larger number of applications Availability.	Limited number of devices to choose from – all from apple.
Apple validates applications.	No multi-tasking for applications
Consistent UI across devices.	Applications must be approved by Apple before being made available via the Marketplace.
Frequent free OS updates.	Can't be unlocked

What are Mobile Development Tools?

- Mobile Development Tools are software designed to assist in the creation of mobile applications.
- This can be accomplished in multiple ways, for example, there are *native mobile development tools*, but also *cross-platform mobile development tools*.

• Native Mobile Development Tools

- A **native development tool** is a software which allows developers to create applications for use in a single particular system, platform or device, like Android, iOS, or Windows.
- A native app is specially made and coded for a specific mobile platform in its native programming language:
 - **iOS (Objective-C or Swift)**
 - **Android (Java or Kotlin)**
 - **Windows Phone (C#)**
- **Native Mobile Development Tool:**
 1. Xcode
 2. Android Studio
 3. AppCode

• Cross-Platform Mobile Development Tools

- programmers on one platform can develop apps for one or more other platforms or mobile operating systems simultaneously.
- This can also enable developers to use the same code base for different platforms. Meaning that such generic apps can be published and used on both an **Android Phone** and an **iPhone**.
- This greatly reduces the time and costs needed for creating an application.
- generic apps tend to have more platform-specific issues and a lower quality (user-interface, performance) than a native application.
- The reason cross-platform mobile development tools are so handy is because there are so many different types of devices out there. If you want to release your app on many app stores so that lots of phones and tablets can use it.

Cross-Platform split into three platforms:

- **Coding Platforms**
- **Low-Coding Platforms**
- **No-Coding Platforms**

Best Mobile App Development Tools For 2019

1. **Android Studio**
2. **Xcode**
3. **Xamarin**

Cellular systems generations

- **1G (first generation):** voice-oriented systems based on analog technology; ex.: Advanced Mobile Phone Systems (AMPS) and cordless systems.
- **2G (second generation):** voice-oriented systems based on digital technology; more efficient and used less spectrum than 1G; ex.:

Global System for Mobile (GSM) and US Time Division Multiple Access (US-TDMA).

- **3G(third generation):** high-speed voice-oriented systems integrated with data services; ex.: General Packet Radio Service (GPRS), Code Division Multiple Access (CDMA).
- **4G (fourth generation):** based on Internet protocol networks and will provide voice, data and multimedia service to subscribers.
- **5G (fifth generation):** faster data rates, higher connection density, much lower latency. device-to-device communication, better battery consumption, and improved overall wireless coverage.

Cellular services

- voice communication.
- Short Messaging Service (SMS).
- Multimedia Messaging Service (MMS).
- Global Positioning System (GPS).
- Wireless Application Protocol (WAP) – to access the Internet.

Cellular network components

- **BTS (Base Transceiver Station):**- main component of a cell and it connects then subscribers to the cellular network; for transmission/reception of information it uses several antennas spread across the cell
- **BSC (Basic Station Controller):**- it is an interface between BTSs and it is linked to BTSs by cable or microwave links; it routes calls between BTSs; it is also connected to the MSC
- **MSC (Mobile Switching Center):**- the coordinator of a cellular network, it is connected to several BSCs, it routes calls between BSCs; links the cellular network with other networks like PSTN through fiber optics, microwave or copper cable

Components of a cellular phone (MSU – Mobile Subscriber Unit)

- **Radio transceiver** – low power radio transmitter and receiver **antenna**, usually located inside the phone.
- **control circuitry** – formats the data sent to and from the **BTS**; controls signal transmission and reception.
- **man-machine interface** – consists from a keypad and a display; is managed by the control circuitry.
- **Subscriber Identity Module (SIM)** – **integrated circuit card** that stores the identity information of subscriber.
- **battery**, usually Li-ion, the power unit of the phone.