Unit -1
Introduction to Mobile and Mobile Programming [2 Hrs]

Mobile Device and its Features

Mobile device is a general term for any handheld computer or smartphone. The term is interchangeable with 'handheld,' 'handheld device,' and 'handheld computer.' Tablets, e-readers, smartphones, PDAs and portable music players with smart capabilities are all mobile devices. It is a computer which is small enough to hold and operate in the hand.

A mobile device has the following features:

- It's portable.
- It's personal.
- It's with you almost all the time.
- It's easy and fast to use.
- It has some kind of network connection.

i) Portable

A mobile device has to be portable, meaning that we can carry it without any special considerations. We can take it to the gym, to the university, to work; we can carry it with us everywhere, all the time.

ii) Personal

We've all heard it: "Don't touch my phone!" A mobile device is absolutely personal. My mobile is mine; it's not property of the family, nor is it managed by the company who manufactured it. I choose the ringtone, the visual theme, the games and applications installed, and which calls I should accept. My wife has her own mobile device, and so do my kids. This personal feature will be very important in our projects. You can browse a desktop website from any computer—your familiar home PC, your computer at work, or even a desktop at a hotel or Internet café—and numerous people may have access to those machines. However, you will almost always browse a mobile website from the same device, and you are likely to be the only person who uses that device.

iii) Companion

Your mobile device can be with you anytime! Even in the bathroom, you probably have your mobile phone with you. You may forget to take lots of things with you from your home in the morning, but you won't forget your wallet, your keys, and your mobile device. The opportunity to be with the user all the time, everywhere, is really amazing.

iv) Easy usage

A notebook (or even a netbook) is portable; it can be with you at any time and it has a network connection, but if you want to use it, you need to sit down and perhaps find a table. Therefore, it's not a mobile device for the purposes of this book. A mobile device needs to be easy and quick to use. I don't want to wait two minutes for Windows to start; I don't want to sit down. If I'm walking downtown, I want to be able to find out when the next train will be departing without having to stop.

v) Connected device

A mobile device should be able to connect to the Internet when you need it to. This can be a little difficult sometimes, so we will differentiate between fully connected devices that can connect any time in a couple of seconds and limited connected devices that usually can connect to the network but sometimes cannot.
A classic iPod (non-Touch) doesn't have a network connection, so it's out of our list too, like the notebooks.

Categories of Mobile Device

There are several categories of mobile devices. Devices can be categorized on the basis of several parameters like size, speed, functionality, etc. Some of the categories are discussed below:

i) Mobile Phones

Those devices which have call and SMS support can be categorized as mobile phones. We still have mobile phones in some markets. They don't have web browsers or connectivity, and they don't have any installation possibilities.
After some years, because of device recycling, such phones will probably not be on the market anymore. The Nokia 1100 was the most widely distributed device in the world, with over 200 million sold since its launch in 2003. In terms of features, it offers nothing but an inbuilt flashlight. The problem is that we can't create web content for it. Some companies may continue to make very low-end entry devices in the future, but hopefully Nokia and most other vendors will stop creating this kind of device. Even newer, cheaper mobile devices now have inbuilt browser support.
This is because the mobile ecosystem (vendors, carriers, integrators, and developers) wants to offer services to users, and a browser is the entry point. For example, through its OVI Services Nokia offers OVI Mail, an email service for non-Internet users in emerging markets. Thanks to this service, many, many people who have never before had access to email can gain that access, with a mobile device costing very low amount. This widespread solution meets a real need for many people in emerging markets, like some countries in Africa and Latin America.

ii) Low-end mobile devices

Low-end mobile devices have a great advantage: they have web support. They typically have only a very basic browser, but this is the gross market. People who buy these kinds of devices don't tend to be heavy Internet users, but this may change quickly with the advent of social networks and Web 2.0 services. If your friends can post pictures from their mobile devices, you'll probably want to do the same, so you may upgrade your phone whenever you can.
Nokia, Motorola, Kyocera, LG, Samsung, and Sony Ericsson have devices for this market. They do not have touch support, have limited memory, and include only a very basic camera and a basic music player.

iii) Mid-end mobile devices

This is the mass-market option for a good mobile web experience. Mid-end devices maintain the balance between a good user experience and moderate cost. We can find a lot of devices in this market sector.

In this category, devices typically offer a medium-sized screen, basic HTML-browser support, sometimes 3G, a decent camera, a music player, games, and application support.
One of the key features of mid-end devices is the operating system (OS). They don't have a well-known OS; they have a proprietary one without any portability across vendors. Native applications generally aren't available publicly and some runtime, like Java ME, is the preferred way to develop installed applications. The same vendors develop these devices as the low-end devices.

iv) High-end mobile devices

Originally the same category as smartphones, high-end devices are generally non-multi touch but have advanced features (like an accelerometer, a good camera, and Bluetooth) and good web support (but not the best in the market). They are better than mid-end devices but not on a par with smartphones.
The enhanced user experience on smartphones is one of the key differences. The other difference is that high-end devices generally are not sold with flat Internet rates. The user can get a flat-rate plan, but he'll have to go out and find it himself.

v) Smartphones

This is the most difficult category to define. Why aren't some mid-end and high-end devices considered "smart" enough to be in this category? The definition of smart evolves every year. Even the simplest mobile device on the market today would have been considered very smart 15 years ago.
A smartphone, as defined today, has a multitasking operating system, a full desktop browser, Wireless LAN (WLAN, also known as Wi-Fi) and 3G connections, a music player, and several of the following features:

- GPS (Global Positioning System) or A-GPS (Assisted Global Positioning System)
- Digital compass
- Video-capable camera
- TV out
- Bluetooth
- Touch support
- 3D video acceleration
- Accelerometer

vi) Non-phone devices

Those devices which doesn't contains call and SMS feature falls into this category. For example, Apple's iPod Touch and iPad are devices in this category. They aren't phones, but they can be personal, are portable and easy to use, can be kept with you most of the time, and have WLAN connections, so they fall into the category of limited connected devices. They both also have a great mobile browser—the same one as the iPhone—so they will be in our list of devices to be considered for development.

vii) Small Personal Object Technology (SPOTs)

This may sound like a sci-fi category, but every year sci-fi gets nearer to us. The only difference between SPOTs and the other devices we've considered is their size: a SPOT may be a watch,

or even a pair of glasses. The LG GD910 in **Figure 1-1** is a watch with 3G support. It's on the market now, so it's not sci-fi.
"OK," you may be thinking, "but are we really going to create a website for a one-inch screen?" Maybe not. But we can create small widgets to update information presented to the users, and this falls under the category of mobile web work.

Figure 1-1. The LG GD910 (the "watchphone") is the first of a new generation of mobile devices that have web support through widgets with updatable information.

viii) Tablets, netbooks, and notebooks

These devices have at minimum a nine-inch display, and they are more like desktops than mobile devices. Some have desktop operating systems and desktop browsers, while others, such as the iPad, have mobile software. If a device has a full operating system, you will need to install antivirus protection and a firewall on it, so it won't meet the easy usage criterion for a mobile device. Also remember that you can't use a netbook while walking.

History of Mobile Devices

Mobile phones, particularly the smartphones that have become our inseparable companions today, are relatively new. However, the history of mobile phones goes back to 1908 when a US Patent was issued in Kentucky for a wireless telephone.
Mobile phones were invented as early as the 1940s when engineers working at AT&T developed cells for mobile phone base stations. The very first mobile phones were not really mobile phones at all. They were two-way radios that allowed people like taxi drivers and the emergency services to communicate. Instead of relying on base stations with separate cells (and the signal being passed from one cell to another), the first mobile phone networks involved one very powerful base station covering a much wider area.
Motorola, on 3 April 1973 were first company to mass produce the first handheld mobile phone. These early mobile phones are often referred to as 0G mobile phones, or Zero Generation mobile phones. Most phones today rely on 3G or 4G mobile technology.

Following are the landmarks in mobile history:

- **1926:** The first successful mobile telephony service was offered to first class passengers on the Deutsche Reichsbahn on the route between Berlin and Hamburg.
- **1946:** The first calls were made on a car radiotelephone in Chicago. Due to the small number of radio frequencies available, the service quickly reached capacity.
- **1956:** The first automated mobile phone system for private vehicles launched in Sweden. The device to install in the car used vacuum tube technology with rotary dial and weighed 40Kg.
- **1969**: The Nordic Mobile Telephone (NMT) Group was established. It included engineers representing Sweden, Denmark, Norway and Finland. Its purpose was to develop a mobile phone system that, unlike the systems being introduced in the US, focused on accessibility.
- **1973**: Dr Martin Cooper general manager at Motorola communications system division made the first public mobile phone call on a device that weighed 1.1Kg.
- **1982**: Engineers and administrators from eleven European countries gathered in Stockholm to consider whether a Europe wide digital cellular phone system was technically and politically possible. The group adopted the Nordic model of cooperation and laid the foundation of an international standard.
- **1985**: Comedian Ernie Wise made the first "public" mobile phone call in the UK from outside the Dicken's Pub in St Catherine's dock to Vodafone's HQ. He made the call in full Dickensian coachman's garb.
- **1987**: The Technical specifications for the GSM standard are approved. Based on digital technology, it focused on interoperability across national boundaries and consequent different frequency bands, call quality and low costs.
- **1992**: The world's first ever SMS message was sent in the UK. Neil Papworth, aged 22 at the time was a developer for a telecom contractor tasked with developing a messaging service for Vodafone. The text message read "Merry Christmas" and was sent to Richard Jarvis, a director at Vodafone, who was enjoying his office Christmas party.
- **1996/97**: UK phone ownership stood at 16% of households. A decade later the figure was 80%. The explosion in growth was in part driven the launch of the first pay as you go, non-contract phone service, Vodafone Prepaid, in 1996.
- **1998**: The first downloadable content sold to mobile phones was the ringtone, launched by Finland's Radiolinja, laying the groundwork for an industry that would eventually see the Crazy Frog ringtone rack up total earnings of half a billion dollars and beat stadium-filling sob-rockers Coldplay to the number one spot in the UK charts.
- **1999:** Emoji's were invented by Shigetaka Kurita in Japan. Unlike their all-text predecessor's emoticons, emoji's are pictures.
- **2000:** The all-conquering Nokia 3310 crash landed on shop shelves. Naturally it was unscathed and went on to sell 126 million units. Over in Japan, the first commercially available camera phones The Sharp J-SH04, launched in November 2000 in Japan. The only snag? you could only use it in Japan. Europe wouldn't get its first camera phone until the arrival of the Nokia 6750 in 2002.
- **2003:** The 3G standard started to be adopted worldwide, kicking off the age of mobile internet and paving the way for the rise of smartphones***. Nepal was one of the first countries in southern Asia to launch 3G services. One of Nepal's first companies to offer the service, Ncell, also covered Mount Everest with 3G.***

- **2007:** The iPhone debuted. Solely available on O2 at launch in the UK and priced at a then eye-watering $499.
- **2008:** The first Android phone turned up, in the form of the T-Mobile G1. Now dubbed the O.G of Android phones, it was a long way from the high-end Android smartphones we use today. Not least because it retained a physical keyboard and a BlackBerry-style trackball for navigation. This year also saw the advent of both Apple's App Store and Android Market, later renamed Google Play Store.
- **2009:** O2 publicly announced that it had successfully demonstrated a 4G connection using six LTE masts in Slough, UK. The technology, which was supplied by Huawei, achieved a peak downlink rate of 150Mbps.
- **2010:** Samsung launched its first Galaxy S smartphone. Usurping former Android giants, HTC, the Samsung Galaxy S range is still the most popular Android brand.
- **2017:** The Nokia 3310 had a revival, sporting a fresh version equipped with basic web browsing, a colourful screen and even a camera. Despite this, it still retained our favourite features from the original 3310, including the iconic design, super-long battery life and even an updated version of Snake.

Following are some of the popular mobile devices of their time:

S.N.	Year	Name of Device
1	1985	Motorola Dynatac 8000X
2	1992	Nokia 1011
3	1996	Motorola StarTAC
4	1997	The Hagenuk GlobalHandy
5	1998	Siemens S10
6	1998	Nokia 5110
7	1999	Nokia 7110
8	1999	Motorola Timeport
9	2000	Nokia 9210 Communicator
10	2000	Sharp J-SH04
11	2000	Nokia 3310
12	2003	Nokia 1100
13	2003	Blackberry 6210
14	2004	Motorola Razr V3

Brands, Models and Platforms

There are several brands, models and platforms currently available. Writing a book about brands and models is very difficult. The market changes a lot every year. Some of the brands, models and platforms are discussed below:

Apple

We are going to start with Apple, not because its devices are the best or because it has the greatest market share, but because Apple has caused a revolution in the market. It changed the way mobile devices are seen by users, and it is the reason why many developers (web or not) have turned their attention to the mobile world.

Apple, a well-known desktop computer company, entered the mobile world with a revolutionary device: the iPhone. Luckily for us, all of Apple's devices are quite similar. They

have a multi touch screen, a 3.5" screen size, WLAN connections, and Safari on iOS (formerly Mobile Safari) as the browser.
Apple's devices have a great feature: an operating system called iOS (formerly iPhone OS) that is based on Mac OS X (a Unix-based desktop OS). Up to this writing, even the first version of the iPhone can be upgraded to the latest operating system version. By default, the iPhone and iPod Touch are charged using USB; when you charge your device, iTunes (the Apple software for managing your device's content and music) will detect automatically if an OS update is available for your device, and you can install the update in minutes without any technical skill needed. That is why today, for a mobile web developer, it's more important to know what OS version an Apple device has installed than which device it is. For those of us whose aim is to create great web experiences for the iPhone, it doesn't matter if the device is an iPhone (the basic phone), an iPhone 3GS (S for speed, a device with more power and speed), an iPhone 4 or an iPod Touch (like the iPhone without the phone). Even within each device type, we have many generations.
Today, we can develop applications for iOS devices on only two platforms: using mobile web techniques, and using the framework built using Objective-C or Swift.

Nokia

Nokia was the most popular brand and had the largest market share in mobile devices and smartphones worldwide. Nokia has devices in all the mobile categories, from very low-end devices to very high-end smartphones.
Nokia has the best support for developers, compared to all the other companies. Hundreds of documents and a huge amount of sample code, ideas, and best practices for many technologies, including technologies used for mobile web development are available on its website for developers, Forum Nokia.
The bad news for developers is that hundreds of different Nokia devices are available today. The good news is that they are very well organized by platform into different series, making it easier for us to develop, test, and port our web applications to most of them.

BlackBerry

Research in Motion (RIM) is the Canadian manufacturer of the BlackBerry devices, mobile devices focused on being "always connected" with push technologies that are primarily used by corporate users who need to remain connected to intranets and corporate networks. RIM calls all its devices "smartphones."
RIM has few devices aimed at the mass market, so most of them have QWERTY keyboards and aren't designed for gaming. Many of them have proprietary input devices, like a scroll wheel or a touchpad; some touch-enabled devices have also been launched in the last few years. All BlackBerrys have the RIM OS, a proprietary operating system compatible with Java ME with extensions, and, of course, a mobile browser. We can categorize the devices by operating system version.
BlackBerry has become very popular in the corporate market because of its integration with Exchange and other corporate servers. A BlackBerry user can browse the Internet via the corporate Internet connection though a proxy, and many other manufacturers, such as Nokia, LG, HTC, and Sony Ericsson, support the BlackBerry email client.

Samsung

Samsung has many devices on the market, most of which are divided into three different series: native devices, Symbian devices, and Windows devices. At the end of 2009, Samsung surprised the market with a new platform for the devices launching from 2010: *Bada*.

Samsung's native devices are low- and mid-end mobile devices with a proprietary OS including a browser and Java ME support, and typically a camera and a music player. Prior to 2010, the smartphones and high-end devices were divided into two categories by operating system Symbian and Windows Mobile each having its own set of features.

The latest devices on the market have touch support, with a UI layer installed over the operating system. For newer devices, there is one feature that is available on all the three platforms: Samsung Widgets. These are small applications created using mobile web technologies that can operate on all the operating systems Samsung uses.

Starting in 2010, Samsung had delivered mobile devices with Bada, Android, and Windows Phone.

Sony Ericsson

Ericsson built many mobile phones in the 1990s, and in 2001 it merged with Sony and created the Sony Ericsson company. Today, Sony Ericsson produces a range of low and mid-end devices and a couple of smartphones. Sony Ericsson, like Samsung, has decided to offer devices with different operating systems. It offers low- and mid-end devices using a proprietary Sony Ericsson operating system, as well as Windows Mobile devices, Android devices, and Symbian devices.

Before 2009, the Symbian devices used UIQ as the UI layer for the operating system. Since 2009, there are Symbian Foundation devices using the same UI layer as Nokia's and Samsung's devices. So, in terms of developing web applications for them, they are very similar. The proprietary OS devices support Java ME and Flash Lite development (and also both at the same time, thanks to a project called Capuchin), and they are divided in series according to the Java ME APIs they support.

So, today we have Sony Ericsson devices from Java Platform 1 (JP-1) to Java Platform 8 (JP-8), with each category differing in terms of the API support and the screen resolution. All the devices have a camera, a music player and, of course, a web browser built in. The Symbian Foundation–based devices are touch-enabled.

Motorola

For many years, Motorola was a leading manufacturer of low- and mid-end devices. Motorola's devices were the first mobile devices on the market, and the company pioneered the clamshell design with the classic Motorola StarTac. Motorola's mobile devices have traditionally used either a proprietary operating system (like the well-known Motorola v3), Symbian UIQ, Windows Mobile, or a Linux-based operating system the company created for its devices. On the proprietary OS–based devices, Java ME and the browser were the only supported development platforms. The Linux-based OS supports Java ME, web, and native development.

Figure 1-2: The Motorola CLIQ was the first Android-based device from this company. It includes MOTOBLUR, a push service connecting your home screen with social networks and news sites.

The Windows-based Motorola devices, like the Motorola Q, which has a QWERTY keyboard, are intended for the corporate market. The company also has some touch devices on the market, all with a built-in camera and music player, and some mobile devices for the two-way radio market, like the Nextel network. These devices have a proprietary OS and the model names usually start with an "i."

There are no series divisions in Motorola, unlike in the Nokia and Sony Ericsson lines, so we will need to use other information (such as the browser used in each device) to test and make decisions about the devices.

LG Mobile

LG Mobile has many low to high-end devices on the market today. Some are based on a proprietary OS with Java ME, Flash, and web support. Some them support web widgets based on WebKit. Most of the new one's are based on Android.

LG participated in the creation of the Symbian Foundation and has two Symbian devices based on the S60 platform, but later on it decided to support Android, which we can see many Android-based LG devices currently.

HTC

HTC has become very popular in the mobile market since it created the first and second Android devices in the world and the first Google phone, the Nexus One. But HTC doesn't only create Android devices; it also produces a lot of Windows Mobile ones. Many HTC devices have touch support, and a key feature is that HTC tries to emulate the same user experience on all its devices. We can think of HTC devices as either Android devices or Windows devices; that's the only distinction that's needed.

This simplicity is reflected in the HTC website for developers: it only contains kernel files for Android devices and links to the Android and Windows Mobile generic websites.

Android

Android is an open source, Linux-based operating system created and maintained by a group of software and hardware companies and operators called the Open Handset Alliance. Google mainly maintains it, so it is sometimes known as the "Google Mobile Operating System." As with any open source software, any manufacturer could theoretically remove all the Google-specific stuff from the operating system before installing it on their devices. However, as of this writing no vendor has done this, which is why every Android device is very "Google friendly."

Android is a software stack including a Linux-core, multitasking operating system based on the concept of a virtual machine that executes bytecode, similar to .NET or JVM (Java Virtual Machine). Google chose Java as the main language to compile (not compatible with Java ME) with Web 2.0 users in mind. Android includes a full HTML browser based on WebKit and, in fact, is very similar to the iPhone Safari browser, and all Android devices to date ship with Google Maps, Google Calendar, and an email client and provide connections to many free Google web services. It's not an obligation, but as of today every Android device is touch-based, and many of them have a QWERTY physical keyboard, GPS, a digital compass, and an accelerometer.

Following is the list of android versions:

Version Name	Version Number	Initial Release Date	Api Level
No version name	1.0	September 23, 2008	1
	1.1	February 9, 2009	2
Cupcake	1.5	April 27, 2009	3
Donut	1.6	September 15, 2009	4
Eclair	2.0 – 2.1	October 26, 2009	5 – 7
Froyo	2.2 – 2.2.3	May 20, 2010	8
Gingerbread	2.3 – 2.3.7	December 6, 2010	9 – 10
Honeycomb	3.0 – 3.2.6	February 22, 2011	11 – 13
Ice Cream Sandwich	4.0 – 4.0.4	October 18, 2011	14 – 15
Jelly Bean	4.1 – 4.3.1	July 9, 2012	16 – 18
KitKat	4.4 – 4.4.4	October 31, 2013	19 – 20
Lollipop	5.0 – 5.1.1	November 12, 2014	21 – 22
Marshmallow	6.0 – 6.0.1	October 5, 2015	23
Nougat	7.0 – 7.1.2	August 22, 2016	24 – 25
Oreo	8.0 – 8.1	August 21, 2017	26 – 27
Pie	9.0	August 6, 2018	28
Android 10	10.0	September 3, 2019	29

(Source: Wikipedia)

Windows Mobile

One of the older mobile operating systems on the market is Windows Mobile (formerly Windows CE for Pocket PC and Smartphones). For many years, its market included the well-known Pocket PCs as Personal Digital Assistants (PDAs) without phone features. The "mobile revolution" pushed Microsoft to create a smartphone version of its mobile operating system, now called Windows Mobile, which is available in two flavours: The Professional (formerly Pocket PC) and Smartphone editions.

Windows Mobile has its own unique features, like Android, and as developers we can consider it as a platform without regard to who the device manufacturer is. Windows Mobile devices are produced by HP, Toshiba, Motorola, Sony Ericsson, Samsung and Palm.

Palm

USRobotics bought Palm Computing Inc. in 1995. At the time, it was the pioneer launching PDA devices. USRobotics later merged with 3Com, and as 3Com was dedicated to network cards and accessories, Palm Inc. was created as a subsidiary. Palm Inc. was very successful, and other manufacturers (including IBM) created other devices licensing its Palm OS. In 1998, a couple of Palm's directors left to create another company, HandSpring, which releases the Treo devices to the market. Half PDA and half mobile phone, they can be considered the first smartphones on the market.

A few years later, Palm decided to divide the company into a hardware manufacturer, palmOne, and an operating system developer, PalmSource. This idea didn't work out: customers didn't accept the palmOne trademark, so the company again acquired the Palm trademark and the operating system became the Garnet OS. In the meantime, Palm acquired HandSpring, so now we have Palm Treo devices.

In 2005, ACCESS (who also had other mobile technologies) acquired PalmSource and the operating system. Suddenly, the new-old Palm company made a difficult decision: it started to manufacture Treo devices with Windows Mobile, killing all hopes for the future of the Garnet OS (formerly Palm OS).

The Treo series was the only type of Palm device that survived in the mobile world, and BlackBerrys, the Nokia E Series, and other devices soon pushed Palm to the bottom of the market. In response, Palm created another operating system for mobile devices, aimed at being a web-oriented platform for iPhone-killer devices. webOS came to the market in 2009 with the first device, the Palm Pre. Other devices, such as the Palm Pixi, followed.

The company didn't go so-well in the market, so in 2010, Palm was acquired by HP, who promised evolution of webOS, so we should expect HP netbooks, tablets and more mobile phones with this operating system in the following years.

Palm's new webOS devices are touch and multitouch devices with a very smooth user interface, excellent web support, and all the functions of a modern mobile device. The operating system and all the device applications are web-based. That's because any "native" application developed for webOS is created using web technologies.

Figure 1-3. Palm has a really interesting history. Pictured here are the original USRobotics PalmPilot, the Handspring Treo, and the new webOS-based Palm Pre

Symbian Foundation

Today there are many Symbian Foundation–based devices on the market (from Nokia, Sony Ericsson, and Samsung), all with similar operating system features. The Symbian Foundation's OS allows us to develop applications using the native C++ framework, Java ME, Adobe Flash, web applications, widgets using web technologies, Python, and Qt, a free C-based framework owned by Nokia.

The open source OS is versioned as Symbian^1, Symbian^2, Symbian^3, etc. As with Android and Windows Mobile devices, if we are talking about a Symbian device we know that it will be very similar to all other Symbian devices, no matter which manufacturer created it.

Introduction to Mobile Programming

Mobile programming is a set of processes and procedures involved in writing software for small, wireless computing devices. It is the act or process by which mobile apps are developed for mobile devices, such as personal digital assistants, enterprise digital assistants or mobile phones.

There are two dominant platforms in the modern smartphone market. One is the iOS platform from Apple Inc. The iOS platform is the operating system that powers Apple's popular line of iPhone smartphones. The second is Android from Google. The Android operating system is used not only by Google devices but also by many other OEMs to build their own smartphones and other smart devices. An original equipment manufacturer (**OEM**) is a company that produces parts and equipment that may be marketed by another manufacturer.

There are several languages used for mobile programming. Languages like Java, Kotlin, C#, Python etc. are popular for android platform and Objective-C, Swift etc. are popular languages for iOS platform. Programmers can select any of the language of their choice for writing mobile programs.

There are four major development approaches when building mobile applications:

- Native Mobile Applications
- Cross-Platform Native Mobile Applications
- Hybrid Mobile Applications
- Progressive Web Applications

Native Applications

Native mobile applications are written in the programming language and frameworks provided by the platform owner and running directly on the operating system of the device such as iOS and Android.

Cross-Platform Applications

Cross-platform native mobile applications can be written in variety of different programming languages and frameworks, but they are compiled into a native application running directly on the operating system of the device.

Hybrid-Web Applications

Hybrid mobile applications are built with standard web technologies - such as JavaScript, CSS, and HTML5 - and they are bundled as app installation packages. Contrary to the native apps, hybrid apps work on a 'web container' which provides a browser runtime and a bridge for native device APIs via Apache Cordova.

Progressive Web Applications

WAs offer an alternative approach to traditional mobile app development by skipping app store delivery and app installations. PWAs are web applications that utilize a set of browser capabilities - such as working offline, running a background process, and adding a link to the device home screen - to provide an 'app like' user experience.

Mobile Application Development Lifecycle

There are two interlinked core components of a mobile application: 1) the mobile application “Front-End” that resides on the mobile device, and 2) the services “Back-End” that supports the mobile front-end.

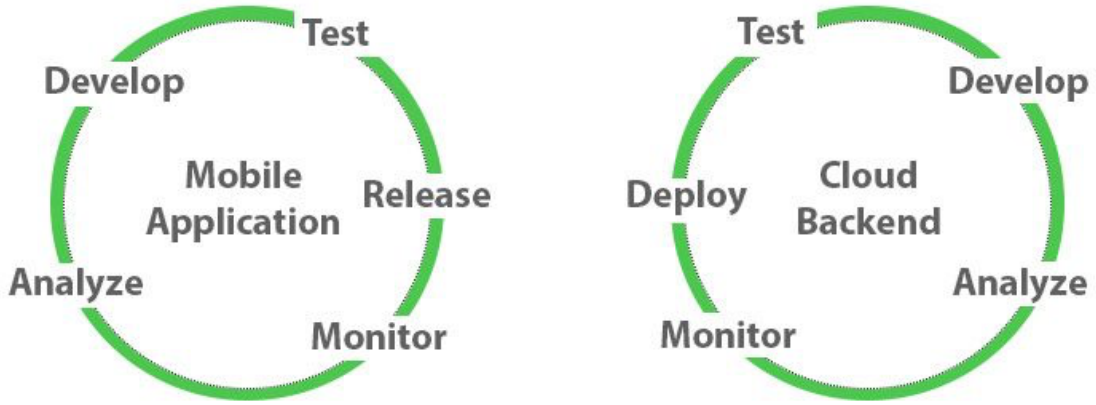

Figure 1-4. Mobile Application Development Life Cycle

- The **mobile front-end** is the visual and interactive part of the application the user experiences. It usually resides on the device, or there is at least an icon representing the app that is visible on the home screen or is pinned in the application catlog of the device. The application can be downloaded from the platform app store, side-loaded directly onto the device, or can be reached through the device's browser.
- Regardless of what front-end platform or development methodology is being used, delivering high-quality mobile applications that delight and retain users requires reliable **back-end services**.
- Given the critical importance of back-end services for the success of the mobile application, the developers have several important architectural decisions that they must consider. These decisions include which services should they build themselves and which third party services should they leverage, and then should they run and maintain their own services or should they take advantage of 3rd party services.

Exercise

1. What do you mean by mobile device? Explain its features.
2. Explain different categories of mobile devices.
3. Explain about history of mobile device in detail.
4. Explain different brands, models and platforms of mobile devices in detail.
5. What do you mean by mobile programming? Explain life cycle of mobile application development.
6. List and explain any five popular programming languages used for developing mobile applications.
7. What are different mobile app development approaches? Explain in detail.