**A.6 Level One**

**Topic A – Productivity, Entertainment & Other Software Applications**

“iOS (formerly iPhone OS) is a [mobile operating system](https://en.m.wikipedia.org/wiki/Mobile_operating_system) created and developed by [Apple Inc.](https://en.m.wikipedia.org/wiki/Apple_Inc.) exclusively for [its hardware](https://en.m.wikipedia.org/wiki/List_of_iOS_devices). It is the operating system that presently powers many of the company's mobile devices, including the [iPhone](https://en.m.wikipedia.org/wiki/IPhone), [iPad](https://en.m.wikipedia.org/wiki/IPad), and [iPod Touch](https://en.m.wikipedia.org/wiki/IPod_Touch). It is the second most popular mobile operating system globally after [Android](https://en.m.wikipedia.org/wiki/Android_(operating_system)).

Originally unveiled in 2007 for the [iPhone](https://en.m.wikipedia.org/wiki/IPhone), iOS has been extended to support other Apple devices such as the [iPod Touch](https://en.m.wikipedia.org/wiki/IPod_Touch) (September 2007) and the [iPad](https://en.m.wikipedia.org/wiki/IPad) (January 2010). As of March 2018, Apple's [App Store](https://en.m.wikipedia.org/wiki/App_Store_(iOS)) contains more than 2.1 million iOS applications, 1 million of which are native for iPads.[[7]](https://en.m.wikipedia.org/wiki/IOS#cite_note-7) These [mobile apps](https://en.m.wikipedia.org/wiki/Mobile_app) have collectively been downloaded more than 130 billion times” (wikipedia)

“The [iOS App Store](https://en.m.wikipedia.org/wiki/App_Store_(iOS)) was opened on July 10, 2008 with an initial 500 applications available.[[23]](https://en.m.wikipedia.org/wiki/IOS#cite_note-23) This quickly grew to 3,000 in September 2008,[[24]](https://en.m.wikipedia.org/wiki/IOS#cite_note-24) 15,000 in January 2009,[[25]](https://en.m.wikipedia.org/wiki/IOS#cite_note-25) 50,000 in June 2009,[[26]](https://en.m.wikipedia.org/wiki/IOS#cite_note-26) 100,000 in November 2009,[[27]](https://en.m.wikipedia.org/wiki/IOS#cite_note-27)[[28]](https://en.m.wikipedia.org/wiki/IOS#cite_note-28) 250,000 in August 2010,[[29]](https://en.m.wikipedia.org/wiki/IOS#cite_note-29)[[30]](https://en.m.wikipedia.org/wiki/IOS#cite_note-30) 650,000 in July 2012,[[31]](https://en.m.wikipedia.org/wiki/IOS#cite_note-31) 1 million in October 2013,[[32]](https://en.m.wikipedia.org/wiki/IOS#cite_note-32)[[33]](https://en.m.wikipedia.org/wiki/IOS#cite_note-33) 2 million in June 2016,[[34]](https://en.m.wikipedia.org/wiki/IOS#cite_note-The_Verge_2_million-34)[[35]](https://en.m.wikipedia.org/wiki/IOS#cite_note-35)[[36]](https://en.m.wikipedia.org/wiki/IOS#cite_note-36) and 2.2 million in January 2017.[[37]](https://en.m.wikipedia.org/wiki/IOS#cite_note-37)[[38]](https://en.m.wikipedia.org/wiki/IOS#cite_note-38) As of March 2016, 1 million apps are natively compatible with the [iPad](https://en.m.wikipedia.org/wiki/IPad) tablet computer.[[39]](https://en.m.wikipedia.org/wiki/IOS#cite_note-39) These apps have collectively been downloaded more than 130 billion times.[[34]](https://en.m.wikipedia.org/wiki/IOS#cite_note-The_Verge_2_million-34) App intelligence firm Sensor Tower has estimated that the App Store will reach 5 million apps by the year 2020.”

“Major versions of iOS are released annually. The current version, [iOS 12](https://en.m.wikipedia.org/wiki/IOS_12), was released on September 17, 2018. It is available for all iOS devices with [64-bit processors](https://en.m.wikipedia.org/wiki/64-bit_computing); the [iPhone 5S](https://en.m.wikipedia.org/wiki/IPhone_5S) and later iPhone models, the [iPad (2017)](https://en.m.wikipedia.org/wiki/IPad_(2017)), the [iPad Air](https://en.m.wikipedia.org/wiki/IPad_Air) and later iPad Air models, all [iPad Pro](https://en.m.wikipedia.org/wiki/IPad_Pro) models, the [iPad Mini 2](https://en.m.wikipedia.org/wiki/IPad_Mini_2) and later iPad Mini models, and the [sixth-generation iPod Touch](https://en.m.wikipedia.org/wiki/IPod_Touch_(6th_generation)). On all recent iOS devices, iOS regularly checks on the availability of an update, and if one is available, will prompt the user to permit its automatic installation.” (Wikipedia)

“The main hardware platform for iOS is the [ARM architecture](https://en.m.wikipedia.org/wiki/ARM_architecture). iOS releases before [iOS 7](https://en.m.wikipedia.org/wiki/IOS_7) can only be run on iOS devices with [32-bit](https://en.m.wikipedia.org/wiki/32-bit) ARM processors ([ARMv6](https://en.m.wikipedia.org/wiki/ARMv6) and [ARMv7-A](https://en.m.wikipedia.org/wiki/ARMv7-A) architectures). In 2013, [iOS 7](https://en.m.wikipedia.org/wiki/IOS_7) was released with full [64-bit](https://en.m.wikipedia.org/wiki/64-bit_computing) support (which includes native 64-bit kernel, libraries, drivers as well as all built-in applications),[[115]](https://en.m.wikipedia.org/wiki/IOS#cite_note-115) after Apple announced that they were switching to 64-bit [ARMv8-A](https://en.m.wikipedia.org/wiki/ARMv8-A)processors with the introduction of the [Apple A7](https://en.m.wikipedia.org/wiki/Apple_A7) chip.[[116]](https://en.m.wikipedia.org/wiki/IOS#cite_note-116) 64-bit support was also enforced for all apps in the [App Store](https://en.m.wikipedia.org/wiki/App_Store_(iOS)); All new apps submitted to the App Store with a deadline of February 2015, and all app updates submitted to the App Store with a deadline of June 1, 2015.[[117]](https://en.m.wikipedia.org/wiki/IOS#cite_note-117) [iOS 11](https://en.m.wikipedia.org/wiki/IOS_11) drops support for all iOS devices with 32-bit ARM processors as well as 32-bit applications,[[118]](https://en.m.wikipedia.org/wiki/IOS#cite_note-118)[[119]](https://en.m.wikipedia.org/wiki/IOS#cite_note-119) making iOS 64-bit only.” (Wikipedia)

**Topic B – User Interface (Window Management & Input Devices)**

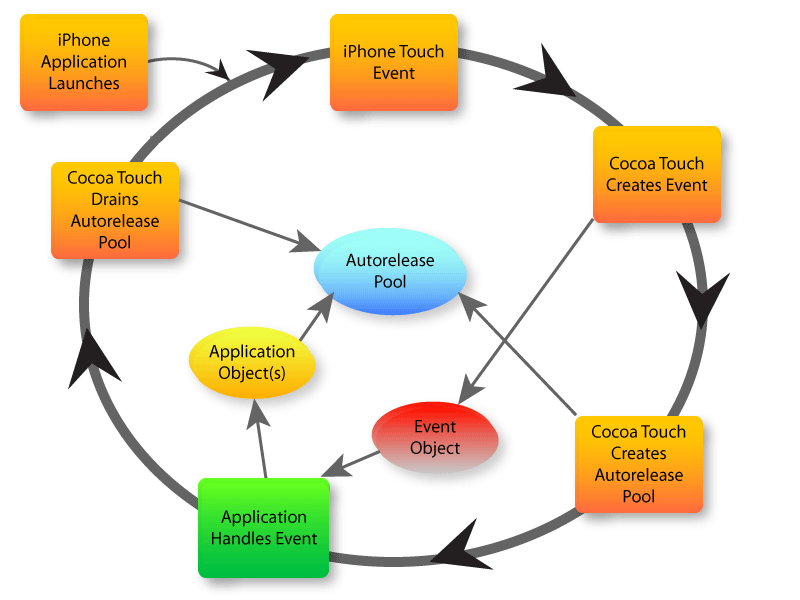
(there are more details available under ‘Features” on wikipedia’s <https://en.m.wikipedia.org/wiki/IOS> )

“The iOS [user interface](https://en.m.wikipedia.org/wiki/User_interface) is based upon [direct manipulation](https://en.m.wikipedia.org/wiki/Direct_manipulation_interface), using [multi-touch](https://en.m.wikipedia.org/wiki/Multi-touch) gestures. Interface control elements consist of sliders, switches, and buttons. Interaction with the OS includes gestures such as swipe, tap, pinch, and reverse pinch, all of which have specific definitions within the context of the iOS operating system and its multi-touch interface. Internal [accelerometers](https://en.m.wikipedia.org/wiki/Accelerometer) are used by some applications to respond to shaking the device (one common result is the [undo](https://en.m.wikipedia.org/wiki/Undo) command) or rotating it in [three dimensions](https://en.m.wikipedia.org/wiki/3D_modeling)(one common result is switching between portrait and landscape mode). Apple has been significantly praised for incorporating thorough [accessibility](https://en.m.wikipedia.org/wiki/Accessibility) functions into iOS, enabling users with vision and hearing disabilities to properly use its products.” (Wikipedia) “called Cocoa Touch”

**Topic C – Memory Allocation, Management,& Devices**

**iPhone applications run in an event loop, as shown in the diagram below. That is, when your iPhone application launches, the program enters the event loop and waits for a user touch event. When a touch event happens, the Cocoa Touch framework detects the event, creates an event object, and allocates and initializes an autorelease pool. Cocoa Touch then invokes your application event handler, making the event object available.**

**Topic D – Process / Task Scheduling and Management (System Startup)**

****

**Topic E – Software Security, Updates & System Tools**

“Apple provides major updates to the iOS operating system annually via [iTunes](https://en.m.wikipedia.org/wiki/ITunes) and also, for iOS 5 and later, [over-the-air](https://en.m.wikipedia.org/wiki/Wireless).[[47]](https://en.m.wikipedia.org/wiki/IOS#cite_note-47) The latest version is [iOS 12](https://en.m.wikipedia.org/wiki/IOS_12), released on September 17, 2018.[[48]](https://en.m.wikipedia.org/wiki/IOS#cite_note-48) It is available for [iPhone 5S](https://en.m.wikipedia.org/wiki/IPhone_5S) and later, [iPad Air](https://en.m.wikipedia.org/wiki/IPad_Air) and later, [iPad Pro](https://en.m.wikipedia.org/wiki/IPad_Pro), [iPad Mini 2](https://en.m.wikipedia.org/wiki/IPad_Mini_2) and later, and sixth-generation [iPod Touch](https://en.m.wikipedia.org/wiki/IPod_Touch).[[49]](https://en.m.wikipedia.org/wiki/IOS#cite_note-49)

Originally, iPod Touch users had to pay for system software updates. This was due to accounting rules making the device not a "subscription device" like iPhone or Apple TV, and significant enhancements to the device required payments.[[50]](https://en.m.wikipedia.org/wiki/IOS#cite_note-50)[[51]](https://en.m.wikipedia.org/wiki/IOS#cite_note-51) The requirement to pay to upgrade caused iPod Touch owners to stay away from updates.[[52]](https://en.m.wikipedia.org/wiki/IOS#cite_note-52) However, in September 2009, a change in accounting rules won tentative approval, significantly affecting both Apple's earnings and stock price, and allowing iPod Touch updates to be delivered for free “ (Wikipedia)

“-iOS utilizes many security features in both hardware and software. Below are summaries of the most prominent features:

**Secure Boot**

Before fully booting into iOS, there is low-level code that runs from the Boot [ROM](https://en.m.wikipedia.org/wiki/Read-only_memory). Its task is to verify that the Low-Level [Bootloader](https://en.m.wikipedia.org/wiki/Booting) is signed by the Apple [Root](https://en.m.wikipedia.org/wiki/Root_certificate) [CA](https://en.m.wikipedia.org/wiki/Certificate_authority) public [key](https://en.m.wikipedia.org/wiki/Key_(cryptography)) before running it. This process is to ensure that no malicious or otherwise unauthorized software can be run on an iOS device. After the Low-Level Bootloader finishes its tasks, it runs the higher level bootloader, known as [iBoot](https://en.m.wikipedia.org/wiki/IBoot). If all goes well, iBoot will then proceed to load the iOS kernel as well as the rest of the operating system.[[166]](https://en.m.wikipedia.org/wiki/IOS#cite_note-:0-166)

**Secure Enclave**

The Secure Enclave is a [coprocessor](https://en.m.wikipedia.org/wiki/Coprocessor) found in iOS devices that contain [Touch ID](https://en.m.wikipedia.org/wiki/Touch_ID) or [Face ID](https://en.m.wikipedia.org/wiki/Face_ID). It has its own secure boot process to ensure that it is completely secure. A hardware [random number generator](https://en.m.wikipedia.org/wiki/Random_number_generation) is also included as a part of this coprocessor. Each device's Secure Enclave has a unique ID that is given to it when it is made and cannot be changed. This identifier is used to create a temporary key that [encrypts](https://en.m.wikipedia.org/wiki/Encryption) the [memory](https://en.m.wikipedia.org/wiki/Random-access_memory) in this portion of the system. The Secure Enclave also contains an anti-replay counter to prevent [brute force attacks](https://en.m.wikipedia.org/wiki/Brute-force_attack).[[166]](https://en.m.wikipedia.org/wiki/IOS#cite_note-:0-166)

**Passcode**

iOS devices can have a passcode that is used to unlock the device, make changes to system settings, and encrypt the device's contents. Until recently, these were typically four numerical digits long. However, since unlocking the devices with a fingerprint by using Touch ID has become more widespread, six-digit passcodes are now the default on iOS with the option to switch back to four or use an alphanumeric passcode.[[166]](https://en.m.wikipedia.org/wiki/IOS#cite_note-:0-166)

**Touch ID**

Touch ID is a fingerprint scanner that is embedded in the home button and can be used to unlock the device, make purchases, and log into applications among other functions. When used, Touch ID only temporarily stores the fingerprint data in encrypted memory in the Secure Enclave, as described above. There is no way for the device's [main processor](https://en.m.wikipedia.org/wiki/Central_processing_unit) or any other part of the system to access the raw fingerprint data that is obtained from the Touch ID sensor.[[166]](https://en.m.wikipedia.org/wiki/IOS#cite_note-:0-166)

**Address Space Layout Randomization**

Address Space Layout Randomization (ASLR) is a low-level technique of preventing [memory corruption](https://en.m.wikipedia.org/wiki/Memory_corruption) attacks such as [buffer overflows](https://en.m.wikipedia.org/wiki/Buffer_overflow). It involves placing data in randomly selected locations in memory in order to make it harder to predict ways to corrupt the system and create exploits. ASLR makes app bugs more likely to crash the app than to silently overwrite memory, regardless of whether the behavior is accidental or malicious.[[167]](https://en.m.wikipedia.org/wiki/IOS#cite_note-167)

**Non-Executable Memory**

iOS utilizes the [ARM architecture's](https://en.m.wikipedia.org/wiki/ARM_architecture) Execute Never (XN) feature. This allows some portions of the memory to be marked as non-executable, working alongside ASLR to prevent buffer overflow attacks including [return-to-libc attacks](https://en.m.wikipedia.org/wiki/Return-to-libc_attack).[[166]](https://en.m.wikipedia.org/wiki/IOS#cite_note-:0-166)

**Encryption**

As mentioned above, one use of encryption in iOS is in the memory of the Secure Enclave. When a passcode is utilized on an iOS device, the contents of the device are encrypted. This is done by using a hardware [AES](https://en.m.wikipedia.org/wiki/Advanced_Encryption_Standard) 256 implementation that is very efficient because it is placed directly between the [flash storage](https://en.m.wikipedia.org/wiki/Flash_memory) and RAM.[[166]](https://en.m.wikipedia.org/wiki/IOS#cite_note-:0-166)

iOS, in combination with its specific hardware, uses [crypto-shredding](https://en.m.wikipedia.org/wiki/Crypto-shredding) when erasing all content and settings by [obliterating](https://en.wiktionary.org/wiki/en:obliterate) all the keys in '[effaceable](https://en.wiktionary.org/wiki/en:efface) storage'. This renders all user data on the device cryptographically inaccessible.[[168]](https://en.m.wikipedia.org/wiki/IOS#cite_note-168)

Keychain

The iOS keychain is a [database](https://en.m.wikipedia.org/wiki/Database) of login information that can be shared across apps written by the same person or organization.[[166]](https://en.m.wikipedia.org/wiki/IOS#cite_note-:0-166) This service is often used for storing passwords for web applications.[[169]](https://en.m.wikipedia.org/wiki/IOS#cite_note-169)

**App Security**

Third-party applications such as those distributed through the App Store must be code signed with an Apple-issued [certificate](https://en.m.wikipedia.org/wiki/Public_key_certificate). In principle, this continues the [chain of trust](https://en.m.wikipedia.org/wiki/Chain_of_trust) all the way from the Secure Boot process as mentioned above to the actions of the applications installed on the device by users. Applications are also [sandboxed](https://en.m.wikipedia.org/wiki/Sandbox_(computer_security)), meaning that they can only modify the data within their individual [home directory](https://en.m.wikipedia.org/wiki/Home_directory) unless explicitly given permission to do otherwise. For example, they cannot access data that is owned by other user-installed applications on the device. There is a very extensive set of privacy controls contained within iOS with options to control apps' ability to access a wide variety of permissions such as the camera, contacts, background app refresh, cellular data, and access to other data and services. Most of the code in iOS, including third-party applications, runs as the "mobile" user which does not have [root privileges](https://en.m.wikipedia.org/wiki/Superuser). This ensures that system files and other iOS system resources remain hidden and inaccessible to user-installed applications.[[166]](https://en.m.wikipedia.org/wiki/IOS#cite_note-:0-166)

**App Store bypasses**

Companies can apply to Apple for enterprise developer certificates. These can be used to sign apps such that iOS will install them directly (sometimes called "sideloading"), without the app needing to be distributed via the App Store.[[170]](https://en.m.wikipedia.org/wiki/IOS#cite_note-tc-edc-explain-170) The terms under which they are granted make clear that they are only to be used for companies who wish to distribute apps directly to their employees.[[170]](https://en.m.wikipedia.org/wiki/IOS#cite_note-tc-edc-explain-170)

**Circa January-February 2019**, it emerged that a number of software developers were misusing enterprise developer certificates to distribute software directly to non-employees, thereby bypassing the App Store. Facebook was found to be abusing an Apple enterprise developer certificate to distribute an application to underage users that would give Facebook access to all private data on their devices.[[171]](https://en.m.wikipedia.org/wiki/IOS#cite_note-171)[[172]](https://en.m.wikipedia.org/wiki/IOS#cite_note-172)[[173]](https://en.m.wikipedia.org/wiki/IOS#cite_note-173) Google was abusing an Apple enterprise developer certificate to distribute an app to adults to collect data from their devices, including unencrypted data belonging to third parties.[[174]](https://en.m.wikipedia.org/wiki/IOS#cite_note-174)[[170]](https://en.m.wikipedia.org/wiki/IOS#cite_note-tc-edc-explain-170) TutuApp, Panda Helper, AppValley, and TweakBox were abusing enterprise developer certificates to distribute apps that offered [pirated software](https://en.m.wikipedia.org/wiki/Pirated_software).[[175]](https://en.m.wikipedia.org/wiki/IOS#cite_note-175)

**Network Security**

iOS supports [TLS](https://en.m.wikipedia.org/wiki/Transport_Layer_Security) with both low- and high-level [APIs](https://en.m.wikipedia.org/wiki/Application_programming_interface) for developers. By default, the App Transport Security framework requires that servers use at least TLS 1.2. However, developers are free to override this framework and utilize their own methods of communicating over networks. When Wi-Fi is enabled, iOS uses a randomized [MAC address](https://en.m.wikipedia.org/wiki/MAC_address) so that devices cannot be tracked by anyone [sniffing](https://en.m.wikipedia.org/wiki/Network_sniffers)wireless traffic.[[166]](https://en.m.wikipedia.org/wiki/IOS#cite_note-:0-166)

Two-Factor Authentication

**Two-factor authentication** is an option in iOS to ensure that even if an unauthorized person knows an [Apple ID](https://en.m.wikipedia.org/wiki/Apple_ID) and password combination, they cannot gain access to the account. It works by requiring not only the Apple ID and password, but also a verification code that is sent to a device that is already known to be trusted.[[166]](https://en.m.wikipedia.org/wiki/IOS#cite_note-:0-166) If an unauthorized user attempts to sign in using another user's Apple ID, the owner of the Apple ID receives a notification that allows them to deny access to the unrecognized device “ (Wikipedia)

**Topic F – File System & User Accounts**

“Apple ID is an authentication method used by [Apple](https://en.m.wikipedia.org/wiki/Apple_Inc.) for [iPhone](https://en.m.wikipedia.org/wiki/IPhone), [iPad](https://en.m.wikipedia.org/wiki/IPad), [Mac](https://en.m.wikipedia.org/wiki/Macintosh) and other Apple devices. Apple IDs contain user personal information and settings. When an Apple ID is used to log into an Apple device, the device will automatically use the settings associated with the Apple ID. An Apple ID account can be created free of charge from the My Apple ID web page.[[1]](https://en.m.wikipedia.org/wiki/Apple_ID#cite_note-1) An Apple ID is a valid email address, protected by a password set by the user that is a case-sensitive alphanumeric string of at least 8 characters. Apple will send a verification email to the email address the user provided and the user is required to follow the [URL](https://en.m.wikipedia.org/wiki/Uniform_resource_locator) included in the verification email to activate the account. It is possible to create an Apple ID without specifying a credit card.[[2]](https://en.m.wikipedia.org/wiki/Apple_ID#cite_note-2) In March 2013, Apple ID launched an optional two-step verification security feature for authentication. When enabled, a second verification step is required when using the Apple ID under certain conditions, such as a web login, or making a Store purchase from a new device. The feature uses the Find My iPhone service to send a four-digit pin code to a trusted device associated with the Apple ID when the second verification step is required for authentication.”

“iCloud allows users to store data such as music and [iOS](https://en.m.wikipedia.org/wiki/IOS) applications on remote computer servers[[15]](https://en.m.wikipedia.org/wiki/Apple_ID#cite_note-:0-15) for download to multiple devices such as iOS-based devices running iOS 5 or later,[[16]](https://en.m.wikipedia.org/wiki/Apple_ID#cite_note-sysrequirements-16) and personal computers running [OS X 10.7.2 Lion](https://en.m.wikipedia.org/wiki/Mac_OS_X_Lion) or later, or [Microsoft Windows](https://en.m.wikipedia.org/wiki/Microsoft_Windows)([Windows Vista](https://en.m.wikipedia.org/wiki/Windows_Vista) service pack 2 or later). iCloud replaced Apple's MobileMe service,[[17]](https://en.m.wikipedia.org/wiki/Apple_ID#cite_note-fromto-17) acting as a data syncing center for email, contacts, calendars, bookmarks, notes, reminders (to-do lists), iWork documents, photos and other data. The service also allows users to wirelessly back-up their iOS devices to iCloud instead of manually doing so using [iTunes](https://en.m.wikipedia.org/wiki/ITunes).”

On IOS, you cannot have multiple user accounts at the same time, but you can log out of your apple ID and into another to gain access to different things/files.

“Apple File System (APFS) is a [proprietary](https://en.wikipedia.org/wiki/Proprietary_software) [file system](https://en.wikipedia.org/wiki/File_system) for [macOS](https://en.wikipedia.org/wiki/MacOS) [High Sierra (10.13)](https://en.wikipedia.org/wiki/MacOS_High_Sierra) and later, [iOS](https://en.wikipedia.org/wiki/IOS) 10.3 and later, [tvOS](https://en.wikipedia.org/wiki/TvOS) 10.2 and later,[[6]](https://en.wikipedia.org/wiki/Apple_File_System#cite_note-6) and [watchOS](https://en.wikipedia.org/wiki/WatchOS) 3.2 and later,[[7]](https://en.wikipedia.org/wiki/Apple_File_System#cite_note-The_Verge_update_today-7) developed and deployed by [Apple Inc.](https://en.wikipedia.org/wiki/Apple_Inc.)[[8]](https://en.wikipedia.org/wiki/Apple_File_System#cite_note-8)[[9]](https://en.wikipedia.org/wiki/Apple_File_System#cite_note-digging-into-apfs-9) It aims to fix [core problems](https://en.wikipedia.org/wiki/HFS_Plus#Criticisms) of [HFS+](https://en.wikipedia.org/wiki/HFS_Plus) (also called Mac OS Extended), APFS's predecessor on these operating systems. Apple File System is optimized for [flash](https://en.wikipedia.org/wiki/Flash_memory) and [solid-state drive](https://en.wikipedia.org/wiki/Solid-state_drive) storage, with a primary focus on [encryption](https://en.wikipedia.org/wiki/Encryption).[[10]](https://en.wikipedia.org/wiki/Apple_File_System#cite_note-9to5Mac_APFS_announced-10)[[11]](https://en.wikipedia.org/wiki/Apple_File_System#cite_note-Ars_APFS_spotted-11) APFS supports 64-bit [inode numbers](https://en.wikipedia.org/wiki/Inode_number), supporting over 9 quintillion files on a single volume. Apple File System is designed to avoid metadata corruption caused by system crashes. Instead of overwriting existing metadata records in place, it writes entirely new records, points to the new ones and then releases the old ones. This avoids corrupted records containing partial old and partial new data caused by a crash that occurs during an update. It also avoids having to write the change twice, as happens with an HFS+ journaled file system, where changes are written first to the journal and then to the catalog file.”

**Topic G – Special Features of your OS**

“Pros:

1. Less chances of malware
2. Curated app store
3. Both hardware and software are controlled by a single company (Apple)” (https://www.prizminstitute.com/blog/android-vs-ios-which-is-the-best-operating-system/)

“ Security: apps are running in silos and cannot touch what other apps are doing. Like, stealing your data

Frugality: due to the way the memory is managed, it uses roughly half the memory as Android (automatic reference counting vs garbage collection)

Ergonomy: iOS adapts gracefully to any screen size or orientation.

Ecosystem: lots of programmers provide a lot of apps, and respond to innovation pretty quickly. Users quickly upgrade to the lastest version as well. Android is much more fragmented.” (Quora.com)

“Apple’s iOS offers consistent and timely software updates and security patches. If you want the same experience on Android, then you must buy one of Google’s Pixel phones.” (<https://www.digitaltrends.com/mobile/android-vs-ios/>)

Features Include (Wikipedia) :

* The home screen, rendered by [SpringBoard](https://en.wikipedia.org/wiki/SpringBoard), displays [application](https://en.wikipedia.org/wiki/Application_software) icons and a dock at the bottom where users can pin their most frequently used apps. The home screen appears whenever the user unlocks the device or presses the physical "Home" button whilst in another app.[[57]](https://en.wikipedia.org/wiki/IOS#cite_note-57) The screen has a status bar across the top to display data, such as time, battery level, and signal strength. The rest of the screen is devoted to the current application. When a passcode is set and a user switches on the device, the passcode must be entered at the Lock Screen before access to the Home screen is granted.[[58]](https://en.wikipedia.org/wiki/IOS#cite_note-58)
* iOS 4 introduced folders, which can be created by dragging an application on top of another, and from then on, more items can be added to the folder using the same procedure. A title for the folder is automatically selected by the category of applications inside, but the name can also be edited by the user.[[71]](https://en.wikipedia.org/wiki/IOS#cite_note-Folders-71)
* [Notification Center](https://en.wikipedia.org/wiki/Notification_Center) , which allows users to view a history of notifications. The user can tap a notification to open its corresponding app, or clear it.[[75]](https://en.wikipedia.org/wiki/IOS#cite_note-75) Notifications are now delivered in banners that appear briefly at the top of the screen. If a user taps a received notification, the application that sent the notification will be opened. Users can also choose to view notifications in modal alert windows by adjusting the application's notification settings. Introduced with iOS 8, widgets are now accessible through the Notification Center, defined by 3rd parties.
* iOS offers various accessibility features to help users with vision and hearing disabilities. One major feature, [VoiceOver](https://en.wikipedia.org/wiki/VoiceOver), provides a voice reading information on the screen, including contextual buttons, icons, links and other [user interface](https://en.wikipedia.org/wiki/User_interface) elements, and allows the user to navigate the operating system through gestures.
* [Multitasking](https://en.wikipedia.org/wiki/Computer_multitasking) for iOS was first released in June 2010 along with the release of [iOS 4](https://en.wikipedia.org/wiki/IOS_4).[]](https://en.wikipedia.org/wiki/IOS#cite_note-TheRegister1-86) Currently, multitasking is supported on iPhone 3GS+, iPod Touch 3rd generation+, and all iPad models.[[87]](https://en.wikipedia.org/wiki/IOS#cite_note-Apple1-87)
* Siri ([/ˈsɪəri/](https://en.wikipedia.org/wiki/Help:IPA/English)) is an [intelligent personal assistant](https://en.wikipedia.org/wiki/Intelligent_personal_assistant) integrated into iOS. The assistant uses voice queries and a [natural language user interface](https://en.wikipedia.org/wiki/Natural_language_user_interface) to answer questions, make recommendations, and perform actions by delegating requests to a set of Internet services. The software adapts to users' individual language usages, searches, and preferences, with continuing use. Returned results are individualized.
* [Game Center](https://en.wikipedia.org/wiki/Game_Center): Game Center is an [online](https://en.wikipedia.org/wiki/Internet) [multiplayer](https://en.wikipedia.org/wiki/Multiplayer_video_game) "social gaming network"[[111]](https://en.wikipedia.org/wiki/IOS#cite_note-appleDEV-111) released by Apple.[[112]](https://en.wikipedia.org/wiki/IOS#cite_note-112) It allows users to "invite friends to play a game, start a multiplayer game through matchmaking, track their [achievements](https://en.wikipedia.org/wiki/Achievement_(video_gaming)), and compare their high scores on a [leaderboard](https://en.wikipedia.org/wiki/Ladder_tournament)." iOS 5 and above adds support for profile photos.[[111]](https://en.wikipedia.org/wiki/IOS#cite_note-appleDEV-111)

**Topic H – Limitations of your OS**

“Cons:

1. Walled-garden ecosystem
2. Customization is limited
3. No expandable storage” (https://www.prizminstitute.com/blog/android-vs-ios-which-is-the-best-operating-system/)

“**Customization**: you can't change much of how your iPhone looks like. Without an app drawer you are basically stuck with the way your apps are and with no space to put away your apps while you are moving them around, it basically sucks. You can't even move around your pages! Also, you can't install launchers and custom Roms. Launchers change the way your home screen looks like. They make your phone awesome. Custom Roms totally change your phone from home screen to notification center...

**File transferring**: for Apple phones got have to first download iTunes, put your songs in it, make a playlist off which songs you want, connect your iPhone, then sync your songs... in Android, all you need to do is connect your phone and drag-and-drop your files (though Samsung Kies is like iTunes, it still works on the drag and drop principle and Kies is not even necessary).

**Camera:** most android phones have a WAY better camera than iPhones. Take the iPhone 6 (8 MP rear) and the Samsung Galaxy Alpha (12 MP rear).

**Third-party controllers**: in iPhone, you can't let a third-party service take control over your phone, while in Android you can.

**Battery:** the battery life of iPhone is very small. And when that small account finished, you plug in your charger only to wait like 10 MINUTES FOR IT TO TURN ON!!

**Price**: most Android phones are WAY cheaper than those whopping prices of iPhones” (Quora.com)

**A.6 Level Two**

Topic A

* What is it?
  + It is a [mobile operating system](https://en.m.wikipedia.org/wiki/Mobile_operating_system) created and developed by [Apple Inc.](https://en.m.wikipedia.org/wiki/Apple_Inc.) exclusively for [its hardware](https://en.m.wikipedia.org/wiki/List_of_iOS_devices)
  + It is the operating system that presently powers many of the company's mobile devices, including the [iPhone](https://en.m.wikipedia.org/wiki/IPhone), [iPad](https://en.m.wikipedia.org/wiki/IPad), and [iPod Touch](https://en.m.wikipedia.org/wiki/IPod_Touch)
  + It is the second most popular mobile operating system globally after [Android](https://en.m.wikipedia.org/wiki/Android_(operating_system))
* Applications
  + 2.2 million available in January 2017
  + These apps have collectively been downloaded more than 130 billion times.App intelligence firm Sensor Tower has estimated that the App Store will reach 5 million apps by the year 2020
* Hardware
  + The main hardware platform for iOS is the [ARM architecture](https://en.m.wikipedia.org/wiki/ARM_architecture)

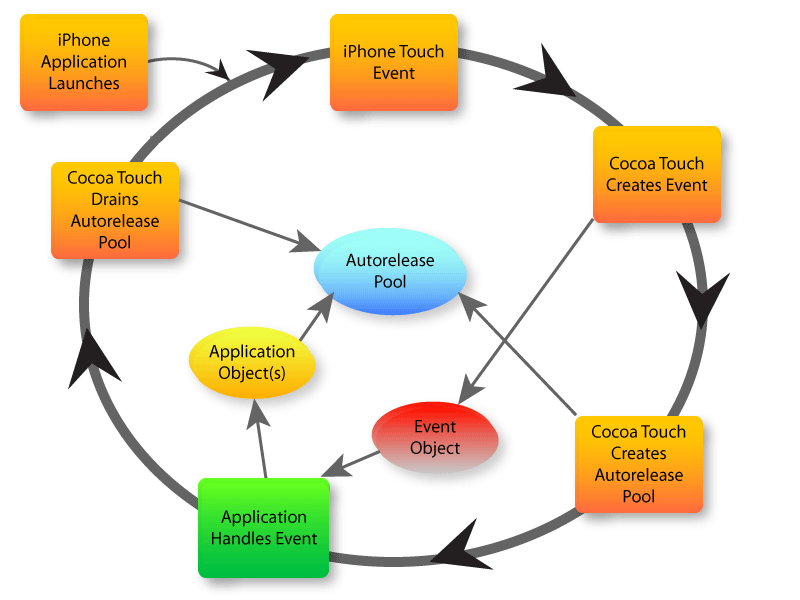
Topic B

* User Interface
  + The iOS [user interface](https://en.m.wikipedia.org/wiki/User_interface) is based upon [direct manipulation](https://en.m.wikipedia.org/wiki/Direct_manipulation_interface), using [multi-touch](https://en.m.wikipedia.org/wiki/Multi-touch) gestures. Interface control elements consist of sliders, switches, and buttons.
  + Interaction with the OS includes gestures such as swipe, tap, pinch, and reverse pinch, all of which have specific definitions within the context of the iOS operating system and its multi-touch interface.
  + Internal [accelerometers](https://en.m.wikipedia.org/wiki/Accelerometer) are used by some applications to respond to shaking the device (one common result is the [undo](https://en.m.wikipedia.org/wiki/Undo) command) or rotating it in [three dimensions](https://en.m.wikipedia.org/wiki/3D_modeling)(one common result is switching between portrait and landscape mode).
* Accessibility
  + Apple has been significantly praised for incorporating thorough [accessibility](https://en.m.wikipedia.org/wiki/Accessibility) functions into iOS, enabling users with vision and hearing disabilities to properly use its products.” (Wikipedia) “called Cocoa Touch

Topic C

* iPhone applications run in an event loop, as shown in the diagram below. That is, when your iPhone application launches, the program enters the event loop and waits for a user touch event. When a touch event happens, the Cocoa Touch framework detects the event, creates an event object, and allocates and initializes an autorelease pool. Cocoa Touch then invokes your application event handler, making the event object available.

Topic D

* ****

Topic E

* Updates
  + Apple provides major updates to the iOS operating system annually via [iTunes](https://en.m.wikipedia.org/wiki/ITunes) and also, for iOS 5 and later, [over-the-air](https://en.m.wikipedia.org/wiki/Wireless).
  + The latest version is [iOS 12](https://en.m.wikipedia.org/wiki/IOS_12), released on September 17, 2018.[]](https://en.m.wikipedia.org/wiki/IOS#cite_note-48) It is available for [iPhone 5S](https://en.m.wikipedia.org/wiki/IPhone_5S) and later, [iPad Air](https://en.m.wikipedia.org/wiki/IPad_Air) and later, [iPad Pro](https://en.m.wikipedia.org/wiki/IPad_Pro), [iPad Mini 2](https://en.m.wikipedia.org/wiki/IPad_Mini_2) and later, and sixth-generation [iPod Touch](https://en.m.wikipedia.org/wiki/IPod_Touch)[]](https://en.m.wikipedia.org/wiki/IOS#cite_note-49)
  + Originally, iPod Touch users had to pay for system software updates. This was due to accounting rules making the device not a "subscription device" like iPhone or Apple TV, and significant enhancements to the device required paymentsThe requirement to pay to upgrade caused iPod Touch owners to stay away from updates. However, in September 2009, a change in accounting rules won tentative approval, significantly affecting both Apple's earnings and stock price, and allowing iPod Touch updates to be delivered for free
* Security: apple uses many features such as:
  + Secure Boot
  + Secure Enclave
  + Passcode
  + Touch ID
  + Address Space Layout Randomization
  + Non-Executable Memory:
  + Encryption: Keychain
  + App Security: Third-party applications such as those distributed through the App Store must be code signed with an Apple-issued [certificate](https://en.m.wikipedia.org/wiki/Public_key_certificate). App Store bypasses
  + Circa January-February 2019
  + Network Security
  + Two-factor authentication is an option in iOS to ensure that even if an unauthorized person knows an [Apple ID](https://en.m.wikipedia.org/wiki/Apple_ID) and password combination, they cannot gain access to the account. It works by requiring not only the Apple ID and password, but also a verification code that is sent to a device that is already known to be trusted

Topic F

* Apple ID is an authentication method used by [Apple](https://en.m.wikipedia.org/wiki/Apple_Inc.) for [iPhone](https://en.m.wikipedia.org/wiki/IPhone), [iPad](https://en.m.wikipedia.org/wiki/IPad), [Mac](https://en.m.wikipedia.org/wiki/Macintosh) and other Apple devices.
  + Apple IDs contain user personal information and settings. When an Apple ID is used to log into an Apple device, the device will automatically use the settings associated with the Apple ID.
  + An Apple ID account can be created free of charge from the My Apple ID web page. An Apple ID is a valid email address, protected by a password
  + Apple ID launched an optional two-step verification security feature for authentication. When enabled, a second verification step is required when using the Apple ID under certain conditions, such as a web login, or making a Store purchase from a new device. The feature uses the Find My iPhone service to send a four-digit pin code to a trusted device associated with the Apple ID when the second verification step is required for authentication.
* iCloud
  + allows users to store data such as music and [iOS](https://en.m.wikipedia.org/wiki/IOS) applications on remote computer serversfor download to multiple devices such as iOS-based devices
* Apple File System (APFS)
  + a [proprietary](https://en.wikipedia.org/wiki/Proprietary_software) [file system](https://en.wikipedia.org/wiki/File_system)
  + APFS supports 64-bit [inode numbers](https://en.wikipedia.org/wiki/Inode_number), supporting over 9 quintillion files on a single volume. Apple File System is designed to avoid metadata corruption caused by system crashes. Instead of overwriting existing metadata records in place, it writes entirely new records, points to the new ones and then releases the old ones.

Topic G

* Pros
  + Less chances of malware
  + Curated app store
  + Both hardware and software are controlled by a single company (Apple)
* Features
  + Folders
  + Notification Center
  + Game Center
  + Multitasking
  + Accesibility
  + Siri

Topic H: Cons

* Walled-garden ecosystem
* Customization is limited
* No expandable storage
* Battery life
* price