

APPENDIX F

Selected Apple innovations that have benefited the App Store

Hardware, software, and integration

#	Description of Feature	Initial Release	Description of Innovation	Examples of Apps Which Benefit from this Innovation
1.	Accelerometer: • All iOS devices have an accelerometer, which delivers acceleration values along the three space dimensions. • The accelerometer enables players to shake or tilt the iPhone as an input for mobile games and, as a result, enables new types of games to be developed for and played on mobile phones.	2007	<ul style="list-style-type: none"> The first iPhone in 2007 was one of the first phones to use accelerometer technology in the U.S. Apple later combined it with other tools, such as a gyroscope and multi-touch screen. The motion-sensing technology combination enables the phone to be used as a mobile game controller. 	<ul style="list-style-type: none"> Any app that uses the accelerometer for motion-sensing, such as fitness tracking and sky viewing. Gaming apps also benefited from this feature; one successful example is SEGA's Super Monkey Ball, which was at the top of the iPhone downloads chart in 2008.
2.	Capacitive Multi-Touch Touchscreen: • Multi-touch is the ability of touchscreens to recognize two or more separate contacts at the same time. • It allows gestures like the intuitive pinch-to-zoom feature.	2007	<ul style="list-style-type: none"> When the iPhone was first introduced in 2007, it featured a multi-touch touchscreen. By allowing consumers to use hands instead of a stylus or physical keyboard, this feature created an easier-to-use device with a far broader range of applications than prior handsets. The iPhone was the first widespread device with this technology. 	<ul style="list-style-type: none"> Games can use multi-touch in their user interfaces. A notable example is Eliss Infinity by Little Eyes LLC, an award-winning puzzle game where players use their fingers to combine and separate planets.
3.	iPhone Camera: • The first iPhone (2007) featured a back-facing camera. Numerous upgrades to the iPhone camera feature have been introduced since.	2007	<ul style="list-style-type: none"> In 2010, Apple added a front-facing camera for the first time. In 2017, Apple introduced 12MP cameras calibrated specifically for Augmented Reality applications. ARKit utilized the advanced cameras to expand Augmented Reality capabilities for games and other apps. Since 2017, Apple has made additional camera-related upgrades to the various iPhone models, including adding more camera sensors and lenses. In 2020, the iPhone 12 Pro and iPhone 12 Pro Max were upgraded with the ability to take photos in Apple ProRAW, which combines the information from the standard RAW format along with iPhone image processing. According to Apple, Apple ProRAW gives consumers more flexibility when editing the exposure, color, and white balance in a photo. Upgrades provided consumers with better quality photos and videos, and developers gained access to better hardware for apps centered on photography/videography with every upgrade, including for Augmented Reality apps. 	<ul style="list-style-type: none"> Photography-related apps that offer photo-capturing and photo-editing abilities benefit from the advanced mobile photography features offered by the iPhone. On social media apps like Instagram, these features support the creation of user-generated content. The photo editing app Darkroom by developer Bergen Co., adds support for ProRAW photos with a new "Tone Map" slider. RAW images are "optimized for preserving details & editing latitude," which can then be processed in Darkroom using exposure-correction and tone-mapping sliders. The result is a photo with "all the convenience of JPEG processing," without the "cost of JPEG compression." AirMeasure by Laan Labs is an example of an Augmented Reality app that leverages the iPhone camera. AirMeasure is a measuring toolkit that uses the ARKit and iPhone camera to measure a range of items, including room dimensions, faraway structures, and people. The camera app DSLR Camera by developer Fulvio Scichilone, utilizes the iPhone camera and Augmented Reality to create "custom layers of 3D information" such as displaying the distance between the subject and the camera.

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A DEFENDANT	United States District Court Northern District of California Case No. 4:20-cv-05640-YGR Case Title <u>Epic Games, Inc. v. Apple, Inc.</u> Exhibit No. <u>DX-5335</u> Date Entered _____ Susan Y. Soong, Clerk By: _____, Deputy Clerk
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4.	Network Access Capabilities: <ul style="list-style-type: none">The first iPhone (2007) had access to the 2G wireless network using Enhanced Data for Global Evolution (“EDGE”) technology, providing download speeds of up to 236 kbps.The iPhone 3G (2008) had access to the 3G network, which enabled download speeds that were twice as fast as the first-generation iPhone.The iPhone 5 (2012) had access to the 4G LTE network, providing download speeds of up to 12 Mbps.The iPhone 12 (2020) had access to the 5G network, providing download speeds of up to 150 Mbps.	2007	<ul style="list-style-type: none"> The App Store launched with 3G enabled in 2008. Apple's introduction of 4G enabled the development of apps with a more comprehensive multimedia experience (i.e., video integrated with audio offerings) and intensive, real-time multiplayer games. Apple's introduction of 5G made Augmented Reality, Virtual Reality and Mixed Reality experiences easier to implement on apps. These features require enhanced data processing which the iPhone facilitates. Apple's introduction of 5G also improved video streaming and locational accuracy, which contribute to the quality of mobile games along with Augmented Reality. 	<ul style="list-style-type: none"> Improved network performance made GPS navigation through apps like Google Maps easier and more accessible in areas outside of Wi-Fi range. The Netflix app and other streaming apps benefited from faster 4G speeds. 5G stands to benefit apps using Augmented Reality like IKEA Place.
5.	GPS: <ul style="list-style-type: none">With the launch of the iPhone 3G in 2008, Apple introduced built-in GPS technology.	2008	<ul style="list-style-type: none"> The original iPhone used Wi-Fi and cellular tower positioning systems that only allowed for approximate location. Including GPS enabled more accurate and faster turn-by-turn navigation, among other location-based features. 	<ul style="list-style-type: none"> Fitness apps like RunKeeper and MapMyRun utilize the GPS functionality to provide workout tracking. Navigation apps like Google Maps and TomTom Go utilize the GPS functionality to provide more accurate turn-by-turn navigation and vehicle mapping services.
6.	Apple Push Notification Service: <ul style="list-style-type: none">Apple Push Notification Service is a service that allows apps to send users a message when something changes in the app. This service prompts users to open apps when needed and prevents them from having to check all apps constantly. In multiplayer games, users can send their friends a push notification to invite them to a game.	2009	<ul style="list-style-type: none"> This innovation addressed a key issue with Apple mobile devices at the time, which was that third-party apps could not run in the background while another app was being used. The push notification service allowed all third-party apps that integrated Apple's Push Notification Service to send users updates and prompts, which reduced the need for users to frequently open and close apps to remain up to date. While the devices still did not offer multitasking, push notifications improved productivity and responded to customer concerns. 	<ul style="list-style-type: none"> AIM for iPhone by AOL was a popular messaging app. The app was an early adopter of the push notification feature, which alerted users when they received a new message from a contact. AIM's adoption of push notifications was said at the time to influence text message providers to lower their costs, as the addition of push notifications meant that AIM communications mimicked the text experience to the extent that it could be a substitute.

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7.	Apple iPhone Chips: <ul style="list-style-type: none"> • Apple's chips have evolved over time to include better processing and better graphics quality. Apple has used Apple-designed chips in its phones since the iPhone 4 in 2010 (A4 chip). • A5 chip (2011) included upgraded graphics (including faster rendering, shading, and response times), and better processing power. • A6 chip (2012) included graphics that were viewed to be almost console quality and allowed for a much longer battery life. • 64-bit A7 chip (2013) improved graphics quality and supported an upgraded OpenGL. • A8 chip (2014) introduced support for Metal and better frame rates and performance, and A9 chip (2015) was 90% faster than A8. • A10 "Fusion" chip (2016) boasted even faster performance, better graphics, and better battery life. • A11 "Bionic" chip (2017) offered multiple cores, led to very fast speeds, included a live light sensor, and had an in-house GPU. • A12 (2018) was the first 7-nanometer chip and included improvements in speed, rendering, and compression along with a new GPU that was 50% faster than in A11. • A13 (2019) led to 40% less power use than A12 and faster graphics that were optimized for Metal. • A14 (2020) led to performance and battery improvements along with enhanced ability for machine learning. 	2010	<ul style="list-style-type: none"> • Apple's use of Apple-designed chips since 2010 made it possible to vertically integrate the iPhone and iPad to maximize battery life and performance. Apple's products were no longer subject to third-party chip limitations and could be customized to match with its software. 	<ul style="list-style-type: none"> • Almost all apps that are run on the iPhone or iPad benefit from these chip innovations.
8.	Gyroscope: <ul style="list-style-type: none"> • The Gyroscope is a motion sensor embedded in Apple's mobile devices that can sense motion on three axes and works with the accelerometer to capture information about the device's position. 	2010	<ul style="list-style-type: none"> • Apple was the first smartphone manufacturer to include a gyroscope. Notably, some dedicated game console devices lacked this feature. • With the accelerometer, the two technologies sense speed changes (accelerometer) and rotation (gyroscope) along three dimensions. 	<ul style="list-style-type: none"> • Pokéémon GO by developer Niantic is an app that used the gyroscope to enable a user experience that would not have been possible without it. The app is a very popular game that had an Augmented Reality setting in which users could see, find, and capture Pokéémon in the real-world environment they were in. The gyroscope was necessary to capture the user's movements as they pursued the Pokéémon.

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9.	iPad (1st Generation): <ul style="list-style-type: none">• The first generation iPad was Apple's first iOS tablet device, with a 10-inch screen and 1 GHz chip.	2010	<ul style="list-style-type: none">• The 10-inch screen, over 3 times the size of the iPhone's, presented a new device on which consumers and developers utilized the App Store.	<ul style="list-style-type: none">• Developers for such games as Need for Speed: Shift (Electronic Arts Inc.), N.O.V.A (Gameloft), Pac-Man Championship Edition (Bandai Namco), and Sonic the Hedgehog (SEGA) expressed excitement upon the release of the iPad because of the new opportunities presented by the larger screen.
10.	iPhone Retina Display: <ul style="list-style-type: none">• The iPhone 4 (2010) introduced the Retina Display which improved screen resolution, making individual pixels unperceivable to the average human eye at a distance of 12 inches.• The iPhone 5 (2012) expanded the iPhone display from 3.5 inches diagonally to 4 inches. A wider, taller screen provided an enhanced viewing and playing surface for all media-rich applications.• The iPhone 6 and iPhone 6 Plus (2014) expanded the iPhone display to 4.7 and 5.5 inches, improving the iPhone's suitability as a rich-media device.• The iPhone X (2017) featured an OLED Super Retina Display and expanded the iPhone display to 5.8 inches and extended the screen across the entire body of the phone. It also eliminated the home button, further increasing the usable footprint of the screen and improving user-interface options for game and app developers.• The iPhone XS Max and iPhone XR (2018) extended the iPhone display to 6.5 and 6.1 inches.• The iPhone 11 Pro and iPhone 11 Pro Max (2019) offered 1200 nits peak brightness, haptic touch and a wide-color range OLED screen for an improved gaming experience.• The iPhone 12 Pro Max (2020) featured an all-screen Retina XDR 6.7-inch OLED display, the largest display for an iPhone.	2010	<ul style="list-style-type: none">• The introduction of Retina Display with the iPhone 4 doubled the pixel resolution to the point to which it would appear "perfectly sharp for normal 20/20 Vision at typical Smartphone viewing distances of 10.5 inches or more."	<p>In 2010, Gameloft's first-person shooter game N.O.V.A. was updated to take advantage of the iPhone's Retina Display. This enabled new high-resolution graphics that were able to rival those of tablet versions of the game.</p>
11.	Multitasking: <ul style="list-style-type: none">• Multitasking allowed multiple apps to run on a device at the same time and made it easier to toggle between different apps.	2010	<ul style="list-style-type: none">• Apple offered a unique implementation of multitasking. While other multitasking features allowed apps to run fully in the background, Apple's solution froze apps in a "last used" state when users switched away and allowed some processes to run simultaneously (such as music or navigation apps and task completion). Restricting the ability to run in the background reduced the load on iPhone memory and preserved device battery life.	<ul style="list-style-type: none">• One of the most prominent applications to adopt multitasking support early was Dropbox, the file sharing app, in 2010. The app allowed users to upload and sync their documents in the background while running other applications, so that users did not have to wait for processes to finish before accessing another app.

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12.	AirDrop: • AirDrop is a wireless file transfer system that works between Apple devices that are close in proximity without internet. It was released on iOS 7 in 2013. This file transfer is more secure than sending files over a network.	2011	• First completely wireless peer-to-peer file-sharing between devices.	• Many file-based apps benefit from AirDrop. One example is Affinity Photo by Serif Labs, which is a popular professional photo editing software on which users can switch easily between mobile and desktop using AirDrop. The company's website advertises AirDrop as a way to transfer files between devices.
13.	Siri: • Siri is a voice-activated assistant that can access apps and perform tasks on apps using voice commands.	2011	• Apple was the first to introduce this feature to a wide audience.	• Pandora, the popular music app, has Siri integration. Users can start, stop, and request music using voice commands. This feature has been advertised by the company.
14.	Touch ID: • Touch ID is a sensor that reads fingerprints to unlock devices and authorize purchases. This can be used for apps to perform local authentication. • The fingerprint scanner can be used for unlocking the device and making secure transactions in the App Store. Touch ID can also be used for iTunes Store, Apple Books Store, and Apple Pay.	2013	• Touch ID was considered to be more reliable and more secure compared to past efforts to include a fingerprint scanner.	• Almost any app with purchases is affected by Touch ID, especially for game apps and apps with in-app purchases.
15.	CarPlay: • CarPlay, formerly known as iOS in the Car, allowed consumers to access their iOS applications on compatible cars while driving, through the car's computer.	2014	• First smartphone manufacturer to include cars in the device ecosystem.	• One of the first apps to have CarPlay support is Stitcher, a popular podcast application. When first announced, the ability to use Stitcher in CarPlay was much-publicized by the company. Stitcher had revenue of \$72.5 million in 2019 and was purchased by SiriusXM for \$325 million in 2020. Other compatible apps are Spotify and iHeart Radio.
16.	Handoff: • Handoff is part of Continuity, a suite of tools that allow you to seamlessly transition between files and processes on separate Apple devices. The new Handoff feature allows users to begin a process or task on one device and continue doing so on another device. It also enables proximity sensing between devices, and also alert users to when they may want to use one device as a mobile hotspot.	2014	• Apple created an infrastructure to integrate different devices in its ecosystem. Users are able to switch between devices without losing information or progress.	• Notetaking or other document-based apps benefit from Handoff because editing can begin on one device and end on another. One example of this is Bear, a well-known note-taking app by developer Shiny Frog Ltd. Bear has advertised its support for Handoff in its social media posts and publicized the ability to "quickly switch devices while working on the same note."

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17.	Apple Pencil and Scribble: <ul style="list-style-type: none">• Apple Pencil was introduced in 2015 as an Apple-specific stylus meant to provide detailed annotations on the iPad. Pencil has been updated to include wireless charging and other features. Pencil has the ability to sense tilt, pressure, and orientation to mimic the handwriting process.• Scribble is meant to make writing directly on the iPad easier. Handwritten text can be searchable, copied and pasted, and it is considered typed text once it is inputted. Scribble can also correct small imperfections in writing.	2015	<ul style="list-style-type: none">• The first stylus to be tailored to Apple devices.• Pencil has “almost no lag on screen.”• Pencil has been updated throughout the years to include new features, like wireless charging.	<ul style="list-style-type: none">• Adobe Photoshop for iPad is one popular app that has benefited from the Pencil integration due to the very fine nature of the work done on the app. Adobe has added special features that can be used while using Pencil, and has integrated various settings for Pencil in the app.
18.	iPhone Stereo Upgrades: <ul style="list-style-type: none">• The iPhone 7 was upgraded with stereo speakers, with speakers on both the top and bottom of the phone which amplifies audio twice as loud as the iPhone 6s, and provides dynamic range for better sound quality.• The iPhone 8 (2017) redesigned the stereo speakers to be 25% louder and a deeper bass than the iPhone 7.• The iPhone XS (2018) introduced “Stereo Widening” which improved stereo sound. The speakers and software upgrade deliver wider sound stereo.	2016	<ul style="list-style-type: none">• Introduced in the iPhone 7, the stereo speakers automatically flip the left and right audio channels when the device is rotated in landscape orientation.• The iPhone XS stereo upgrades increased the performance of the front speaker, which resulted in a “richer” sound and “deeper” bass.	<ul style="list-style-type: none">• Bethesda’s Elder Scrolls: Blades utilized the Stereo Widening features of the iPhone XS to create “an immersive aural experience without the use of headphones.”
19.	Dark Mode: <ul style="list-style-type: none">• One of the newest features was Dark Mode, which creates a dark background and color scheme for the entire device screen when turned on or when automatically initiated by time changes.	2019	<ul style="list-style-type: none">• This is the first mobile operating system to have a built-in Dark Mode that applies to all built-in apps.	<ul style="list-style-type: none">• One app that was an earlier adopter of iOS Dark Mode was Flexibits Inc.’s Fantastical, a calendar app. The Fantastical website walks users through how to implement dark mode and advertises its dark and light settings as a feature of the app.

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20.	LiDAR: <ul style="list-style-type: none">• Apple introduced Light Detection and Ranging (“LiDAR”) systems on iPhone 12 Pro, which improves photographs and Augmented Reality.	2020	<ul style="list-style-type: none">• Improved upon existing smartphone LiDAR technology by implementing scanning technology that increases range by up to five meters.	<ul style="list-style-type: none">• Snapchat by Snap, Inc. became one of the first apps to take advantage of the new LiDAR technology, implementing new filters and lenses with Lens Studio 3.2.• LiDAR Scanner 3D by developer Marek Simonik and Canvas by developer Occipital, Inc. utilized the technology to enable users to create accurate 3D models of their homes.
21.	M1 ARM Chips: <ul style="list-style-type: none">• Apple's use of M1 chips in high-performance PCs brought an in-house designed ARM chip (typically used in mobile phones) to an Apple computer, resulting in faster speeds and better battery life. These chips allow iOS and iPadOS apps to run natively on Macs. Apple released these computers with Rosetta 2, which allowed non-native apps built for the older chips to run on new computers.	2020	<ul style="list-style-type: none">• First to be used in high-performance computers.• Apple's integration means that M1 Macs can also run iOS and iPadOS apps.• Competitors have attempted using ARM chips in computers before, however the resulting devices ran into processing issues.	<ul style="list-style-type: none">• Blizzard's World of Warcraft is a popular multiplayer game with millions of users. It was one of the first apps to switch to running natively on M1 Macs. After the switch, reviewers had positive things to say about how M1 improved the performance of the game. Commentators speculated that World of Warcraft's adoption of M1 would lead others to do so as well.

Source: See my backup.

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Developer tools

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1.	Xcode: <ul style="list-style-type: none">• Xcode is a complete developer toolset for creating apps for Mac, iPhone, iPad, Apple Watch, and Apple TV.• In 2008, Apple launched a new version of Xcode that enabled developers to build applications for the iPhone.• Brings user interface design, coding, testing, debugging, and submitting to the App Store all into a unified workflow.	2003	<ul style="list-style-type: none">• Xcode is Apple's integrated development environment ("IDE"), which has updated since its release with many new SDKs and a new programming language (Swift, see below for more detail).• Each release of Xcode has provided more functionality for developers. Xcode 6 contained 2.3 GB of content, whereas Xcode 11 contained more than three times as much (7.6 GB).	<ul style="list-style-type: none">• Potential benefit to all apps.• The iPhone Developer Program Satisfaction Survey in 2010 found 89% of developers were satisfied with Xcode.• Apple Insider describes Xcode as "[a] long-standing tool for app production, Xcode is a well-known integrated development environment (IDE), enabling developers to write the code and compile apps that can be used on various devices and operating systems. As Apple's own IDE, it is primarily used for the development of apps within its own ecosystem, though it can be used for writing source code in a variety of languages for use in other projects."
2.	Software Development Kit: <ul style="list-style-type: none">• The first iOS software development kit ("SDK") provided developer tools to build apps leveraging the iPhone's hardware and software such as the Multi-Touch touchscreen and accelerometer.• Developer tools such as Xcode (environment to develop applications supporting multiple languages), Interface Builder (build interfaces without code), iPhone Simulator (test apps on the computer), debugging features (locate problems within code), and Instruments (optimize and audit applications) provided developers with a broad toolset for app development.• Apple enabled the use of open-source programming interfaces such as OpenGL and OpenAL providing developers the ability to replicate quality and fidelity of console games.	2008	<ul style="list-style-type: none">• The SDK provided developers access to the new iPhone's hardware and software innovations, such as the Multi-Touch user interface, the three-axis accelerometer, and geographical location and technology.• Today, Apple provides 150,000 APIs for developers using iOS 14.• Apple's support for the OpenGL graphics API in iPhones allowed higher-quality games to be played on the device.• According to Apple's developer documentation, there are over 60 Software Development Kits available for developers in addition to the iOS SDK.	<ul style="list-style-type: none">• Super Monkey Ball by SEGA was launched together with the iOS SDK and is an example of an app that leveraged the SDK to utilize the iPhone's accelerometer, instead of a traditional joystick or keyboard. Senior Producer Ethan Einhorn stated that "It's pretty amazing what we were able to come up with in only two weeks of development," and that "[f]or the first time, [...] we're able to create an authentic console experience in your pocket."• The game Kroll by Digital Legends Entertainment is an example of an early adopter of OpenGL and touch controls and was presented at Apple's WWDC in 2008. It was described as giving users an experience that did not seem like it was on the phone. Its developers touted the 3D rendering and called the capabilities of OpenGL on iPhone "often better than portable gaming device[s]." The game won several awards when first released.
3.	Core Motion API: <ul style="list-style-type: none">• Apple released the Core Motion API in 2010 along with the gyroscope-enabled iPhones. The new API made it possible for developers to incorporate information from the gyroscope, magnetometer, and accelerometer embedded in the iPhone by compiling data from all three to identify a device's positioning and movement. This was especially important for games.	2010	<ul style="list-style-type: none">• Apple is the first to include a gyroscope in their phones, and Core Motion was the API designed to handle the data it generated. The API made it easier for developers to access and utilize the data in their apps.	<ul style="list-style-type: none">• Almost all gyroscope-enabled apps use Core Motion to integrate the gyroscope data into applications. This includes games, but it also includes health and wellness applications that track the user's movement.

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4.	GameKit: <ul style="list-style-type: none">GameKit is a set of developer tools that enables developers to implement Game Center social-gaming network features, as well as multiplayer matchmaking.GameKit was updated in 2011 to introduce turn-based games.Game Center and Game Kit underwent a redesign in 2020 allowing users to view Game Center features in GameKit-integrated apps directly rather than through the Game Center app.	2010	<ul style="list-style-type: none">Game Center replaced previous third party networks on iOS like OpenFeint and Gameloft Live which only reached a small number of users.GameKit was free and easily accessible to all iOS developers and provided access to a much larger network of users.Consumers can directly download and purchase games through the Game Center app; in the nine months after its release, Game Center had 50 million registered users, which surpassed Xbox Live's 30 million users.	<ul style="list-style-type: none">Infinity Blade, released by Epic Games on iOS devices in 2010, was among the first game apps to integrate GameKit features. Consumers were able to play multiplayer matches with each other through the Game Center and unlock 64 achievements. By 2012, Infinity Blade had grossed over \$23 million, and was Epic's most profitable franchise in terms of years invested compared to revenue at the time.Sonic & SEGA All-Stars Racing was initially released with only local online and Bluetooth multiplayer capabilities, which required users to be within proximity to play against one another. Once integrated with Game Center, users could then play online with up to three friends.
5.	Dynamic Type: <ul style="list-style-type: none">Dynamic Type is an API that developers can add to their apps that allows consumers to customize the size of text on their screen.	2013	<ul style="list-style-type: none">In 2017, Dynamic Type was updated with built-in text styles which can automatically adjust font size according to the user's accessibility preferences. Consumers can also now scale the iOS Navigation Bar by long-pressing the Tab Bar icons.	<ul style="list-style-type: none">All apps can benefit with increased accessibility features, media apps in particular. More than 40% of iOS users have changed the font size away from the default size.
6.	SceneKit and SpriteKit: <ul style="list-style-type: none">SpriteKit (2013) is a 2D graphics framework that supports custom shaders and lighting, advanced physics effects and animations, and integrates with SceneKit.SceneKit (2014) is a 3D graphics framework that enables 3D rendering by incorporating a physics engine, a particle generator, and processes for scripting actions of 3D objects when animated in a scene (adjusting geometry, materials, lights, and cameras).	2013	<ul style="list-style-type: none">SceneKit and SpriteKit are easy-to-access, and have built-in project templates in Xcode 6.	<ul style="list-style-type: none">Disco Bees (by Scopely), launched in 2013, is a puzzle-matching game that was built entirely using SpriteKit. The developers found that using SpriteKit enabled them to "go quickly from concept to a polished game." The app reached 1 million downloads on the App Store within the first five months.Squashy Bug (by Appsolute Games LLC), launched in 2017, is a game that was built using SpriteKit.
7.	HealthKit and CareKit: <ul style="list-style-type: none">HealthKit provides a central, secure repository of health and fitness data on Apple's devices, which applications may access with the consumer's permission.Apple built CareKit, a platform to allow users to manage ongoing illness and has partnered with several high-profile institutions.	2014	<ul style="list-style-type: none">Among the first central databases to store health data written from various apps on a smartphone.In a few months after release, there were over 130 apps that integrated HealthKit; many innovative apps collecting various health measurements were released on the App Store and integrate with HealthKit.	<ul style="list-style-type: none">Lifesum: Diet & Macro Tracker is an app that allows users to collect data on their nutritional intake, integrates with HealthKit by sending data on daily nutritional measurements, and also retrieves data from HealthKit such as the user's weight, or sleep quality. In February 2021, the app generated \$800,000 in revenue on iOS devices and was downloaded over 300,000 times.

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8.	HomeKit: <ul style="list-style-type: none">• HomeKit is an SDK for creating apps that communicate with and control connected accessories in a consumer's home.• Developers can configure actions for smart devices, which can also be triggered with Siri.• HomeKit Secure Video (2019) allows local devices to analyze security camera footage, then encrypts the footage before sending it to iCloud for storage.• HomeKit-enabled Routers (2019) automatically firewall off each smart home accessory in a users home.	2014	<ul style="list-style-type: none">• HomeKit allows smart home and Internet of Things devices to work with iOS devices.• HomeKit enforces end-to-end encryption on all accessories and iOS devices, making it more secure than competitors.• Apple introduced a HomeKit Secure Video feature which encrypts and stores security footage for free on iCloud. Previously, security camera manufacturers would store footage on their own servers.• The automatic firewall for HomeKit-enabled Routers prevents one compromised device from infecting the rest of the network.	<ul style="list-style-type: none">• Apple now supports over 700 smart devices, which have passed HomeKit's security standards. These include smart lights, switches, thermostats, window shades, security, doorbells, and appliances.• Eve Systems has created a family of HomeKit-enabled accessories such as lights, appliances, radiators, and air quality monitors.• Follow the Sun by Matthew Corey is an app that allows lighting that can change to be automatically adjusted throughout the day.
9.	Metal: <ul style="list-style-type: none">• Metal is Apple's proprietary graphics framework.• Provides "near-direct access" to the GPU, enabling developers to maximize the graphics quality and computation efficiency of apps.• Enables builds on "an approachable, low-overhead architecture" with precompiled code to correct the lighting and shading of 3D graphics, fine-grained resource control, and multithreading support.	2014	<ul style="list-style-type: none">• Apple Metal is more concise and robust, requiring significantly fewer lines of code compared to other graphics APIs.• Metal places less strain on the CPU compared to OpenGL (one of the most common graphics APIs that required a lot of computational power to run).	<ul style="list-style-type: none">• iOS apps now widely use Metal, in 2017 Apple cited 148,000 apps making use of Metal directly and another 1.7 million that benefit from higher-level frameworks optimized for Metal.• Asphalt 8: Airborne by Gameloft was one of the first apps to be updated for support with Metal when iOS 8 was released, which greatly improved its graphics without the performance deterioration. It has been critically acclaimed, with a score of 91 out of 100 on Metacritic. The game now has 470 million players.• Gameloft's Modern Combat 5: Blackout was also updated with Metal, which enabled the game to use up to five times more particles, allowing for richer environments and weather effects, improved impact particles, and denser explosions.
10.	Swift: <ul style="list-style-type: none">• Swift is an open-source, easy-to-learn, general-purpose language, built by Apple using a modern approach to safety, performance, and software design patterns. Swift has a more simplified syntax and grammar, and is more concise, allowing less code to perform the same tasks.• It is integrated into Xcode, and is interoperable with existing application code written in other languages.• Swift Playgrounds (2016) was introduced as an app that helped developers learn how to program in Swift.• Swift was upgraded with SwiftUI in 2019, which enables easier and more interactive development of user interfaces.	2014	<ul style="list-style-type: none">• Code written in Swift is often faster than code written in previous languages used to program iOS apps, and was found to be 2.6x faster than Objective-C and 8.4x faster than Python 2.7 in completing a search algorithm.• Swift became one of the top 10 most popular languages in the world within three years. In 2019, Swift was officially the fastest growing programming language in history, according to the TIOBE Index.• When Swift launched, Objective-C was the language Apple used for iOS. At the time, Objective-C was the fastest growing language in the world. Apple still chose to create Swift, a new language with a modern syntax that made it easier for developers to make their apps. Apple made that language free and open source and supports versions for Linux and Windows.	<ul style="list-style-type: none">• Based on a 2019 study, some notable examples of apps with a portion of their code written in Swift include Microsoft Outlook (67%), Hulu (62%), Tinder (47%), Postmates (67%), and Walmart (80%)• Lyft in 2015, a year after Swift's release, completely rewrote its iOS app in the new language. Lyft's VP of engineering stated that "[y]ou could see the advantages of Swift, just in compactness and the more modern programming paradigm." In the space of three months, nearly all of Lyft's iOS developers were working in Swift, with the average engineer taking 2-3 weeks to be comfortable with the new language. Previously, a project that took more than a month with multiple engineers would now take a week for one engineer programming in Swift. The re-written app was more compact, performing the same amount of tasks with less than a third of the lines of code.

Selected Apple innovations that have benefited the App Store

Developer tools

#	Description of Feature	Initial Release	Description of Innovation	Examples of Apps Which Benefit from this Innovation
11.	TestFlight: <ul style="list-style-type: none">• TestFlight provides developers with the tools to invite volunteer testers, distribute prerelease versions of their app, and receive reviews and feedback.• Consumers can download TestFlight and browse for apps that developers are testing.	2014	<ul style="list-style-type: none">• Apple integrated TestFlight into the iOS development workstream and added key features to improve the distribution process such as allowing multiple versions of an app to be tested simultaneously and enabling developers to automatically update the beta versions of apps instead of relying on testers to do it manually.	<ul style="list-style-type: none">• Clubhouse, by developer Alpha Exploration Co., used TestFlight during its early testing of its new social networking app. Although it was immensely popular, it was important for the developers to grow the app in size gradually to remain in control of building the composition of their community, ensure the app did not break, and to tune the app as it grew.
12.	GameplayKit, Model I/O, and ReplayKit: <ul style="list-style-type: none">• As part of the iOS9 update, developers got access to three new gaming SDKs: GameplayKit (helps create artificial intelligence), Model I/O (helps to light 3D models), and ReplayKit (lets users record and share gameplay).• ReplayKit Streaming (2016) enabled users to live-stream the video on their screens, such as streaming gameplay.	2015	<ul style="list-style-type: none">• Model I/O can share data directly with the MetalKit and SceneKit SDKs to help load, process, and render 3D assets more efficiently.• ReplayKit enables developers to integrate screen recording in their apps, so users can now record gameplay and share with friends.	<ul style="list-style-type: none">• Google's YouTube Gaming for iOS can now live stream games that have ReplayKit enabled. Live streams can capture both what is seen on the screen as well as audio from the user and video from the front-facing camera.
13.	ResearchKit: <ul style="list-style-type: none">• ResearchKit provides researchers and developers with open source programming tools to create apps for medical research.• ResearchKit integrates with HealthKit, providing researchers with access to relevant data from users who opt in.	2015	<ul style="list-style-type: none">• ResearchKit was first to enable medical researchers to crowdsource data through mobile devices on a large scale.	<ul style="list-style-type: none">• Stanford Researchers released five apps using the new ResearchKit framework. One app, MyHeart Counts, studies health by measuring the user's daily activity, fitness level, and other factors, and had 11,000 iPhone users sign up. Previously, enrolling "10,000 people in a medical study [...] would take a year."
14.	Taptic Engine: <ul style="list-style-type: none">• The Taptic Engine is Apple's mechanism for haptic feedback on the iPhone. Haptic feedback recreates a sense of touch or movement using a motor that emits different levels of vibration power and sensations.• Some basic applications of the Taptic Engine are to relay system notifications and reinforce audio alerts.	2015	<ul style="list-style-type: none">• In comparison to previous tools used for vibrations, the Taptic Engine is much more precise and gives better and more varied feedback with associated actions.• In 2016, Apple made the Taptic API available to developers, enabling them to utilize the feature in their apps.• In 2019, the newly launched iPhone and iOS featured "Haptic Touch." Haptic Touch kicks in when a user long-presses the screen, offering a small vibration as acknowledgement following the press.	<ul style="list-style-type: none">• Feral Interactive Ltd's GRID Autosport, an auto racing simulation game, uses haptic feedback to let players "feel" things like hitting curbs and losing tire traction.
15.	CloudKit: <ul style="list-style-type: none">• CloudKit provides developers with a storage option for their app's data. Each app gets up to 1 petabyte of free storage on the iCloud, which can be accessed using the developer tools in CloudKit.• CloudKit also provides a dashboard to monitor app server activity, user activity, bandwidth usage, and trends.	2015	<ul style="list-style-type: none">• CloudKit enables developers to leverage iCloud, which can securely share data across all Apple platforms and devices.	<ul style="list-style-type: none">• Ulysses is a Markdown editor that uses CloudKit for its native storage.

Selected Apple innovations that have benefited the App Store

Developer tools

#	Description of Feature	Initial Release	Description of Innovation	Examples of Apps Which Benefit from this Innovation
16.	SiriKit: <ul style="list-style-type: none">• SiriKit is a set of tools that allow apps to connect to Siri to perform different tasks using user voice commands even when the app is not open.	2016	<ul style="list-style-type: none">• Previously, third-party apps could not directly integrate voice commands via Siri.• Introduced Siri Shortcuts in 2018 to further simplify common actions like requesting a rideshare.	<ul style="list-style-type: none">• Rideshare apps like Uber and Lyft were among the first third-party apps to integrate Siri voice commands, allowing users to hail a rideshare without needing to open their app.• VoIP apps were also among the first adopters. These apps allow users to make calls via the internet, allowing consumers to use Siri to make calls.
17.	ARKit: <ul style="list-style-type: none">• SDK that enabled developers to incorporate augmented reality (“AR”) into their apps to handle functions such as detecting movement in a local environment.• ARKit utilized the iPhone’s gyroscope, accelerometer, and advanced camera to project images on real-life surfaces.• ARKit 2 (2018) introduced the ability for shared AR experiences in multiplayer gaming applications.• ARKit 3 (2019) introduced People Occlusion, which made it possible for the camera to detect when real objects were in between the virtual object and the camera’s field of view.• ARKit 4 (2020) introduced Location Anchors, allowing developers to place AR experiences, like life size art installations or navigational directions, at a specific point in the world.	2017	<ul style="list-style-type: none">• Apple’s ARKit made AR accessible to wider audiences in contrast to other paid, third-party AR SDKs prior to 2017.• Developers can access ARKit through Apple’s Developer Program for no extra charge.• Apple calibrated the iPhone 8’s upgraded camera, gyroscopes, accelerometers, and action motion tracking for AR applications.	<ul style="list-style-type: none">• In the first six months after launch, more than 13 million ARKit-built apps had been installed by consumers.• IKEA Place, the retailer’s first ARKit app, creates lifelike pictures of furniture placed live into your home through AR. The app scales virtual objects to 98% accuracy. Six months after launch, it had been downloaded over 2 million times.• Pokémon GO by developer Niantic was first released in 2016 with a third-party AR mode. According to CNET, this AR mode drained iPhone users’ batteries and turned some consumers away from the app. The app now utilizes ARKit, which features smoother and better-integrated AR gameplay.
18.	Core ML and Create ML: <ul style="list-style-type: none">• Core ML (2017) is a developer tool that integrates a variety of pre-trained machine learning model types into apps.• Core ML handles a variety of training tasks such as recognizing images, sounds, and motion.• Create ML (2018) is a developer tool that provides an easy-to-use visual interface for developers to create their own machine learning models.	2017	<ul style="list-style-type: none">• Core ML is built on top of technologies such as Metal, which means it “seamlessly takes advantage” of the CPU and GPU to provide “maximum performance and efficiency.”• Create ML enables developers with “just a little bit of data [...] and no previous machine learning expertise” to create machine learning models “in minutes.”	<ul style="list-style-type: none">• Memrise is an education app that features flashcard-based lesson plans for language learning. The Memrise developer team originally used an open source neural networks library to train their model, but found that switching to Core ML “reduced model training time from 24 hours to 48 minutes,” and “shrank [the model’s] footprint from 90MB to 3MB.”• Homecourt app by NEX Team Inc. uses Core ML and is the “first AI-powered basketball app that uses the latest mobile AI to record, track, and chart shots in real time for players of all levels.”

Selected Apple innovations that have benefited the App Store

Developer tools

#	Description of Feature	Initial Release	Description of Innovation	Examples of Apps Which Benefit from this Innovation
19.	RealityKit and Reality Composer: <ul style="list-style-type: none">• RealityKit is a high-level Augmented Reality (“AR”) SDK that easily blends virtual objects with real world environments, scales virtual objects automatically on different devices, and handles the networking demands of shared AR experiences. It is seen as a simpler version of ARKit for less experienced developers, can be used in conjunction as it natively integrates with ARKit, and has a Swift API.• Reality Composer is a new utility app that allows designers to edit AR scenes, animations, and events from Mac and iOS devices.	2019	<ul style="list-style-type: none">• RealityKit handles many AR tasks automatically without needing to write boilerplate code unlike previous AR SDKs.• Reality Composer makes it easy to build, test, tune, and simulate AR experiences directly on the iPhone or iPad.	<ul style="list-style-type: none">• Reality Composer is available as an app for free on the App Store. According to Apple, “[n]ow anyone can quickly prototype and produce content for AR experiences that are ready to integrate into apps using Xcode or export to AR Quick Look. Reality Composer lets you build animations and interactions on iOS and Mac to enrich your 3D content.”

Source: See my backup.

Selected Apple innovations that have benefited the App Store

Consumer privacy and security

#	Description of Feature	Initial Release	Description of Innovation	Examples of Apps Which Benefit from this Innovation
1.	Sandbox Environment: <ul style="list-style-type: none"> The sandbox environment isolates apps from each other to prevent an app's code from interacting with the operating system at large. Sandboxes isolate apps from critical system resources and other apps, restrict apps from making changes to the device, and prevent apps from accessing files stored by other apps, creating security and stability. Apple's sandbox environment provides developers with tools to test in-app purchases within their apps and more recently (2020) added other features to test. 	2007	<ul style="list-style-type: none"> The sandbox environment increases security and aims to prevent malware from infecting the operating system. By limiting the permissions of third-party apps, Sandboxing is able to increase "the security and integrity of the operating system." Apple permits testing in a sandbox environment for app features like in-app purchases, upgrades, downgrades, and cancellations for subscriptions. 	<ul style="list-style-type: none"> All apps benefit from the security and protection that the sandboxing environment provides against malicious attacks. Consumers receive privacy protection. For example, "third party applications can access... health data through the HealthKit framework," which requires the user to grant access for the app to read and write health data.
2.	System Security Features: <ul style="list-style-type: none"> Apple's system security controls access to system resources in devices which includes the boot-up process, software updates, and protecting system resources such as CPU, memory, disk, software programs, and stored data. The system contains several layers including hardware, software, and operating system integrity. 1) Hardware system security features include a boot ROM (first code executed by a device at startup), AES engines (algorithms for encryption and decryption), and a Secure Enclave (a system on chip with its own boot ROM and AES engine). 2) Software system security installs only from Apple-signed code. 3) Operating system integrity determines what capabilities are afforded to code that is executed. 	2007	<ul style="list-style-type: none"> System security features prevent malware attacks at the startup of the device and ensure that devices only execute "known-good code" to prevent attacks while the consumer uses the device. Compared to competitors, the App Store has received far less criticism regarding malware. According to ArsTechnica in 2012, "[w]hatever critics may say about Apple's App Store, [...], complaints about malware aren't one of them." 	<ul style="list-style-type: none"> All apps benefit from the security and protection that Apple's system security features provide against malicious attacks. According to Apple's Platform Security Guide Fall 2019, Apple's app "Find My" uses existing cryptographic primitives to enable the groundbreaking capability of distributed finding of an offline Mac — without exposing to anyone, including Apple, the identity or location data of any of the users involved."
3.	Activation Lock: <ul style="list-style-type: none"> Locks iPhone and prevents it from being erased or re-activated without the owner's Apple ID password. It also prevents Find My iPhone from being disabled. 	2013	<ul style="list-style-type: none"> Prior to this feature, an iPhone could be wiped and re-sold after being stolen. The introduction of this feature reduced iPhone theft. 	<ul style="list-style-type: none"> In the year following the introduction of Activation Lock, there was a 40% decrease in iPhone theft in San Francisco, 25% decrease in New York, and 50% decrease in London.
4.	Secure Enclave: <ul style="list-style-type: none"> Established a separate processor on iPhones and Macs that securely stores encryption keys for biometric information such as the data used for Face ID and Touch ID. 	2018	<ul style="list-style-type: none"> Prior to this feature, biometric information was stored and encrypted on the same processor. The Secure Enclave makes it more difficult for devices to be hacked. 	<ul style="list-style-type: none"> Many mobile banking apps, including those for major banks like Chase and Citibank, allow users to sign in with Face ID. Secure Enclave ensures that these apps can offer this feature without giving developers access to users' biometric data.

Selected Apple innovations that have benefited the App Store

Consumer privacy and security

#	Description of Feature	Initial Release	Description of Innovation	Examples of Apps Which Benefit from this Innovation
5.	Location Sharing Options: <ul style="list-style-type: none"> In 2019, Apple introduced an option that allows iPhone users to only share their location with an app once. In 2020, Apple gave consumers the option to only give apps an approximate rather than precise location. 	2019	<ul style="list-style-type: none"> Prior to the “Just Once” feature, consumers only had the option to allow location tracking “Always,” “Never,” and “While Using.” Prior to the approximate location feature, consumers only had the option to grant an exact location or no location. 	<ul style="list-style-type: none"> Streaming apps have different content rights in different geographical regions, and require information on the consumer’s location to determine what content can be streamed. Since an exact location is not required, the approximate location feature can be used to limit the amount of information shared. Other examples of apps that can use approximate location to minimize data collection with no impact to the app functions include weather apps, local news apps, and dating apps.
6.	Sign in with Apple: <ul style="list-style-type: none"> Allows iPhone users to securely log in to apps in one click while protecting their privacy. iPhone users can “hide” their real email address from developers and have emails forwarded to them through a randomized address generated by Apple. Any of these randomized addresses can be easily disabled to stop receiving communications from an app. 	2019	<ul style="list-style-type: none"> Prior to this feature, apps shared personal data with third-party sites when those third-party sites were used for sign-in services. 	<ul style="list-style-type: none"> Many well-known apps have added Sign in with Apple. These include popular games like Candy Crush Saga by King and Pokémon GO by Niantic.
7.	Mic/Camera indicator: <ul style="list-style-type: none"> iOS provides an on-screen indicator when an app is accessing the device’s microphone or camera. 	2020	<ul style="list-style-type: none"> Previously, there was no indication that an app was using the consumer’s microphone or camera. 	<ul style="list-style-type: none"> All apps that access the iPhone microphone or camera will display an indicator light on the iPhone screen. For example, when using a video conferencing app such as Zoom, WhatsApp, or Signal, an orange and a green dot will be displayed in the top right hand side of the screen.
8.	Privacy labels: <ul style="list-style-type: none"> List the types of data being collected in an easily scannable format. Apple has divided the privacy label into three categories: <ol style="list-style-type: none"> Data used to track you: This information is used to follow your activities across apps and websites. Data linked to you: This information is tied to your identity, such as your purchase history or contact information. Data not linked to you: This information is not directly tied to you or your account. 	2020	<ul style="list-style-type: none"> Prior to this feature, consumers did not have clear visibility into the data collection practices for each app, especially at the point of download. Privacy Labels present information that Apple requires developers to submit, including information on the data collected and stored when a consumer engages with an app. 	<ul style="list-style-type: none"> Starting in December 2020, all apps will need to publish Privacy Labels to be listed or updated on the App Store. For example, a consumer can now find the Privacy Labels listed for music streaming app Spotify, and learn that Spotify tracks data such as Location, Browsing History, and Usage Data.

Source: See my backup.

Selected Apple innovations that have benefited the App Store App business models

#	Description of Feature	Initial Release	Description of Innovation	Examples of Apps Which Benefit from this Innovation
1.	In-app purchases: <ul style="list-style-type: none">• Apps can offer in-app purchases to unlock features or functionality.• Since 2020, developers can review and process refund requests for in-app purchases.	2009	<ul style="list-style-type: none"> • Apple was among the first to introduce in-app purchases as a new form of app monetization. • The introduction of in-app purchases eliminated the need for developers to offer separate paid and free versions of the same app. • When Touch ID was introduced in 2013, it was integrated with the App Store to allow users to make one-click purchases, including in-app purchases. • When Face ID launched in 2017, it was also made to allow one-click purchases, including in-app purchases. 	<ul style="list-style-type: none"> • Developer King's Candy Crush Saga offers a popular \$0.99 "Extra Moves" in-app purchase. "Extra Moves" allow a player to move through a level faster. In 2014, 97.7% of Candy Crush players did not make any payments, however the remaining players spent \$1.3 billion on in-app purchases which were said to have been for extra lives, extra moves, color bombs, lollipop hammers, and gold bars. • Developer Supercell's Clash of Clans offers a free download with in-app purchases, including a popular \$4.99 "Pile of Gems" in-app purchase. • Epic Games launched a free version of Fortnite with in-app purchases in 2018. Fortnite's in-app purchases included bundles like the \$4.99 "Iris Starter Pack." In the free version of the game, players can scavenge for weapons, ammo, and resources for constructing buildings, which enables players to familiarize themselves with the environment prior to making purchases.
2.	Subscriptions: <ul style="list-style-type: none">• Apps can offer subscriptions for content.	2011	<ul style="list-style-type: none"> • Apple was among the first to introduce subscriptions as a new way to monetize apps. 	<ul style="list-style-type: none"> • Top subscription-based apps include entertainment apps (e.g. streaming services), gaming, and dating apps. In 2020, according to TechCrunch, "the top 100 subscription apps worldwide generated \$10.3 billion on the App Store, up 32% over 2019." • Individual gaming apps also offer subscriptions. For example, Minecraft (by Mojang) offers a \$3.99 "Realms Monthly Subscription."
3.	Family Sharing: <ul style="list-style-type: none">• Enabled families to share purchases including subscription games, apps, and in-app purchases.• Intended to help developers attract subscribers and increase engagement and retention.• Up to six family members can also share Screen Time, an iCloud storage plan, and a family photo album.	2014	<ul style="list-style-type: none"> • Apple was the first company to allow users to share apps, games, books, and video purchases with their family members across mobile devices. 	<ul style="list-style-type: none"> • All App Store purchases, including in-app purchases or subscriptions, where the developer has enabled Family Sharing. For example, the calorie-tracking app FoodNoms by developer Algebraic Labs, LLC allows consumers to share its subscription among members of their Family Sharing group.
4.	Video Partner Program: <ul style="list-style-type: none">• Apple lowered its commission rate to 15% for members of the Video Partner Program who stream premium TV content.	2016	<ul style="list-style-type: none"> • The Video Partner Program enabled subscription video providers to provide their content on the Apple TV app, helping customers discover video content in one app, across all their devices. 	<ul style="list-style-type: none"> • Apple allows Amazon Prime Video to bypass Apple's payment infrastructure and use its own payment system, when consumers purchase a movie or TV show. • Smaller and international services such as Altice One and Canal+ are also qualified as Apple's "premium subscription video entertainment Providers," and hence exempt from the 30% commission.

Selected Apple innovations that have benefited the App Store

App business models

#	Description of Feature	Initial Release	Description of Innovation	Examples of Apps Which Benefit from this Innovation
5.	"Reader" rule: <ul style="list-style-type: none">Consumers can access content purchased through means other than the App Store on their iPhones. The rule specifically applies to reader apps such as magazines, newspapers, books, audio, music, and video.Reader apps may allow consumers to create accounts on iOS for the free tier version of the app. Reader apps may also offer account management functionality for existing customers (e.g., suspend an account).	2017	<ul style="list-style-type: none">This policy clarified how reader apps could allow users to access previously purchased content.It also clarified the conditions under which consumers could create an account on iOS (i.e., for the free tier), and gave explicit permission for reader apps to offer account management functionality to existing customers.	<ul style="list-style-type: none">Apps like Amazon's Kindle and Netflix fall under the "Reader" rule. It enabled Kindle to allow users to access previously purchased books through the iOS app. It also enabled Netflix to allow users to watch videos on the iOS app using a previously purchased subscription.
6.	"Multiplatform services" rule: <ul style="list-style-type: none">Apps that operate services across multiple platforms may allow users to access content, subscriptions, or features they have acquired in the app on other platforms or on a website, provided those items are also available as in-app purchases within the app.	2018	<ul style="list-style-type: none">This policy clarified how apps operating across multiple platforms could allow users to access content acquired elsewhere.	<ul style="list-style-type: none">Games using microtransaction systems enable users to purchase in-app currency for use across platforms. For example, Minecraft (by Mojang) offers "Minecoins" as an in-game currency that can be bought and used on iOS as well as other platforms including Android, Windows, and Xbox One.
7.	Apple Arcade: <ul style="list-style-type: none">Apple Arcade is a game service that includes exclusive, curated games that users can access for a subscription fee.Apple Arcade is also available on both Mac and Apple TV, and it supports third-party console and Made for iPhone controllers.	2019	<ul style="list-style-type: none">Apple Arcade buys and invests in games before they are launched instead of paying developers as users spend more time on the game. Apple Arcade has been compared to Netflix in that it acquires games and encourages developers to take more risks.By financing developers, Apple Arcade offers consumers games that they made not have had available to them otherwise and gives developers the ability to develop games that may not fit existing monetization strategies.	<ul style="list-style-type: none">Card of Darkness, a card game in which users battle monsters, launched on Apple Arcade. The game's creator, Zach Gage, stated that it was a difficult game to develop because of issues with pricing, and that he began making the game once Apple reached out to him about Apple Arcade.
8.	Small Business Program: <ul style="list-style-type: none">Eligible small businesses are given a reduced commission rate of 15% on paid apps and in-app purchases.Existing developers who have made up to 1 million U.S. dollars in revenue in 2020 for all of their apps, as well as developers new to the App Store, can qualify for the program and the reduced commission.	2020	<ul style="list-style-type: none">The App Store Small Business Program was designed to accelerate innovation and increase revenue for small developers.	<ul style="list-style-type: none">Initial estimate suggests that 98% of developers would benefit from this program. Small developers created the majority of apps and expect to see large commission reductions due to this program.Co-founder of the fitness app MySwimPro praised Apple and said "The new App Store program will be a huge help to our revenue from purchases in the App Store." Similarly, developer for game "Song of Bloom" believed that "This is a big opportunity for the indie gaming spirit to become truly mobile."

Source: See my backup.

Selected Apple innovations that have benefited the App Store Storefront

#	Description of Feature	Initial Release	Description of Innovation	Examples of Apps Which Benefit from this Innovation
1.	<p>App Store:</p> <ul style="list-style-type: none"> The App Store launched on iPhone 3G in 2008. In iOS 6 (2012), the App Store added Top Charts and Genius tab that offered personalized recommendations for iOS Applications. In addition, Apple released the Smart Banner feature for consistent promotion of apps. In iOS 7 (2013), the App Store introduced parental control with classification and filtering capabilities for apps/game by age. iOS 7 also introduced automatic app updating and app suggestions to consumers based on location. In iOS 8 (2014), Apple added search optimization capabilities, including App Previews and Explore tab. App Previews allowed developers to showcase up to three videos to potential players. The App Store was redesigned in 2017. 	2008	<ul style="list-style-type: none"> The App Store made apps more accessible and greatly improve user and developer experiences. Commentators noted that, before it was invented, “installing software on mobile devices had traditionally been a nightmare. Developers had to host the app themselves, find a place to sell it, then walk their customers through the installation. Few bothered.” Updates to the App Store were designed to make the platform more personalized and convenient for consumers, while expanding the ways in which developers could promote and monetize their apps. 	<ul style="list-style-type: none"> All apps are transacted through the App Store.
2.	<p>Game Center:</p> <ul style="list-style-type: none"> Game Center is a social gaming network that features leaderboards, achievements, and matchmaking. It enables real-time and turn-based multiplayer functionality in game apps. In 2011, Game Center was updated so that consumers could download or purchase games directly through an “App Store-like page” within the Game Center app. Consumers could view and directly download apps in their Game Center friends’ lists of games without leaving the Game Center app. Game Center Challenges (2012) enabled sending of push notifications to engage with friends. 	2010	<ul style="list-style-type: none"> Game Center successfully implemented a social gaming network on mobile devices. Unlike the console networks, which required rigorous approval processes for developers to implement features from their network, Game Center was made available to small, independent developers. Consumers can directly download and purchase games through the Game Center app. In the nine months after its release, Game Center had 50 million registered users, which surpassed Xbox Live’s 30 million users. 	<ul style="list-style-type: none"> Infinity Blade was released by Epic Games on iOS devices in 2010, and was among the first games to integrate GameKit features. Users were able to play multiplayer matches with each other through Game Center, and unlock 64 achievements. By 2012, Infinity Blade had grossed over \$23 million, and was at the time, Epic’s most profitable franchise in terms of years invested compared to revenue. Sonic & SEGA All-Stars Racing was initially released with only local online and Bluetooth multiplayer capabilities, which requires users to be within proximity to play against one another. Once integrated with Game Center, users could then play online with up to three friends.
3.	<p>iMessage Apps:</p> <ul style="list-style-type: none"> Third Party Messages Access allows developers to build integrations into Apple’s popular Messages app. iMessage Apps are apps that can be downloaded or bought through the iMessage App Store and used directly within the Messages app. These include apps intended just for iMessage, as well as extensions and integrations of bigger apps. 	2016	<ul style="list-style-type: none"> iMessage Apps enhanced functionality and offered new ways to create and share content, play games, and make payments. 	<ul style="list-style-type: none"> One of the first apps to embrace third-party access to Messages was Genius, a popular music lyrics app. Genius publicly embraced the app’s availability through iMessage and described the change as iMessage getting “really crazy” and urging users to “get hyped” for a “powerful-and potentially very hilarious” new feature. Games like Words with Friends by Zynga Inc. can be played with others through the Message app.

Selected Apple innovations that have benefited the App Store Storefront

#	Description of Feature	Initial Release	Description of Innovation	Examples of Apps Which Benefit from this Innovation
4.	App Store Redesign: <ul style="list-style-type: none">• “Today”: an editorial section used to promote a new app every day along with “how-to guides” and “article-like description pages for apps.”• Apps could be pre-ordered before release.• The top charts were separated into those for games and those for non-game apps. Prior to the change, popular games tended to “crowd out up-and-coming apps on the charts.”• Other smaller tweaks included “use of previews, imagery and video to better showcase an app’s content; clearer details about an app’s in-app purchases; easier-to-read information about an app’s rank, star rating, age appropriateness, and reviews.”	2017	<ul style="list-style-type: none">• With the launch of iOS 11 in 2017, the redesign of the App Store improved design and discoverability.• The iOS 13 (2019) update allowed apps to take up to 50% less storage space when being downloaded, while app updates would be 60% smaller. Apps would also load twice as fast as before.	<ul style="list-style-type: none">• Apps featured by Apple saw download boosts of up to 800%. Big publishers like Electronic Arts and Warner Bros benefited greatly, but small publishers also got a chance to shine. According to an industry study, 29% of the apps Apple featured since the redesign were from publishers who had fewer than 10,000 downloads.
5.	App Clips: <ul style="list-style-type: none">• An App Clip is a brief introduction to an app that pops up to complete individual, discrete tasks when consumers summon them.• App Clips allow users to preview apps without downloading them and focus on getting a task done quickly.	2020	<ul style="list-style-type: none">• Brought the idea of a short app preview of an app to a much broader audience than previous versions by competitors.• Integrated real-world tags to call up the app clips, which enables app discovery outside of the App Store.	<ul style="list-style-type: none">• The Panera Bread app allows users to order food from the popular chain online when you navigate towards it on maps. Consumers can order food through the app without downloading the app, but also without navigating to a website, calling, or using another application.

Source: See my backup.