I'm not a bot

A great many gamers complain about the Fallout 4 low FPS issue on PC. What causes the Fallout 4 frame drop problem? How to improve Fallout 4 FPS? Now, let’s explore the answers together with MiniTool.Fallout 4 is an action role-playing game released on November 10, 2015. It is available on Microsoft Windows, Xbox One, and PlayStation 4. There is no doubt that Fallout 4 is an amazing game. However, various issues also come up with the game such as Fallout 4 crashing, Fallout 4 long loading times, Fallout 4 mods not working, and the one discussed in this post.What Causes Fallout 4 Low FPSFallout 4 low FPS is one of the most common issues that many PC gamers encounter. As it’s well known, Fallout 4 has received many negative comments due to its poor optimization. Since its release, this game has always experienced performance losses, stuttering, lagging, FPS drops, and everything of the like. This makes people mod Fallout 4 on PC to get the game in a workable state.In addition, the Fallout 4 random FPS drops problem also occurs due to some known causes. Many gamers reported that Fallout 4 frame drops when the VSync is turned on. Furthermore, other settings like Vibration, Controller, high God rays, and Draw Distance are also responsible for the problem.Fortunately, we summarized several effective ways to fix Fallout 4 low FPS after investigating extensive user reports and posts. Let’s see how to get more FPS in Fallout 4.How to Improve Fallout 4 FPSHow to improve FPS in Fallout 4? You can try the following 5 proven ways in order until the Fallout 4 frame rate drops problem gets solved.# 1. Check Your System HardwareBefore you start trying other fixes, we recommend you check if your computer meets the basic system requirements of Fallout 4. If you don’t know how to check PC specs, this post provides a full guide.Operating System: Windows 10/8/7 (64-bit required)Processor: Intel Core i5-2300 2.8GHz / AMD Phenom II X4 945 3.0GHz or equivalentMemory: 8 GBHard disk: at least 30 GB of free spaceVideo: NVIDIA GTX 550 Ti 2GB / AMD Radeon HD 7870 2GB or equivalentGraphics Memory: 2 GBTo know more details on how to upgrade the hardware, you can refer to the following guides:# 2. Turn off the Vibration and Controller SettingsMany players reported that the Fallout 4 random FPS drops when they turned on the Vibration for the game as well as the controller. In this case, disabling the Vibration settings may help you fix the problem.Step 1. Launch your Fallout 4 game and load the main menu. Once you are inside the game, go to the Pause Menu and select Settings.Step 2. Go to the Gameplay tab and scroll down the list of settings to the Vibration and Controller sections. Once you find them, simply turn them Off.Step 3. Exit the Pause menu and restart the game to check if the Fallout 4 framerate drop issue is fixed.# 3. Turn off the Built-in VSyncVSync is a built-in feature in Fallout 4 that can be used to regulate the game’s frame rate and the refresh rate of the monitor. However, VSync was designed for 30fps on consoles. If you turn on the VSync or sync higher, the Fallout 4 framerate drop issue can occur. Here you can try disabling this feature and see if it works.Step 1. Exit the game completely by ending it via Task Manager.Step 2. Press Win + E keys to open the File Explorer, and then navigate to the following Fallout 4 installation directory path.This PC/Documents/My Games/Fallout4Tip: If you can’t find the Fallout 4 directory, you can open the Steam client, and then navigate to Library, right-click the Fallout 4 game and select Properties, go to the Local Files tab and click on Browse local files. Then you will open the local files of the game.Step 3. Inside the Fallout 4 folder, right-click the Fallout4Prefs.ini file and select Open with Notepad.Step 4. In the Notepad window, locate the iPresentInterval=1 line and replace 1 with 0. Then press Ctrl + S keys to save the change. If it is not here, you can add the line and set its value to 0.Step 5. If there is a file name Fallout 4.ini or Fallout4_Default.ini, you need to do the same procedure as Step 4 to set the iPresentInterval value to 0.Once done, restart the game and check if the Fallout 4 low FPS issue disappears.# 4. Turn the God Rays to LowAnother possible reason for Fallout 4 random FPS drops is the high value of the God Rays. In this case, you can try lowering the God Rays. For that:Step 1. Repeat Step 1 and Step 2 in # 1 to locate the Fallout 4 path.Step 2. Under the directory, find a file named Fallout4Custom.ini, right-click it and select Open with Notepad.Step 3. In the pop-up window, add the following lines and save the change.[General]sStartingConsoleCommand=gr off# 5. Close All Unnecessary ProcessesIf there are too many CPU or GPU-hogging processes running in the background, it may trigger the Fallout 4 frame rate drops issue. In this case, closing them can help you fix the problem.Step 1. Press Ctrl + Shift + ESC keys to open Task Manager and click on More details.Step 2. In the Processes tab, right-click the unnecessary programs and select End task. Then repeat this progress to close other tasks. Raja Slot: Game Strategis yang Siap Mengubah Cara Bermain Slot Online Call of Duty: Black Ops 6 Breaks Viewership Records Chaos Ensues: Dr Disrespect Unleashed on Black Ops 6 Deadpool & Wolverine | Official Trailer Dragon Ball Returns: Sparking! ZERO Venom: The Last Dance – Final Trailer (HD) Yakuza's Latest Game Promises a Heartfelt Story Long-Awaited Return: Space Marine 2 Finally Arrives Hellblade 2: A Psychological Horror Adventure S.T.A.L.K.E.R. Sequel Arrives After 15 Years Dune: Part Two | Official Trailer FURIOSA : A MAD MAX SAGA | OFFICIAL TRAILER #1 Kingdom Come Deliverance 2 Release Date Announced Get Ready to Build Empires: Civilization 7 Release Date Announced If you buy through our links, IGN may earn an affiliate commission. Learn more.Fallout 4 NewsLoad More Fallout 4 Map is an Interactive Map Checklist with everything in the game. Find and track all Items, Weapons, Armor, and Collectibles in the game with the help of our Interactive Map. The Fallout 4 Interactive Map is regularly updated with detailed information for all Quests, Equipment, Locations, and other Points of Interests. Everything you need to find in the Commonwealth, Far Harbor and Nuka-World can be found on this Interactive Fallout 4 Interactive Map. Fallout 4 Map Interactive Checklist Commonwealth Checklist Far Harbor Checklist Nuka World Checklist Welcome to the Wasteland, as you traverse through the desolate landscapes, ruins and sprawling settlementes of this world, you'll encounter both danger and discovery. This guide serves as your starting point in your adventure set in this post-apocalyptic world, that includes over 800 locations filled with various items, quests and.points of interest that players can explore and interact with. The map is divided into different zones, each with its own unique locations and features. Including unmarked locations, which are places not officially named or marked on the map but contain loot or are otherwise of interest. Fallout 4 Interactive Map is a comprehensive tool that helps players navigate the vast world of Fallout 4, discover new locations, and keep track of their progress. Vip members will be able to see their completion rates and keep track of all items per category by marking them on the map. This feature is the best option for players that want to keep track of their progress while exploring the Wasteland. All Content Available in Fallout 4 Map With this powerwful tool, you will be able to navigate the Wasteland with ease, uncovering powerful loot, solving puzzles, and facing powerful challenges. Explore the multiple regions, buildings, ruins, towns, cities, abandoned sites, shipwrecks, and hidden locations. Lore related items lie hidden within its vast expanse, waiting for that explorer that is willing to search beyond mere survival needs. Among these coveted collectibles are Holotapes, Bobbleheads and Magazines, each carrying unique stories and also benefits, in form of perks, that enrich your adventure. Holotapes serve as gateways into lore-packed narratives penned by the voices of both famous figures from our world's history and original characters born within this post-apocalyptic universe. Collecting them unveils the intricate layers of stories that shape the world you navigate, each offering valuable quests or rare items upon playback at a terminal in your settlement. Bobbleheads are more than just collectible novelties; they represent personal achievements and tributes to characters who have left their mark on the Commonwealth. Whether it's capturing one of the game's iconic creatures or completing a particularly challeging quest, these figurines act as mementos of your exploits, some even providing permanent passive effects once discovered. Perk Magazines offer glimpses into various aspects of the life in the Wasteland. They can be found scattered across the map and, like holotapes, contribute to a deeper understanding of the world when perused in settlement libraries. The Commonwealth’s diversity lies not only in its physical landscapes but also in the factions vying for control: from the Institute and the Railroad to the Brotherhood of Steel and the Minutemen. Urban areas, Outlying Farmlands and Settlements and Unique Locations such as the Shipwreck of the USS Riptide, and other places to discover. Each locations offers unique ooportunities for exploration, combat and scavenging, while also contributing to the rich lore and story of Fallout 4. Whether it's a bustling city, a quiet farm, or a dangerous, monster infested ruin, there's always something new to discover in the wasteland of Fallout 4. Powerful and Unique Loot on the Fallout 4 Map The thrill of discovery is amplified by the prospect of dingin powerful loot. Hidden withing the vast expanse of the map are Weapons, Armor, and Items that can significantly enhance your gameplay. From legendary weapons dropped by great enemies, to unique gear locked in advanced safe located in secret locations, as the wasteland is a treasure trove waiting to be explored. Generally the more dangerous the location, the better the loot. So don't hesitate to venture into the unknown. How to use the Baldur's Gate 3 Interactive Map The search bar matches partial words so you can try to put "weapon" or "quest" and see what comes up. You can filter by category using the checkmark layers on the right side of the map. Please see our Walkthrough and Game Progress Route to figure out where to go! VIP USERS: PROGRESS TRACKER: Now live for ALL DEVICES! Click on any item and "mark as complete" to save your progress to your account and view it on ANY of your logged in devices. VIP USERS: Progress Reset, Multiple Character Slots and PERSONAL CHECKLIST now available! Use the links to select slots and reach your checklist. We will add "mark as complete" from the checklist soon. VIP USERS: SIDEBAR REMOVAL. If you're on a laptop or your resolution is under 1500px, the sidebar will disappear. You can also use this feature on a large desktop if you simply make your tab a bit smaller and reload. You can then full screen your tab without sidebar and without having to enter "full screen" VIP USERS: You can put the map FULL SCREEN by clicking the expand screen icon (desktop and android only): Categories in the Map One of the most unique features of Fallout 4 is the ability to create settlements. You can bring in settlers and your companions to create a thriving community in the post-apocalyptic Wasteland. The settlers can be put to different tasks including making food, defending the area, and setting up shops. This completely changes the way you can approach Fallout 4 if you’re into base building. So with that in mind, here are the top 15 settlements which are excellent in the game! 15 . The Mechanist’s Lair The Mechanist’s Lair is located under the Robco Sales and Service Center. This location can only be unlocked after the Automatron DLC is completed. The Mechanist, Isabel Cruz can be a settler here if she is spared but she won’t take up any space. She can give you special missions occasionally to destroy rogue robots roaming around the Commonwealth which is useful for earning quick XP. As a radio beacon can’t be set here, you need to move settlers to this location. You can establish supply lines with your settlers as you can’t set up food resources in this settlement. 14 . Abernathy Farm The Abernathy Farm is a family settlement owned by the Abernathy family. It is a great location to gather crops as there are a few designated plots for them. Connie Abernathy also is a vendor from whom you can buy useful items. It is also a fairly protected settlement as raiders don’t often attack here due to the farm being a bit of an isolated area.13 . Hangman’s Alley Hangman’s Alley is located in Fenway Park in Boston. It is the only location available as a settlement in the ruined city. After clearing out the area, you can assign settlers and establish supply lines which are beneficial when you are in the area. The location has prebuilt defense posts, which can be scrapped if needed and is secluded from all sides which is great for an artillery base.12 . The Slog The Slog is the only Tarberry bog in the Commonwealth which is run by ghouls who were exiled from Diamond City. After completing a few quests, the location can be unlocked for new settlers to move in. This location is great for the player if they want to gather tarberry and other resources like corn. Deirdre, a ghoul is also available as a vendor here.11 . The Castle The Castle is the headquarters of the Minutemen of the Commonwealth located east of the Gwinnett Restaurant and Brewery. It can be unlocked when the player progresses with the Minutemen storyline and completes the Taking Independence quest. The location is huge and can be used for a large number of settlers and supply lines. You also unlock the ability to use the artillery after unlocking this settlement.10 . Starlight Drive-In This location is a drive-in movie theater filled with a large movie screen and a bunch of wrecked cars. The location can be unlocked as a settlement when Preston Garvey tells the Sole Survivor to secure it. The area is very large and can be used by a lot of settlers. It can also be used as an artillery base if needed.9 . Warwick Homestead Warwick Homestead is occupied by the Warwick family and their employees. The settlement is located by the sea and is filled with different kinds of crops which can be taken by the player. The settlement can be unlocked either by completing the Minutemen mission, Warwick Homestead: Greenskins, or the Institute quest, Building a Better Crop.8 . Kingsport Lighthouse The Kingsport Lighthouse is another possible settlement location in the game. It had been occupied by the Children of Atom cultists and a Glowing One prior to the player’s arrival. After clearing the area, it can be used to set up a settlement. While this location is prone to raids, it can be used to set up near-perfect defenses for protection.7 . Spectacle Island Spectacle Island is an isolated island located near the Warwick Homestead. What makes this settlement amazing is that it is huge and can be made into a small thriving community within itself. The mirelurks around can be killed to fully unlock the settlements. The island is also composed of many resources including corn, razorgrain, tarberry, etc. 6 . Echo Lake Lumber Mill This settlement is located in Far Harbor and can only be unlocked after completing Small Berth’s quest relating to it. It is one of the largest settlements in the game and can be used to house a maximum number of settlers. The location is also useful for setting up proper defense positions and stores. Supply lines can also be set up.5 . Longfellow’s Cabin Longfellow’s Cabin is probably the first location you can unlock as a settlement in the Far Harbor DLC. By recruiting Old Longfellow as a companion, the location can be used as a settlement. While it has a somewhat rocky surface, it can be used to set up useful defense positions when it is attacked by the creatures from the Fog. Wandering merchants can also be attracted by setting up trade posts.4 . Covenant Covenant is another possible settlement in the main game. It is a small village of people who are working with the Institute in order to identify synths. The location can be used as a settlement if one sides with the settlers or kills them after completing the related questline. However, some beds cannot be used for new inhabitants so you need to craft some new ones. There are also mutfruit plants that can be harvested if needed.3 . Sanctuary Hills Sanctuary Hills is the long-lost home of the Sole Survivor before the Great War. It can be acquired as a settlement when Preston Garvey and the people under his protection decide to move there for safety. The location is important as if one decides to pursue the Minutemen questline, they need to visit this location constantly. Shops, supply lines, and defense posts can be set up to benefit the settlers.2 . Red Rocket Truck Stop Red Rocket Truck Stop is another important location in the game that can be used as a settlement. The place is where you first meet Dogmeat and has an armor and weapons workbench, a power armor station, and a chemistry station. It has all the necessary crafting benches to start you off your journey across the Commonwealth. With mods and DLC items, it can be made to look the same as it was pre-war.1 . Vault 88 Finally, we have Vault 88, your very own vault which you can acquire after completing the Vault Tec DLC. Up to 30 settlers can be housed in this settlement, all with their very own Vault suit and Pip Boy. Settlers can be assigned to various shops and stations along with recreational activities which increases the happiness of the settlement. The vault can be designed according to your own taste and there is no limit to this. The mods make it even better. And with that, you’ll find these settlements will benefit your journey across the Commonwealth in different ways. Good Luck fellow Wastelanders!You May Also Be Interested In: 2015 video game 2015 video gameFallout 4Developer(s)Bethesda Game Studios[a]Publisher(s)Bethesda SoftworksDirector(s)Todd HowardProducer(s)Ashley ChengJeff GardinerDesigner(s)Emil PagliaruloProgrammer(s)Guy CarverArtist(s)Istvan PelyWriter(s)Emil PagliaruloComposer(s)Inon ZurSeriesFalloutEngineCreation EnginePlatform(s)Microsoft WindowsPlayStation 4PlayStation 5Xbox OneXbox Series X/SRelease November 10, 2015 PS4, Windows, Xbox OneNovember 10, 2015PS5, Xbox Series X/SApril 25, 2024 Genre(s)Action role-playingMode(s)Single-player Fallout 4 is a 2015 action role-playing game developed by Bethesda Game Studios and published by Bethesda Softworks. It is the fourth main game in the Fallout series and was released worldwide on November 10, 2015, for Microsoft Windows, PlayStation 4, and Xbox One. The game is set within an open world post-apocalyptic environment that encompasses the city of Boston and the surrounding Massachusetts region known as "The Commonwealth". The main story takes place in the year 2287, 10 years after the events of Fallout 3 and 210 years after "The Great War", which caused a nuclear holocaust. The player assumes control of a character simply referred to as the "Sole Survivor", who emerges from a long-term cryogenic stasis in Vault 111, an underground nuclear fallout shelter. After witnessing the murder of their spouse and the kidnapping of their son, the Sole Survivor ventures out into the Commonwealth to search for their missing child. The player explores the game's dilapidated world, completes various quests, helps out various factions, and acquires experience points to level up and increase the abilities of their character. New features to the series include the ability to develop and manage settlements and an extensive crafting system where materials scavenged from the environment can be used to craft explosives, upgrade weapons and armor, and construct, furnish, and improve settlements. Fallout 4 is the first game in the series to feature a fully-voiced protagonist. Fallout 4 received positive reviews from critics, with many praising the world depth, player freedom, overall amount of content, crafting, story, characters, and soundtrack. Criticism was mainly directed at the game's simplified role-playing elements compared to its predecessors and technical issues. The game shipped 12 million units to retailers, which generated $750 million within the first 24 hours of its launch. It received numerous accolades from various gaming publications and award events, including the respective awards for Game of the Year and Best Game at the D.I.C.E. Awards and British Academy Games Awards. Bethesda has released six downloadable content add-ons, including the expansions Far Harbor and Nuka-World. Fallout 4 is an action role-playing game set in an open world environment. Gameplay is similar to that of Fallout 3 and Fallout: New Vegas, the two previous primary iterations in the series. However, unlike the previous two titles, the gun-gameplay was handled by id Software.[1] Returning features include a camera that can switch between a first-person and third-person perspective. Fallout 4 introduces features including a layered armor system, base-building, a dialogue system featuring 111,000 lines of dialogue,[2] and a crafting system which implements every lootable object in the game. Enemies such as Mole Rats, Raiders, Super Mutants, Deathclaws, and Feral Ghouls return along with the companion Dogmeat.[3] The player can freely roam in the game's world and leave a conversation at any time. If the player has discovered a certain location they may fast travel to it, unless playing on "Survival Difficulty" in which fast traveling is disabled. Weapons can be customized; the game includes over 50 guns, which can be crafted with a variety of modifications, such as receivers, barrel types, and laser focusers, with over 700 modifications available. Power Armor has been redesigned to be more like a vehicle than a suit of armor, requiring fusion cores and being essentially dead weight without it[4][better source needed] and can be modified, allowing the player to add items such as a jetpack or selecting separate types of armor plating for each part of the suit.[5] A new feature of the series is the ability to craft and deconstruct settlements and buildings. The player can select and break down many in-game objects and structures, and use the resultant raw materials to freely build their own structures. In addition, the towns can be powered with working electricity, using a power line system. Merchants and non-player characters can inhabit the player's settlements, for which the player must provide sustenance by growing food in makeshift patches and building water pumps. The player can build various defenses around their settlements, such as turrets traps, and bombs, to defend against random attacks.[6] When using V.A.T.S., real-time action is slowed down, and players can see the probability of hitting each body part of the enemies through a percentage ratio displayed here on the PlayStation 4 version. The Pip-Boy, a personal computing device strapped to the player character's wrist, allows the player to access a menu with statistics, maps, data, and items the player has acquired. The player can find game cartridges, called Holotapes, which can be played on the Pip-Boy or a terminal. A new feature for the Pip-Boy interface is a downloadable application for iOS, Android, and Windows smartphones and tablets. This optional app allows players to access the Pip-Boy interface on a separate screen, and play the collected game cartridges when not playing the main game. Another returning gameplay feature is the Vault-Tec Assisted Targeting System (V.A.T.S.). While using V.A.T.S., real-time combat is slowed down (instead of stopped entirely as in previous entries), and action is played out from varying camera angles in a computer graphics version of "bullet time". Various actions, including firing shots in V.A.T.S., expend the Sole Survivor's supply of Action points, limiting what a player can do in a certain period. While in V.A.T.S., the player can target individual body parts with attacks to inflict specific injuries; headshots can be used for quick kills or to blind, legs can be targeted to slow enemy movement, and opponents can be disarmed by shooting at their weapons. Unlike previous games, in which the player had a random chance to inflict a critical hit, they are now performed manually through V.A.T.S.[7] At the beginning of the game, players are given points to spend on a character progression system called S.P.E.C.I.A.L. The system represents seven statistics, namely strength, perception, endurance, charisma, intelligence, agility, and luck. When the player earns enough experience points to gain a level, they unlock an ability. When the player allocates more points to a statistic, more abilities can be unlocked. These perks can be upgraded to improve the protagonist's efficiency and to further unlock abilities.[8] There are about 275 perks available for the player to unlock. There is a soft level cap of 65535 and the game does not end once the main story is complete.[9] The player may travel with only one companion at a time, although other characters accompany the player in certain quests. These companions can interact with the environment on the player character's behalf. For example, if the player character does not have the required skills to hack a terminal or pick a lock, they can order the companion to do it for them. Any companion present besides Dogmeat will react to certain player actions in one of four ways (love, like, dislike, or hate), which either raises or lowers their "affinity". Raising a companion's affinity to 1,000 points will result in them "idolizing" the player and granting a specific perk. Partnership with companions is also possible at higher affinities. The companion will leave if affinity drops low enough, and some actions can turn them hostile on sight. Fallout 4 takes place in the year 2287, 10 years after the events of Fallout 3 and 210 years after the Great War, a war between the United States and China over natural resources that ended in a nuclear holocaust in 2077. The setting is post-apocalyptic, covering a region that includes Boston and other parts of New England known as "The Commonwealth". Unlike the previous titles, Fallout 4's story begins on the day the bombs dropped: October 23, 2077. The game takes place in an alternate version of history that features 1940s and 1950s aesthetics, such as diners and a drive-in theater, while design and technologies advance in the directions imagined during the era. The resulting universe is thus a retro-futuristic one, where the technology has evolved enough to produce laser weapons, manipulate genes and create nearly-autonomous artificial intelligence, all within the confines of 1950s' technology such as the widespread use of atomic power and vacuum tubes, as well as having the integrated circuitry of the digital age. The architecture, advertisements, and general living styles are depicted to be largely unchanged since the 1950s, while including contemporary products, such as a robotic rocking horse for children in one advertisement, or posters for the underground Vaults that play a central role in the storyline of the game.[citation needed] There are four main factions that the player can choose to support throughout the story; the Institute, a secretive organization that specializes in the creation of artificial humanoids called "synths", the Brotherhood of Steel, an anti-synth faction hoping to preserve and control technology in the Commonwealth; the Minutemen, a faction that aims to drive out raiders and other threats out of the Commonwealth; and the Railroad, a secretive organization dedicated to rescuing synths from the Institute. The player's character (voiced by either Brian T. Delaney or Courtenay Taylor) takes shelter in Vault 111, emerging exactly 210 years later on October 23, 2287, and assuming the name of the "Sole Survivor".[10] There are thirteen possible companions in the story. Dogmeat, a loyal German Shepherd, is the only mandatory companion, but six others must at least be encountered; Codsworth (Stephen Russell), the Sole Survivor's robot butler; Deacon (Ryan Alosio), a Railroad agent; John Hancock (Danny Shorago), the mayor of Goodneighbor; Nick Valentine (Stephen Russell), a synth detective; Piper Wright (Courtney Ford), an intrepid reporter; and Preston Garvey (Jon Gentry), a resilient member of the Minutemen. The other six possible companions are Cait (Katy Townsend), an Irish-accented cage fighter; Curie (Sophie Simone Cortina), a robot scientist turned Synth; Paladin Danse (Peter Jessop), a Brotherhood of Steel member, MacCready (Matthew Mercer), a mercenary; Strong (Sean Schemmel), a human-sympathetic Super Mutant; and X6-88 (David Paluck), an Institute Courser. Seven of the companions become romance options once they idolize the Sole Survivor, regardless of the gender of the player character: Cait, Curie, Danse, Hancock, MacCready, Piper, and Preston.[11] In the Commonwealth during the year 2077, the protagonist and their family—consisting of their husband Nate (Brian T. Delaney) or wife Nora (Courtenay Taylor), depending on the player's chosen sex, and their baby son Shaun—escape into Vault 111, gaining entry due to a Vault-Tec representative signing them up for it immediately prior to a nuclear attack. Inside, the family members are tricked into entering cryogenic pods and frozen alive. 150 years later, the protagonist's spouse is killed and Shaun is taken away by a mysterious group. The life support system malfunctions at a later date and unfreezes the protagonist, who leaves their pod to find the remaining residents of Vault 111 deceased, gaining the nickname of the "Sole Survivor". They return home and reunite with their former robot butler Codsworth (Stephen Russell), who reveals that a total of 210 years have passed since the nuclear attack. At Codsworth's suggestion, the Sole Survivor reaches the nearby town of Concord, befriending a dog named Dogmeat (River) and a member of a revived version of the Minutemen named Preston Garvey (Jon Gentry). In Diamond City, the Sole Survivor learns that an organization called the Institute has been terrifying the Commonwealth by kidnapping humans and replacing them with Synths, humanoid robots who are indistinguishable from real humans. After rescuing android private detective Nick Valentine (Russell), the Sole Survivor uncovers the identity of their spouse's killer as Conrad Kellogg (Keythe Farley). The Sole Survivor hunts down Kellogg and kills him, though Kellogg spends his last moments revealing that Shaun is being held in the Institute. The Sole Survivor steals a cybernetic device from Kellogg's brain to access his memories with the help of Dr. Amari (Meher Tatna). Meanwhile, the Brotherhood of Steel arrives in the Commonwealth, and a former Institute employee instructs the Sole Survivor to craft a teleportation device required to infiltrate the Institute. With the help of the Railroad, an underground movement aiming to free Synths from the Institute, the Sole Survivor retrieves a chip and has it decoded. After successfully crafting the teleportation device, the Sole Survivor enters the Institute. The Sole Survivor meets a much older Shaun (Tony Amendola), who is revealed to have become the Institute's director and explains that his abduction 60 years ago was part of a Synth experiment due to his pre-war DNA. Should the Sole Survivor choose to align themselves with Shaun, they learn that Shaun is dying of cancer and agree to his request that they succeed him as the Institute's director, helping him track down and re-enslave escaped Synths. Should the Sole Survivor refuse to join Shaun, they engage in combat against Shaun and the entire Institute with the help of various other anti-Institute factions; the Sole Survivor then detonates a nuclear reactor, destroying the Institute. If the Sole Survivor officially joined the Minutemen earlier in the game, the Minutemen would help them wipe out the other factions. Todd Howard, game director of both Fallout 4 and Fallout 3, in 2010 The initial plans for Fallout 4 were formed in 2009, when director Todd Howard wanted to explore the world of Fallout before the bombs fell. Thus, a team began production on the game that year, including Istvan Pely, lead artist of Fallout 3, after finishing that game's downloadable content (DLC). Meanwhile, development on The Elder Scrolls V: Skyrim had Bethesda's full attention, and after that game was released in 2011, the studio continued to regularly support it until 2013 with updates and DLC. After that content was finished, Fallout 4 entered full production from mid-2013 to mid-2015.[12] Unlike the previous two titles—Fallout 3 and Fallout: New Vegas—which used the Gamebryo engine, Fallout 4 uses the Creation Engine, which was used in The Elder Scrolls V: Skyrim. Modified for Fallout 4, the Creation Engine includes a revamped character editor system that allows freeform creation of faces without the use of sliders seen in previous games. Instead, the player can click and drag each feature of the face to accurately customize their character, which can either be a man or woman as the previous Fallout titles have featured.[13] Bethesda announced that the game would run at 1080p resolution and 30 frames per second on PlayStation 4 and Xbox One.[14] Bethesda revealed that mobile devices would be integrated into the game as a form of second screen, acting as a secondary display for the Pip-Boy.[15] For the first time in the Fallout series, the player's character, the Sole Survivor, is fully voice-acted, including all decision-based dialogue options.[16] Brian T. Delaney and Courtenay Taylor are the two player character voice actors.[17] Todd Howard revealed that mods for the PC versions of the game would be usable on the Xbox One version and that the team hoped to bring them to the PlayStation 4 version eventually.[18][19] When asked about the failed effort to add a paid mod system to The Elder Scrolls V: Skyrim, Howard stated there were no plans for a similar effort with Fallout 4.[20] The mods created by PC players through The Creation Kit, which contains the official modding tools, were released for Xbox One and PlayStation 4 in May 2016 and November 2016 respectively.[21][22][23][24] Main article: Creation Engine Fallout 4 uses Bethesda's Creation Engine, which was created for The Elder Scrolls V: Skyrim.[25] Dynamic lighting allows shadows to be created by any structure or item in the game world. Howard stated in the E3 2015 Press Conference that the updated Creation Engine allows for next-generation god rays and advanced volumetric lighting.[vague] The engine features a variety of visual effects not present in previous Bethesda games such as motion blur, temporal anti-aliasing, height fog, dynamic dismemberment, screen space reflections, filmic tone mapping, an updated material system—for wet textures—among numerous others.[26] The engine allows the Bethesda team to add more dynamic lighting to every scene as well as "paint surfaces with realistic materials".[27] Bethesda released an example on how the engine works: "When a rain storm rolls in, our new material system allows the surfaces of the world to get wet, and a new cloth simulation system makes cloth, hair, and vegetation blow in the wind."[28] The updated Creation Engine allows for a more advanced character creation system, which uses sculpting—forgoing the series of sliders present in previous games. In detail, the new character creation system introduces a new, freeform, slider-free facial editor controlled via a dynamic, real-time modeling interface.[29] With regards to the aforementioned fluid animations, the updated engine also allows a much more open approach to conversations with NPCs—wherein the camera views can change depending on the player's preference from a first-person view to a cinematic third-person view—compared to Fallout 3's rigid and instanced conversation system. The protagonist features dynamic dialogue, which is context-sensitive and allows players to back out of a conversation. In Howard's words, "You are free to walk away anytime if you want, or you can even shoot him in the face."[30] On June 2, 2015, Bethesda published a countdown timer scheduled to expire on June 3, 2015, at 14:00 UTC.[31] The game's website went live slightly ahead of schedule, revealing the game along with its box art and platforms.[32][33] The site was taken down later but was put back up again at the scheduled time. The trailer was released when the countdown timer expired,[4] and the game was confirmed to take place in Boston and its surrounding Massachusetts countryside, as suggested by earlier rumors.[34][35] More details were given during Bethesda's E3 2015 press conference on June 14, 2015.[36][37] Fallout 4 became available for pre-order following the product announcement. In addition to the standard edition of the game, there is a collector's edition which includes a wearable replica of the Pip-Boy. This can house a smartphone device, which can run the second screen functionality of the game.[38] As a pre-order bonus for the Windows version of the game, an announcer pack featuring the voice of Mister Handy was released for the multiplayer online battle arena game, Dota 2, developed by Valve.[39] Bethesda announced that Fallout 4 had gone gold on October 23, 2015.[40] The game was released for Windows, PlayStation 4 and Xbox One on November 10, 2015.[41] After Fallout 4's release, Bethesda has released several patches to address some of the issues that were present at the game's launch along with presenting features that improve general gameplay. The first patch—coded as patch 1.2—fine-tuned the game by improving the frame rate. Patch 1.2 fixed a few bugs and errors present at the launch of the game but interfered with unofficial mod support.[42][43] Patch 1.3 improved the game's graphics on all platforms, along with presenting the game with new features such as an added status menu for settlers in settlements. Regarding the graphical updates introduced in this patch, the PC platform was given a new weapon debris effect and a new ambient occlusion setting. The patch fixed several bugs and glitches present in the game.[44] Patch 1.4 was designed to ready the game for the upcoming Creation Kit and downloadable content. Patch 1.4 brought a variety of additions to the settlement building mechanic of the game by adding a symbol to new content placed in by the modding community along with adding a variety of items, such as Raider and Super Mutant decors. The patch also brought general improvements to the game's stability.[45] The 1.5 patch added a revamped survival mode along with support for the downloadable and included bug fixes.[46] Similar to the previous Bethesda games, Fallout 4's fan community-created unofficial patches to address issues and bugs unaddressed by the official patches.[47][48][49] During E3 2016, a virtual reality mode for the game was announced, to be released in 2017.[50] Fallout 4 VR was released as a stand-alone game on December 4, 2017, for PC on the HTC Vive platform.[51] A performance update for the PlayStation 4 and Xbox One versions, allowing higher frame rates and 4K resolution support when played on PlayStation 5 and Xbox Series X/S, was announced in December 2022.[52] It was planned for release in 2023, but was delayed.[53] Bethesda later announced that the update was reworked into native versions for these platforms. The update was released on April 25, 2024, alongside stability improvements and fixes for existing platforms, ultrawide support for PC, and additional free Creation Club content.[54] However, it also introduced a host of problems for players, including broken mod support and UI issues in ultrawide mode on PC. Quality mode on Xbox also stopped working and settings on Steam Deck were wiped. Those playing the game through PlayStation Plus Extra were initially unable to update their version of the game.[55] Main article: Fallout 4 downloadable content On February 16, 2016, Bethesda announced details, prices, and release dates for the first three add-ons for Fallout 4.[56][57] The first add-on, Automatron, which allows the player to build their custom robot companion by using robot parts while adding additional quests, was released to the European and North American markets on March 22, 2016.[58] This was followed by Wasteland Workshop on April 12, 2016, which introduces new build options for settlements and the ability for the player to put captured creatures or humans in a cage, and adds new decorations like neon lights and lettering.[59][60] The third add-on, titled Far Harbor, is a story expansion set in the post-war city of Far Harbor, Maine, and was released on May 19, 2016.[61][62][63] On June 12, 2016, at E3 2016, Bethesda revealed three new add-on packages for the game; the first two, Contraptions Workshop, released on June 21, 2016, and Vault-Tec Workshop, released on July 26, 2016, are structured similarly to the Wasteland Workshop add-on, offering the player more build options and decorations; the Vault-Tec Workshop also adds a brief narrative. Fallout 4's third add-on, Nuka-World, which was released on August 30, 2016, adds an amusement park-based area for the player to explore, in which the player can either side with or put an end to various raider groups residing in the park. If the player decides to do the former, they can help one of the raider groups take control of various settlements in the Commonwealth from the base game.[64][65] Main article: Creation Club At E3 2017, Bethesda announced that Fallout 4 would support Creation Club, an in-game support system to purchase and download custom content.[66] Creation Club went live in August 2017.[67] ReceptionAggregate scoreAggregatorScoreMetacriticPC: 84/100[82]PS4: 87/100[83]XONE: 88/100[84]Review scoresPublicationScoreDestructoid7.5/10[68]Electronic Gaming Monthly9/10[69]Game Informer9/10[70]GameRevolution[71]GameSpot9/10[72]GamesRadar+ [73]GameTrailers9/10[74]Giant Bomb(PC) [75](Consoles) [76]IGN9.5/10[77]PC Gamer (US)88/100[78]Polygon9.5/10[79]VideoGamer.com9/10[80]The Guardian[81]Edit on Wikidata Fallout 4 received "generally favorable" reviews on all three platforms according to review aggregator Metacritic. GameSpot's Peter Brown awarded it a score of 9 out of 10, saying "Fallout 4 is an argument for substance over style and an excellent addition to the revered open-world series." Brown praised the "thought-provoking" narrative, "intuitive" creation tools, the large amount of content, the overall combat, and the overall freedom the player is given.[72] Game Informer's Andrew Reiner scored the game a 9 out of 10 and said: "Bethesda has created another game you can lose your life in. New experiences just keep coming, and you always have another perk to unlock." Reiner praised the "vastly improved" combat, the "denser" world, and the "brilliant" score, but had mixed feelings about the visuals.[70] Dan Stapleton of IGN scored the game a 9.5 out of 10 and wrote: "The world, exploration, crafting, atmosphere, and story of Fallout 4 are all key parts of this hugely successful sandbox role-playing game. (It is) an adventure I'll definitely replay and revisit. Even the technical shakiness that crops up here and there can't even begin to slow down its momentum."[77] Phil Savage of PC Gamer mentioned that Fallout 4 is "a loving production. It's filled with care and attention to detail" and that it was "a pleasure to pick through the world". He concluded his review by stating "many of Fallout 4's problems, like every Bethesda RPG before it, are a consequence of what makes them unforgettable".[78] Polygon awarded it a score of 9.5 out of 10, saying "Fallout 4 brings great gameplay to match its world and ambiance".[79] Destructoid gave the game a 7.5 out of 10, writing "a lot of the franchise's signature problems have carried over directly into Fallout 4".[85] Fallout 4 sold 1.2 million units on Steam in its first 24 hours of release.[86] The game also sold more digital than physical units on day one of launch.[87] With almost 470,000 concurrent Steam players on launch day, Fallout 4 broke Grand Theft Auto V's record for having the most concurrent online players in a Steam game not developed by Valve.[88] Bethesda shipped 12 million units to retailers within the first 24 hours,[89] grossing $750 million.[90] In February 2017, Pete Hines announced that Fallout 4 had sold more units over the same period than Skyrim, though he did not provide an official number.[91] Fallout 4 received numerous awards and nominations from gaming publications such as GameSpot,[92] GamesRadar,[93] EGM,[94] GameRevolution,[95] and IGN.[96][97] The game received "Game of the Year" awards from the 19th Annual D.I.C.E. Awards and the 12th British Academy Games Awards, as well as numerous nominations for the top gaming honor from The Game Awards,[98] The Daily Telegraph,[99] PC Gamer,[100] IGN and more.[101] It was also placed on various lists of the best games of 2015 in which GameSpot put it at sixth,[92] and GamesRadar at fourth.[102] The game also received the "Role-Playing Game of the Year" award from the Game Critics Awards and the Academy of Interactive Arts & Sciences.[101][103] Awards and nominations for Fallout 4 Year Award Category Recipient(s) Result Ref(s). 2015 Game Critic Awards 2015 Best of Show Fallout 4 Won [101] Best PC Game Fallout 4 Won Best Role Playing Game Fallout 4 Won 33rd Golden Joystick Awards Most Wanted Game Fallout 4 Won [104] The Game Awards 2015 Game of the Year Fallout 4 Nominated [105] Best Score/Soundtrack Inon Zur Nominated Best Role Playing Game Fallout 4 Nominated 2016 19th Annual D.I.C.E. Awards Game of the Year Fallout 4 Won [106] Role-Playing/Massively Multiplayer Game of the Year Fallout 4 Won Outstanding Achievement in Game

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Retrieved from " 2Video or display resolutions with a width of around 4,000 pixels 4K resolution refers to a horizontal display resolution of approximately 4,000 pixels.[1] Digital television and digital cinematography commonly use several different 4K resolutions. In television and consumer media, 3840 × 2160 (4K UHD) with a 16:9 aspect ratio is the dominant standard, whereas the movie projection industry uses 4096 × 2160 (DCI 4K). The 4K television market share increased as prices fell dramatically throughout 2013 and 2014.[2][3] Comparison of common broadcast resolutions Comparison of common display resolutions The term "4K" is generic and refers to any resolution with a horizontal pixel count of approximately 4,000.[4]:2 Several different 4K resolutions have been standardized by various organizations. The terms "4K" and "Ultra HD" are used more widely in marketing than "2160p" (cf. "1080p"). While typically referring to motion pictures, some digital camera vendors have used the term "4K photo" for still photographs, making it appear like an especially high resolution even though 3840×2160 pixels equal approximately 8.3 megapixels, which is not considered to be especially high for still photographs.[5] Comparison of DCI and UHD resolutions In 2005, Digital Cinema Initiatives (DCI), a prominent standards organization in the cinema industry, published the Digital Cinema System Specification. This specification establishes standardized 2K and 4K container formats for digital cinema production, with resolutions of 2048 × 1080 and 4096 × 2160 respectively.[6]:§4.3.1 The resolution of the video content inside follows the SMPTE 428-1 standard,[6]:§3.2.1 which establishes the following resolutions for a 4K distribution:[7]:6 4096 × 2160 (full frame, 256:135 or ≈1.90:1 aspect ratio) 3996 × 2160 (flat crop, 1.85:1 aspect ratio) 4096 × 1716 (CinemaScope crop, ≈2.39:1 aspect ratio) 2K distributions can have a frame rate of either 24 or 48 FPS, while 4K distributions must have a frame rate of 24 FPS.[6]:§3.1.4.2 Some articles claim that the terms "2K" and "4K" were coined by DCI and refer exclusively to the 2K and 4K formats defined in the DCI standard.[8] However, usage of these terms in the cinema industry predates the publication of the DCI standard,[9][10][11][12] and they are generally understood as casual terms for any resolution approximately 2000 or 4000 pixels in width, rather than names for specific resolutions.[4]:2[13]:109 In 2007, the Society of Motion Picture and Television Engineers published SMPTE ST 2036-1, which defines parameters for two UHDTV systems called UHDTV1 and UHDTV2.[14][15] The standard defines the following characteristics for these systems: A resolution of 3840 × 2160 (UHDTV1) or 7680 × 4320 (UHDTV2)[15]:§5.2 Square (1:1) pixels, for an overall image aspect ratio of 16:9[15]:§5.1 A framerate of 23.976, 24, 25, 29.97, 30, 50, 59.94, 60, 100, 119.88, or 120 Hz with progressive scan[15]:§1.2 RGB, Y′CBCR 4:4:4, 4:2:2, or 4:2:0 pixel encoding[15]:§7.7 10 bpc (30 bit/px) or 12 bpc (36 bit/px) color depth[15]:§1.2 Colorimetry characteristics as defined in the standard, including color primaries, quantization parameters, and the electro-optical transfer function. These are the same characteristics later standardized in ITU-R BT.2020. UHDTV1 systems are permitted to use BT.709 color primaries up to 60 Hz.[15]:§6.2 In 2012, the International Telecommunication Union, Radiocommunication Sector published Recommendation ITU-R BT.2020, also known as the Ultra High Definition Television (UHDTV) standard.[16] It adopts the same image parameters defined in SMPTE ST 2036–1.[17] Although the UHDTV standard does not define any official names for the formats it defines, ITU typically uses the terms "4K", "4K UHD", or "4K UHDTV" to refer to the 3840 × 2160 system in public announcements and press releases ("8K" for the 7680 × 4320 system).[18] In some of ITU's other standards documents, the terms "UHDTV1" and "UHDTV2" are used as shorthand.[19] In October 2012, the Consumer Electronics Association (CEA) announced their definition of the term Ultra High-Definition (or Ultra HD) for use with marketing consumer display devices.[20] CEA defines an Ultra HD product as a TV, monitor, or projector with the following characteristics:[21] A resolution of 3840 × 2160 or larger An aspect ratio of 1.77:1 (16:9) or wider Support for color depth of 8 bpc (24 bit/px) or higher At least one HDMI input capable of supporting 3840 × 2160 at 24, 30, and 60 Hz progressive scan (though not necessarily with RGB / Y′CBCR 4:4:4 color), and HDCP 2.2 Capable of processing images according to the color space defined in ITU-R BT.709 Capable of upscaling HD content (i.e. 720p / 1080p) The CEA definition does allow manufacturers to use other terms—such as 4K—alongside the Ultra HD logo.[4]:9 Since the resolution in CEA's definition is only a minimum requirement, displays with higher resolutions such as 4096 × 2160 or 5120 × 2880 also qualify as "Ultra HD" displays, provided they meet the other requirements. Some 4K resolutions, like 3840 × 2160, are often casually referred to as 2160p.[22][23][24] This name follows from the previous naming convention used by HDTV and SDTV formats, which refer to a format by the number of pixels/lines along the vertical axis (such as "1080p" for 1920 × 1080 progressive scan, or "480i" for the 480-line interlaced SDTV formats) rather than the horizontal pixel count (≈4000 or "4K" for 3840 × 2160). The term "2160p" could be applied to any format with a height of 2160 pixels, but it is most commonly used in reference to the 4K UHDTV resolution of 3840 × 2160 due to its association with the well-known 720p and 1080p HDTV formats. Although 3840 × 2160 is both a 4K resolution and a 2160p resolution, these terms cannot always be used interchangeably since not all 4K resolutions are 2160 pixels tall, and not all 2160p resolutions are ≈4000 pixels wide. However, some companies have begun using the term "4K" to describe devices with support for a 2160p resolution, even if it is not close to 4000 pixels wide. For example, many "4K" dash cams only support a resolution of 2880 × 2160 (4:3);[25][26] although this is a 2160p resolution, it is not a 4K resolution. Conversely, Samsung released a 5120 × 2160 (64:27) TV, but marketed it as a "4K" TV despite its 5K-class resolution.[27][28] In 2015, LG Display announced the implementation of a new technology called M+ which is the addition of white subpixel along with the regular RGB dots in their IPS panel technology.[29] The media and internet users later called this "RGBW" TVs because of the white sub pixel. Most of the new M+ technology was employed on 4K TV sets which led to a controversy after tests showed that the addition of a white sub pixel replacing the traditional RGB structure would reduce the resolution by around 25%. After tests done by Intertek in which the technical aspects of LG M+ TVs were analyzed and they concluded that "the addressable resolution display is 2,880 X 2,160 for each red, green, blue", in other words, the LG TVs were technically 2.8K as it became known in the controversy.[30][31] Although LG Display has developed this technology for use in notebook display, outdoor and smartphones, it is more popular in the TV market due to the supposed 4K UHD marketed resolution but still being incapable of achieving true 4K UHD resolution as defined by the CTA as 3840x2160 active pixels with 8-bit per color. This negatively impacts the rendering of text, making it a bit fuzzier, which is especially noticeable when a TV is used as a PC monitor.[32][33][34][35][36] In 2019, Sony was granted the CinemaWide trademark by the European Union Intellectual Property Office (EUIPO), in which the trademark covers 'Class 9' electronic devices, including smartphones.[37] According to Sony and SID,[38] the standard defines a CinemaWide 4K product with the following characteristics: A resolution of 3840 × 1644 or larger An aspect ratio of 21:9 Capable of playing back 4K resolution video (2160p) in an aspect ratio of 21:9 Capable of upscaling non-4K content (i.e. 720p / 1080p)[39] Sony Xperia smartphones are the most widely known products that equipped with CinemaWide 4K display, such as Xperia 1, Xperia 1 II, Xperia 1 III, Xperia 1 IV and Xperia 1 V. Video sharing website YouTube and the television industry have adopted 3840 × 2160 as their 4K standard.[40][41] As of 2014[update], 4K content from major broadcasters remained limited.[42] By late 2014, 4K content was becoming more widely available online, including on Apple TV, YouTube, Netflix, Hulu, and Amazon Prime Video.[43][44] By 2013, some UHDTV models were available to general consumers in the range of US$600.[45][46] As of 2015[update], prices on smaller computer and television panels had dropped below US$400.[47] On March 26, 2013, the Advanced Television Systems Committee announced new proposals of a new standard called ATSC 3.0 which would implement UHD broadcasts at resolutions of up to 3840 × 2160 or 7680 × 4320.[48][49][50][51] The standard would also include framerates of up to 120 Hz, HEVC encoding, wide color gamut, as well as high dynamic range.[52][53][54] In 2014, the Digital Video Broadcasting Project released a new set of standards intended to guide the implementation of high resolution content in broadcast television. Dubbed DVB-UHDTV, it establishes two standards, known as UHD-1 (for 4K content) and UHD-2 (for 8K content). These standards use resolutions of 3840 × 2160 and 7680 × 4320 respectively, with framerates of up to 60 Hz, color depth up to 10 bpc (30 bit/px), and HEVC encoding for transmission.[55] DVB is currently focusing on the implementation of the UHD-1 standard.[56] DVB finalized UHD-1 Phase 2 in 2016, with the introduction of service by broadcasters expected in 2017. UHD-1 Phase 2 adds features such as high dynamic range (using HLG and PQ at 10 or 12 bits), wide color gamut (BT. 2020/2100 colorimetry), and high frame rate (up to 120 Hz).[57][56] As of February 2025, both YouTube and Vimeo support high-resolution video uploads, with maximum resolutions of 4096 × 2304 pixels (approximately 9.4 megapixels) and 4096 × 2160 pixels (approximately 8.8 megapixels), respectively.[58] The growing availability of 4K content across streaming platforms like Netflix, Amazon Prime Video, and YouTube has made it more accessible to consumers. Vimeo's 4K content is currently limited to mostly nature documentaries and tech coverage.[59][60] High Efficiency Video Coding (HEVC or H.265) facilitates streaming of 4K content at bitrates between 20 to 30 Mbit/s, offering efficient compression without significant quality loss.[61] In January 2014, Naughty America launched the first adult video service streaming in 4K.[62][63] In February 2025, Super Bowl LIX was broadcast in 4K resolution with Dolby Vision HDR and Dolby Atmos sound for the first time. Fox aired the game, and it was also available for free streaming in 4K on Tubi, marking a significant milestone in sports broadcasting.[64][65] See also: Category: Mobile phones with 4K video recording The first mobile phones to be able to record at 2160p (3840 × 2160) were released in late 2013, including the Samsung Galaxy Note 3, which is able to record 2160p at 30 frames per second. In the year 2014, the OnePlus One was released with the option to record DCI 4K (4096 × 2160) at 24 frames per second, as well as LG G3 and Samsung Galaxy Note 4 with optical image stabilization. In the year 2015, Apple announced the iPhone 6s was released with the 12 megapixel camera that has the option to record 4K at 25 or 30 frames per second. In the years 2017 and 2018, mobile phone chipsets reached sufficient processing power that mobile phone vendors started releasing mobile phones that allow recording 2160p footage at 60 frames per second for a smoother and more realistic appearance.[66] iMac with Retina Display (2014) is one of the earliest computers that utilise 4K widescreen.[67] Samsung UN105S9 105-inch (2,700 mm) ultra-high-definition 4K television In 1984, Hitachi released the ARTC HD63484 graphics processor, which was capable of displaying up to 4K resolution when in monochrome mode.[68] The resolution was targeted at the bit-mapped desktop publishing market.[68] The first commercially available 4K camera for cinematographic purposes was the Dalsa Origin, released in 2003.[69][70] 4K technology was developed by several research groups in universities around the world, such as University of California, San Diego, CALIT2, Keio University, Naval Postgraduate School and others that realized[71] several demonstrations in venues such as IGrid in 2004 and CineGrid. YouTube began supporting 4K for video uploads in 2010 as a result of leading manufacturers producing 4K cameras.[72] Users could view 4K video by selecting "Original" from the quality settings until December 2013, when the 2160p option appeared in the quality menu.[73] In November 2013, YouTube began to use the VP9 video compression standard, saying that it was more suitable for 4K than High Efficiency Video Coding (HEVC). Google, which owns YouTube, developed VP9.[72] Theaters began projecting movies at 4K resolution in 2011.[74] Sony was offering 4K projectors as early as 2004.[75] The first 4K home theater projector was released by Sony in 2012.[76] Despite this, there's not many finished films with 4K resolution as of 2023. Even for movies and TV shows shot using 6K or 8K cameras, almost all finished films are edited in HD resolution and enlarged to fit a 4K format.[77] Sony is one of the leading studios promoting UHDTV content, as of 2013[update] offering a little over 70 movie and television titles via digital download to a specialized player that stores and decodes the video. The large files (≈40 GB), distributed through consumer broadband connections, raise concerns about data caps.[78] In 2014, Netflix began streaming House of Cards, Breaking Bad,[79] and "some nature documentaries" at 4K to compatible televisions with an HEVC decoder. Most 4K televisions sold in 2013 did not natively support HEVC, with most major manufacturers announcing support in 2014.[80] Amazon Studios began shooting their full-length original series and new pilots with 4K resolution in 2014.[81] They are now currently available through Amazon Video.[82] In March 2016 the first players and discs for Ultra HD Blu-ray—a physical optical disc format supporting 4K resolution and high-dynamic-range video (HDR) at 60 frames per second—were released.[83] On August 2, 2016, Microsoft released the Xbox One S, which supports 4K streaming and has an Ultra HD Blu-ray disc drive, but does not support 4K gaming.[84] On November 10, 2016, Sony released the PlayStation 4 Pro, which supports 4K streaming and gaming,[85] though many games use checkerboard rendering or are upscaled 4K.[86] On November 7, 2017, Microsoft released the Xbox One X, which supports 4K streaming and gaming,[87] though not all games are rendered at native 4K.[88] This section may need to be rewritten to comply with Wikipedia's quality standards. You can help. The talk page may contain suggestions. (July 2024) Though the price of home cinema viewing devices began to drop rapidly from 2013, the digital video projector market saw limited expansion as very few manufacturers had fully 4K-capable lineups. Native 4K projectors remained priced in the five-figure range well into 2015, only falling below US$10,000 later that year. Sony was the sole major manufacturer offering a comprehensive 4K projection solution as of 2015.[89] Critics argue that, at typical direct-view panel sizes and viewing distances, the extra pixels of 4K are unnecessary for normal human vision.[citation needed] In contrast, home cinema projectors use larger screens without necessarily increasing the viewing distance to match the scale. One technique to provide a more affordable 4K experience in home cinema projectors is "e-shift." Developed by some manufacturers, e-shift extrapolates additional pixels from 1080p sources to either upscale to 4K or display 4K from native 4K sources at a much lower price point than native 4K projectors. This technology reached its fourth generation in 2016.[90][91][92][93] JVC applied this technology to create an 8K flight simulation system for Boeing, meeting the visual acuity limits of 20/25.[94] The first pixel-shifted 4K UHD projectors adopted by the market are Optoma, BenQ, Dell, et al., for those adopt a 2718×1528 pixel structure. The amount of data these projectors process is true 4K, but they overlap the pixels, which is what pixel shifting is. In fact, each of those pixels is far larger. In fact, each one has 50% more area than true 4K. Pixel shifting projectors. This way, they project a pixel and shift it up to the right by a half diameter and project it again with modified data—the second pixel overlaid on the first. This would result in adjacent red and green pixels effectively forming yellow, with a fringe on one side of red, on the other of green—except that the fringe takes on another color as the next line of pixels overlaps too. 4K UHD or 1080p pixel shifting cannot reveal the fine detail of a true 4K projector such as those Sony ships in the business, education, and home markets. JVC has one true 4K at $35,000 (in mid-2017) and another for $120,000.[citation needed] While projecting UHD, it might look as though the pixel structures would have 1/4 the area of 1080p; it just doesn't happen with pixel shifting. That much resolution is only carried by a true 4K projector. This is why "true" 4K costs so much more than 4K UHD projectors that have more or less similar feature sets. They produce smaller pixels, finer resolution—no loss of detail or color from the overlapping pixels. This is in stark contrast to the small variation in the aspect ratio difference, which would be capable of being noticeable in a few companies, such as Kaleidescape, offering media servers that enable 4K UHD Blu-ray movies with a wide dynamic range in a home theater.[95] In November 2014, American satellite provider DirecTV (owned by AT&T) became the first pay-TV provider to offer access to 4K content, although limited to selected video-on-demand films.[96] In August 2015, British sports network BT Sport launched a 4K feed, with its first broadcast being the 2015 FA Community Shield football match. Two production units were used, producing the traditional broadcast in high-definition, and a separate 4K broadcast. As the network did not want to mix 4K footage with upconverted HD footage, this telecast did not feature traditional studio segments at pre-game or half-time, but those hosted from the stadium by the match commentators using a 4K camera. BT envisioned that if viewers wanted to watch studio analysis, they would switch to the HD broadcast and then back for the game. Footage was compressed using H.264 encoders and transmitted to BT Tower, where it was then transmitted back to BT Sport studios and decompressed for distribution, via 4K-compatible BT TV set-top boxes on an eligible BT Infinity internet plan with at least a 25 Mbit/s connection.[97][98] In late 2015 and January 2016, three of Canada's television providers – including Quebec-based Vidéotron, Ontario-based Rogers Cable, and Bell Fibe TV, announced that they would begin to offer 4K compatible set-top boxes that can stream 4K content to subscribers over gigabit internet service.[99][100] On October 5, 2015, alongside the announcement of its 4K set-top box and gigabit internet, Canadian media conglomerate Rogers Communications announced that it planned to produce 101 sports telecasts in 4K in 2016 via its Sportsnet division, including all Toronto Blue Jays home games, and "marquee" National Hockey League games beginning in January 2016. Bell Media announced via its TSN division a slate of 4K telecasts to begin on January 20, 2016, including selected Toronto Raptors games and regional NHL games.[101][102][103] On January 14, 2016, in cooperation with BT Sport, Sportsnet broadcast the first ever NBA game produced in 4K – a Toronto Raptors/Orlando Magic game at O2 Arena in London, England. On January 20, also during a Raptors game, TSN presented the first live 4K telecast produced in North America.[99][101][104] Three days later, Sportsnet presented the first NHL game in 4K.[105] Dome Productions, a joint venture of Bell Media and Rogers Media (the respective owners of TSN and Sportsnet), constructed a "side-by-side" 4K mobile production unit shared by Sportsnet and TSN's first 4K telecasts; it was designed to operate alongside a separate HD truck and utilize cameras capable of output in both formats.[106] For the opening game of the 2016 Toronto Blue Jays season, Dome constructed "Trillium" – a production truck integrating both 4K and 1080i high-definition units.[107] Bell Media's CTV also broadcast the 2016 Juno Awards in 4K as the first awards show presented in the format.[108] In February 2016, Spanish-language Univision trialed 4K by producing a closed-circuit TV broadcast of a football friendly between the national teams of Mexico and Senegal from Miami (America) in the format. The broadcast was streamed privately to several special viewing locations. Univision aimed to develop a 4K streaming app to publicly televise the final of Copa América Centenario in 4K.[109][110][111] In March 2016, DirecTV and CBS Sports announced that they would produce the "Amen Corner" supplemental coverage from the Masters golf tournament in 4K.[112][113] In late 2016, Telus TV announced that they would begin to offer 4K compatible set-top boxes.[114] After having trialed the technology in limited matches at the 2013 FIFA Confederations Cup,[115] and the 2014 FIFA World Cup (via private tests and public viewings in the host city of Rio de Janeiro),[116] the 2018 FIFA World Cup was the first FIFA World Cup in which all matches were produced in 4K. Host Broadcasting Services stated that at least 75% of the broadcast cut on each match would come from 4K cameras (covering the majority of main angles), with instant replays and some camera angles being upconverted from 1080p sources. These broadcasts were made available from selected rightsholders, such as the BBC in the UK, and selected television providers in the United States.[117][118][119] Technical limitations in distributing 4K broadcasts (including the increased cost of 4K-compatible production equipment)[120] have led to some broadcasters deciding against the format in favour of emphasizing 1080p/HDR broadcasts instead. After having broadcast UEFA Euro and the Champions League final in the format, UEFA discontinued 4K coverage for both in 2024, as broadcasters elected to put resources behind HDR and other on-air features instead.[121] Some U.S. broadcasters, such as CBS Sports,[122][123] Fox Sports,[124] and USA Network[125] have broadcast events promoted as having "4K" feeds, but are actually 1080p/HDR broadcasts upconverted to 4K. For the 2024 Summer Olympics, USA Network's "4K" coverage was sourced from host broadcaster Olympic Broadcasting Services (OBS) in 4K, but downconverted to 1080p when received by NBC Sports' studios, and then upconverted to 4K for distribution.[125] Examples of some 4K resolutions used in displays and media Format Resolution Aspect ratio Pixels - 4096 × 3072 1.33 4:3 12,582,912 - 4096 × 2560 1.6 16:10 10,485,760 - 4096 × 2304 1.77 16:9 9,437,184 DCI 4K (full frame) 4096 × 2160 ≈1.90 256:135 8,847,360 DCI 4K (CinemaScope cropped) 4096 × 1716 ≈2.39 1024:429 7,020,544 DCI 4K (flat cropped) 3996 × 2160 1.85 37:20 8,631,360 WQUXGA 3840 × 2400 1.6 16:10 9,216,000 4K UHD 3840 × 2160 1.77 16:9 8,294,400 - 3840 × 1920 2.0 2:1 7,372,800 - 3840 × 1620 2.370 64:27 6,220,800 - 3840 × 1600 2.4 12:5 6,144,000 DFHD 3840 × 1080 3.55 32:9 4,147,200 The resolution of 3840 × 2160 is the dominant 4K resolution in the consumer media and display industries. This is the resolution of the UHDTV1 format defined in SMPTE ST 2036–1,[15] as well as the 4K UHDTV format defined by ITU-R in Rec. 2020,[16] and is also the minimum resolution for CEA's definition of Ultra HD displays and projectors.[21] The resolution of 3840 × 2160 was also chosen by the DVB project for their 4K broadcasting standard, UHD-1.[56] This resolution has an aspect ratio of 16:9, with 8,294,400 total pixels. It is exactly double the horizontal and vertical resolution of 1080p (1920 × 1080) for a total of 4 times as many pixels, and triple the horizontal and vertical resolution of 720p (1280 × 720) for a total of 9 times as many pixels. It is sometimes referred to as "2160p", based on the naming patterns established by the previous 720p and 1080p HDTV standards. In 2013, televisions capable of displaying UHD resolutions were seen by consumer electronics companies as the next trigger for an upgrade cycle after a lack of consumer interest in 3D television.[126] This resolution is used mainly in digital cinema production, and has a total of 8,847,360 pixels with an aspect ratio of 256:135 (≈19:10). It was standardized as the resolution of the 4K container format defined by Digital Cinema Initiatives in the Digital Cinema System specification, and is the native resolution of all DCI-compliant 4K digital projectors and monitors.[6] The DCI specification allows several different resolutions for the content inside the container, depending on the desired aspect ratio. The allowed resolutions are defined in SMPTE 428-1:[6]:§3.2.1[7]:p. 6 4096 × 2160 (full frame, 256:135 or ≈1.90:1 aspect ratio) 3996 × 2160 (flat crop, 1.85:1 aspect ratio) 4096 × 1716 (CinemaScope crop, ≈2.39:1 aspect ratio) The DCI 4K standard has twice the horizontal and vertical resolution of DCI 2K (2048 × 1080), with four times as many pixels overall. Digital movies made in 4K may be produced, scanned, or stored in a number of other resolutions depending on what storage aspect ratio is used.[127][128] In the digital cinema production chain, a resolution of 4096 × 3112 is often used for acquiring "open gate" or anamorphic input material, a resolution based on the historical resolution of scanned Super 35 mm film.[129] Various other non-standardized 4K resolutions have been used in displays, including: 4096 × 2560 (1.60:1 or 16:10); this resolution was used in the Canon DP-V3010, a 30-inch (76 cm) 4K reference monitor designed for reviewing cinema footage in post-production, released in 2013.[130] 4096 × 2304 (1.77:1 or 16:9); this resolution was used in the 21.5-inch (55 cm) LG UltraFine 22MD4KA 4K monitor, jointly announced by LG and Apple in 2016[131] and used in the 21.5" 4K Retina iMac computer. 3840 × 2400 (1.60:1 or 16:10); this resolution was used in the 22.2-inch (56 cm) IBM T220 and T221 monitors, released in 2001 and 2002 respectively. This resolution is also referred to as "WQUXGA", and is four times the resolution of WUXGA (1920 × 1200).[132] More recently, this resolution has returned in the Dell XPS Laptop series, under the name "UHD+".[133] 3840 × 1920 (2:1 or 16:8); this resolution is largely used by 360° videos[134] as they largely use a 2:1 aspect ratio. The reason is to represent a 360° on the horizontal axis and a 180° on the vertical. 3840 × 1600 (2.40:1 or 12:5); a number of computer monitors with this resolution have been produced, the first being the 37.5-inch (95 cm) LG 38UC99-W released in 2016. This resolution is equivalent to WQXGA (2560 × 1600) extended in width by 50%, or 3840 × 2160 reduced in height by ≈26%.[135] LG refers to this resolution as "WQHD+" (Wide Quad HD+),[136] while Acer uses the term "UW-QHD+" (Ultra-wide Quad HD+)[137] and some media outlets have used the term "UW4K" (Ultra-wide 4K).[138][139] 3840 × 1080 (3.55:1 or 32:9); this resolution was first used in the Samsung C49HG70, a 49-inch (120 cm) curved gaming monitor released in 2017. This resolution is equivalent to dual 1080p displays (1920 × 1080) side-by-side, but with no border interrupting the image. It is also exactly one half of a 4K UHD (3840 × 2160) display. Samsung refers to this resolution as "DFHD" (Dual Full HD).[140] Sony Handycam FDR-AX1 See also: List of 4K video recording devices The main advantage of recording video at the 4K standard is that fine spatial detail is resolved well.[141] Individual still frames extracted from 3840×2160-pixel video footage can act as 8.3 megapixel still photographs, while only 2.1 megapixels at 1080p and 0.9 megapixels at 720p. If the final video resolution is reduced to 2K from a 4K recording, more detail is apparent than would have been achieved from a native 2K recording.[141] Increased fineness and contrast is then possible with output to DVD and Blu-ray.[142] Some cinematographers record at 4K with the Super 35 film format to offset any resolution loss that may occur during video processing.[143] In full size, this image shows the difference between four subsampling schemes. The color images appear similar. The lower row shows the resolution of the color information. Many consumer electronics such as mobile phones store video footage in Y′CBCR format with 4:2:0 chroma subsampling, which records color information at only one quarter the resolution as the brightness information.[144] For 3840 × 2160 video, this means that the color information is only stored at 1920 × 1080.[145] Consumer cameras and mobile phones record 2160p footage at much higher bit rates (usually 50 to 100 Mbit/s) than 1080p (usually 10 to 30 Mbit/s). This higher bit rate reduces the visibility of compression artifacts, even if viewed on monitors with a lower resolution than 2160p. Film portalTelevision portal 1080p Full HD – digital video format with a resolution of 1920 × 1080, with vertical resolution of 1080 lines 1440p (WQHD) – vertical resolution of 1440 lines List of 4K video recording devices 2K resolution – digital video formats with a horizontal resolution of around 2,000 pixels 5K resolution – digital video formats with a horizontal resolution of around 5,000 pixels, aimed at non-television computer monitor usage 8K resolution – digital video formats with a horizontal resolution of around 8,000 pixels 10K resolution – digital video formats with a horizontal resolution of around 10,000 pixels 16K resolution – experimental VR format 32K resolution Aspect ratio (image) – proportional relationship between an image's width and height Digital cinema Display resolution standards High Efficiency Video Coding (HEVC) – video standard that supports 4K & 8K UHDTV and resolutions up to 8192 × 4320 Rec. 2020 – ITU-R recommendation for UHDTV, defining formats with resolutions of 4K (3840 × 2160) and 8K (7680 × 4320) Ultrawide formats ^ Goulekas, Karen (2001). 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