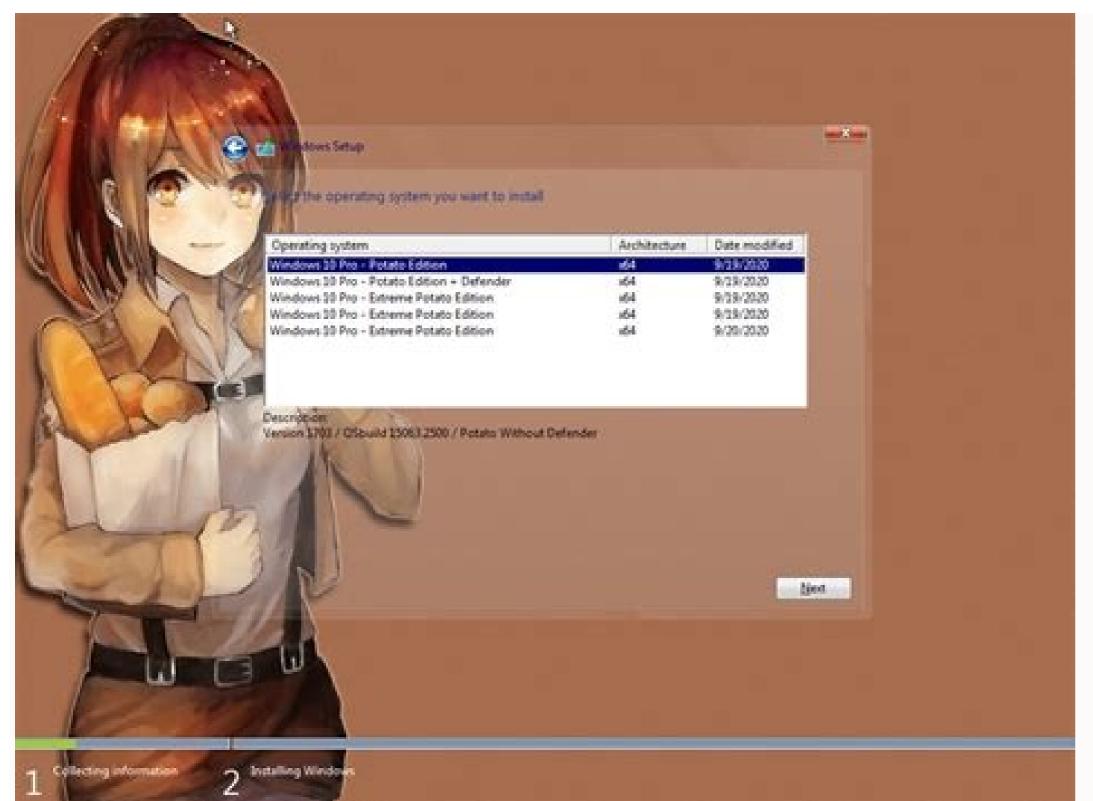
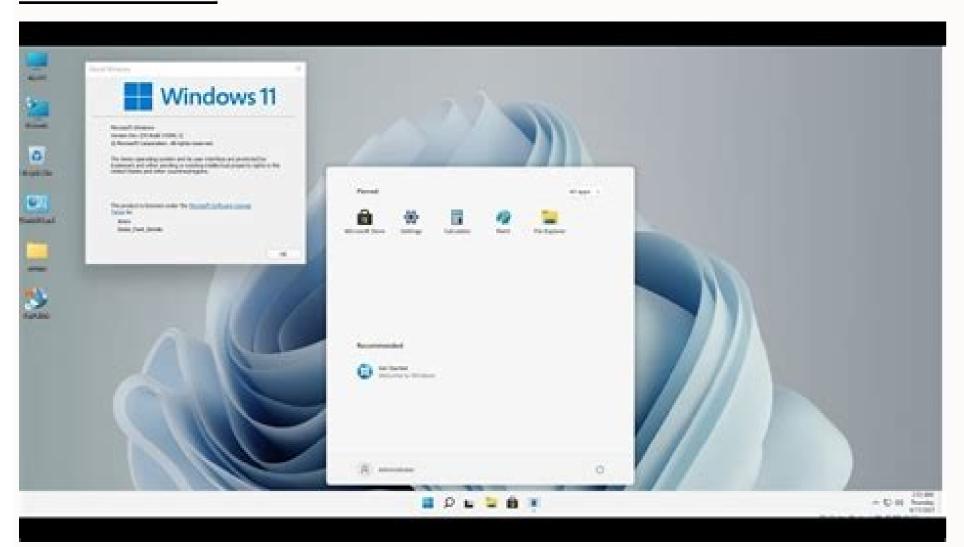
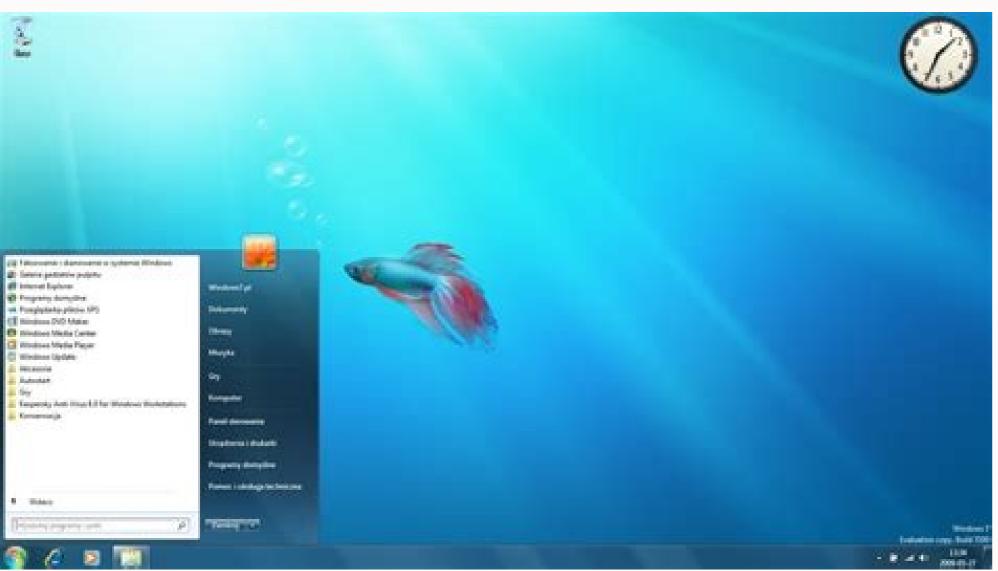
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ĐÑĐ¾ÑĐ¾Đ²: 752 566 2021 Computer Operating System Microsoft Windows 11 Windows NT version Screenshot of the new Start menu and centered taskbar[1] Developed by COSC, Microsoft+Writing language, C+ Source available (via Shared Source [2][3][4][5]Released to production June 24, 2021; 13 months ago (2021-10-05)[6]Last version of 22H2 (10.0.22621.819) (November 8, 2022; 9 days ago (2022-11-08)[7]) [±] Last version of 22H channel preview (10.0.22623.891) (before November 8, 2022; 9 days ago) [8][9] [±] Beta Channel 10.0.25236.1010 (November 4, 2022; 13 days ago) (2022-11-04)[11]) [±] Marketing targeting language 1 A0fill tablet [12][13]Language list Afrikaans, Albanian, Amharic, Arabic, Armenian, Assamese, Azerbaijani, (Bangladesh), Bangla (India), Basque, Belarusian, Catalan, Central Kurdish, Cherokee, Simplified Chinese, Traditional Chinese, Croatian, Czech, Danish, Dari Persian (Afghanistan), Dutch, German, Greek, English (UK), English (UK), English (UK), Estonian, Finnish, Filipino, French (Canada), French (Canad Malayalam, Maltese, Maori, Marathi, Mongolian, Nepali, North Sotho, Norwegian Bokmöl, Norwegian Bokmöl, Norwegian Nynorsk, Odia, Persian (Cyrillic, Berbian (Cyrillic, Berbian (Cyrillic, Serbian), Punjabi (Gurmukhi), Punjabi (G (Latin), Sindhi (Arabic), Sinhala, Slovak, Slovenian, Spanish (Argentina, Bolivia, Chile, Colombia, Costa Rica, Ecuador, Dominican Republic, Salvador, Guatemala, Honduras, Latin America, Mexico, Panama, Paraguay, Peru, Puerto Rico, Spain, Uruguay, Venezuela), Swahili, Swedish, Tajik, Tamil, Tatar, Telugu, Thai, Tigrinya, Tswana, Turkish, Turkmen, Ukrainian, Urdu, Uighur, Uzbek, Valencian, Vietnamese, Welsh, Wolf, Xhosa, Yoruba, Zulu Update method Windows Update Microsoft Store Windows NT kernel) UserlandNative APIWindows APIWindows Update Microsoft Store Windows NT kernel) UserlandNative APIWindows NT kernel (Windows NT ke API.NET Framework Universal Windows Platform Windows Subsystem for Android Windows Subsystem for Linux Dev Walking UI Windows 11 New Features Removed Features Version History Versions Linked XboxWindows Insider Microsoft Store Universal Platform Windows NT Operating System released in October 2021. It is a free update for its predecessor Windows 10 (2015) available for all Windows 10 devices that meet the new Windows 11 system requirements. Windows 11 includes significant changes to the way Windows works that were affected by the Windows 10X discontinuation, including a redesigned Start menu that replaces its "live tiles" with a separate "widgets" window in the taskbar, the ability to creating tiled window sets that can be minimized as a group and restored from the taskbar; and new gaming technologies inherited from the Xbox Series X and Series S, like Auto HDR and DirectStorage on compatible hardware. Like its Windows 10 predecessor, Internet Explorer (IE) has been integrated into the Windows environment. Microsoft has also announced plans to provide more flexibility in software that can be distributed through the Microsoft Store and to support Android apps in Windows 11 have been increased over Windows 10, citing security reasons. Microsoft officially supports the operating system only on devices with an 8th generation Intel Core processor or later, Qualcomm Snapdragon 850 ARM system-on-chip or higher, with UEFI Secure Boot and Trusted Platform Module (TPM) 2.0 supported and enabled (although Microsoft can provide OEM exceptions to the TPM 2.0 requirement). Although the operating system can be installed on unsupported processors, Microsoft does not guarantee the availability of updates. Windows 11 removed support for 32-bit x86 processors and devices that use BIOS firmware. Windows 11 has had a mixed receptionPreliminary information about the operating system focused on its more stringent hardware requirements, with debate over whether they were legitimately intended to improve Windows security or as a ploy to sell customers newer devices and change-related e-waste. Upon release, it was praised for its improved visual design, window management, and greater emphasis on security, but was criticized for various modifications to aspects of the user interface that were considered inferior to its predecessor. As of October 2022 [Update] Windows 11 is the second most popular version of Windows with a share of 15%[15] (and up to 16% in the US[16] and higher in some countries)[17]. PC,[18] although Windows 10 remains the most popular with 5.5 times the market share of Windows 7, but behind Windows 10: 72% worldwide and 77% in the US.[19] Across all platforms, 4.0% of PCs run Windows 11. Development At Ignite in 2015, Microsoft employee Jerry Nixon announced that Windows 10 would be "the last version of Windows." This statement, as confirmed by Microsoft, "reflects" its point of view. The operating system was considered a service, and new versions and updates were released over time. In October 2019, Microsoft announced Windows 10X, a future version of Windows 10 designed exclusively for dual touchscreen devices such as the upcoming Surface Neo. It featured a redesigned UI designed with contextual "positions" for different screen configurations and usage scenarios, as well as changes such as a centered taskbar and an updated Start menu without Windows 10 "live items". Windows apps should run in "containers" to optimize performance and power consumption. Microsoft has announced that it plans to release Windows apps should run in "containers" to optimize performance and power consumption. Microsoft has announced that it plans to release Windows apps should run in "containers" to optimize performance and power consumption. Microsoft has announced that it plans to release Windows apps should run in "containers" to optimize performance and power consumption. Microsoft has announced that it plans to release Windows apps should run in "containers" to optimize performance and power consumption. Microsoft has announced that it plans to release Windows apps should run in "containers" to optimize performance and power consumption. we need to focus on meeting customer needs where they are now", and thus announced that Windows 10X will only run on one device, at the beginning and that Microsoft was working on a Windows 10 UI update codenamed "Valley of the Sun" to be included in a late 2021 feature update codenamed "Cobalt". Internal documentation says Sun Valley's goal was to "refresh[e]" the Windows UI and make it "smoother" with a more consistent WinUI, while reports suggest Microsoft plans to improve the UI elements that appear in Windows 10X, [28] In January 2021, it was reported that Microsoft published a job offer that referred to a "wide visual overhaul of Windows". By December 2020, Microsoft has started rolling out and announcing some of these visual changes and other new features in Windows 10 Insider Preview builds, such as new system icons (also including environment resource replacement starting with Windows 95). [30] Task view improvements to change background on each virtual desktop, x86-64 emulation on ARM, and add auto HDR feature from Xbox Series X.[31][32][33] On May 18, 2021, Windows Service and Delivery Manager John Cable announced that Windows 10X has been canceled and that Microsoft will "speed up the integration of core 10X technology into other parts of Windows and enterprise products." In an announcement at the Microsoft Build 2021 developer conference, CEO and President Satya Nadella, he took it himselfa few months. He also teased that an official announcement would be coming very soon. Just a week after Nadella's speech, Microsoft began sending out invitations to a special Windows startup sound video on YouTube, and many people cited both the timing of the Microsoft event and the length of the Windows 11, [38][39] On June 24, 2021, Windows 11 is a "reinterpretation of the operating system name. System like Windows 11 is a "reinterpretation of the operating system name." system". Another developer event on the same day discussed additional developer information such as updates to the Microsoft Store, a new Windows App SDK (codenamed "Project Reunion"), new Fluent Design guidelines, and more.[44] [45][46] Release and marketing The name of the Windows 11 operating system was accidentally included in Microsoft's official support document in June 2021, [47][48] On June 15, 2021, images of a Windows 11 desktop beta leaked online, [49][50] followed by a leak of said version on the same day. [51] Screenshots and leaks show a user interface reminiscent of the discontinued Windows 10X, complete with a redesigned out-of-the-box (OOBE) experience and Windows 11 branding.[52] Microsoft later confirmed the leaked beta's authenticity, and Panay said it was an "early weird build." During a media event on June 24, Microsoft also announced that Windows 10 devices via Windows Update. [57] On June 28th, Microsoft Windows Insiders announced the release of the first preview and SDK of Windows 11. On August 31, 2021, Microsoftthat Windows 11 was scheduled to be released on October 5, 2021. [59] The release will roll out gradually, offering the upgrade first to newer eligible devices. [6] Since its predecessor Windows 10 was released on July 29, 2015, more than six years earlier, this is the longest period between Successive released October 25, 2001) and Windows NP (released January 30, 2007). The first TV commercial for Windows 11 aired during the NFL 2021 kickoff on September 9, 2021; it was intended to show "a sense of immersion and fluidity" with screenshots of the operating system's features and Xbox Game Studios' Halo Infinite. Other launch day promotions included lighting up the Burj Khalifa in Dubai using images of the Windows 11 logo and the default "Bloom" wallpaper, and Mikey Likes It ice cream parlor in New York giving away free cups of "Bloomberry" ice cream. cream[63][64] Microsoft officially released Windows 11 on October 4, 2021 at 14:00. PT[65] as an optional in-place update via Windows 11 Setup Assistant (which can update or generate an ISO image or USB installation media) or via Windows Update in floating point mode;

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Microsoft expected Windows 11 to be available on all eligible devices via Windows 10, eligible devices via Windows 10, eligible hardware may have an upgrade option available during an OBE.[69] Retail copies of Windows 11 (consisting of a license key and USB flash drive) were released on May 9, 2022, [70] [71]
and digital licenses became available in the Microsoft Store on July 28, 2022. [72] Features Main article: New features in Windows 11 See also: List of features removed in Windows 11, the first major release of Windows 11 See also: List of features removed in Windows 11.
usability and flexibility upgrade[57] includes new productivity and social networking features, as well as security and accessibility updates that address some of the shortcomings of Windows 10[73]. Windows 11 also updates that address some of the shortcomings of Windows 10[73].
Win32, rich web apps, and other packaging technologies in the Microsoft Store along with Universal Windows Platform apps. [74] Microsoft Store emulation on ARM-based
platforms.[76] The Microsoft Teams collaboration platform is integrated into the Windows 11 user interface and accessible through the taskbar. Skype is no longer included with the operating system by default.[77][78][79] Microsoft Claims performance improvements such as smaller updates, faster web browsing "in any browser", faster wake up from
sleep, and faster Windows Hello authentication. Windows 11 ships with the Google Chrome web browser, which is based on Chromium (for compatibility[81][82] with the Google Chrome web browser[83]) and does not include or support Internet Explorer[84]. Its MSHTML renderer (Trident) is still included in the operating system for backwards
compatibility, and Edge can be configured via Group Policy to display whitelisted sites in "IE mode" (which still uses the MSHTML used by IE instead of the Blink layouts.). ).[85] Windows 11 is the first version of Windows since the original retail version of Windows 95 that does not ship with Internet Explorer.[86] The updated Xbox[87][88] app,
along with Auto HDR and DirectStorage technologies introduced with Xbox Series X and Series S, will be integrated into Windows 11; The latter requires a DirectX 12 capable graphics card and an NVMe SSD. User Interface The redesigned user interface is common to the entire operating system based on the Fluent Design System; Transparency
shadows, a new color palette and rounded geometry are scattered throughout the interface. A common aspect of the theme is a look known as "mica", which is described as "an opaque dynamic material that includes a theme and desktop wallpaper images to draw backgrounds for persistent windows such as apps and settings." [90][91] Most of the
user interface and Start menu are heavily inspired by Windows 10X, which is now discontinued. [92] The Segoe UI font, which has been updated to a resizable version that improves its ability to scale between different screen resolutions. [93] By default, taskbar buttons are centered and permanently pinned to the
bottom of the screen; it cannot be moved to the top, left, or right edge of the screen, as in previous versions of Windows, without making manual changes to the registry. The notification sidebar can now be accessed by clicking the date and time, with other quick action toggles as well as volume, brightness, and media playback controls switching to a
new settings pop-up that appears when the taskbar is clicked. The Widgets button on the taskbar displays a panel with Microsoft Start[95], a news aggregator with personalized stories and content (an extension of the What's Hot and Interests panel introduced in later versions of Windows 10).[80] [90] ] Microsoft Teams is also integrated into the
taskbar and a pop-up window displays a list of recent conversations.[79] The Start menu has been significantly redesigned, with the "live tiles" used in Windows 8.x and 10 replaced with a more traditional toolbar, and its
context menus have been redesigned to move some tasks (such as copy and paste) to the toolbar at the top of the menu.other operations in the drop-down menu.[90] Task View, a feature introduced in Windows 10, has been extended
with two additional features; hovering over the window maximize button displays a pre-defined "anchor group". When a display is disabled in a multi-monitor setup, windows previously displayed on that screen
will be minimized rather than automatically moved to the home screen. If the same display is reconnected, the windows Subsystem for Android More information: Project Astoria and Windows Subsystem for Android (WSA) became available for
Windows 11 beta for users in the US[98], allowing users to install and run Android apps on your devices. Users can install Android apps from any source in APK file format.[99] An Amazon Appstore became available to users
of the US release channels on February 15, 2022, with Windows 11 Release Build 22000.527, which was released on the same day. WSA is based on the same day. WSA is based on the Intel Bridge runtime compiler; Intel has stated that this technology is independent of its processor and will also be supported on x86-64 and ARM processors from other manufacturers. System
security Under the minimum system requirements, Windows 11 only runs on devices with a Trusted Platform Module 2.0 security coprocessor. [105][106] According to Microsoft, the TPM 2.0 coprocessor is a "critical building block" of protection against hardware and hardware attacks. Also, Microsoft now requires a Windows deviceinclude
virtualization-based security (VBS), hypervisor-protected code integrity (HVCI), and secure boot built-in and enabled by default. The operating system also has hardware stack protection for supports multi-factor authentication and
biometric authentication via Windows Hello. [107] Versions Main article: Windows 11 version history Windows 11 tomes in two main versions; the Home edition for consumers, and the Pro edition, which includes additional networking and security features (such as BitLocker) and the ability to join a domain. Windows 11 Home may be limited to
verified software from the Microsoft Store ("S-Mode") by default.[109] The initial setup of Windows 11 Fro in the future.[111] Windows 11 Fro in the future.[111] Windows 11 SE was announced on November 9, 2021 as an entry
level education-only release; it is intended to be the successor to Windows 10 S, and also to compete primarily with the Chrome operating system. Designed to be managed by Microsoft Intune, it has been redesigned based on feedback from educators to simplify the user experience and reduce "clutter" like Snap Layouts which don't contain layouts
for more than two apps at a time and all apps open by default. and the widgets will be removed. It comes bundled with apps like Microsoft Store; third party software is provided or
installed by administrators. For some organizations migrating from Google Chrome, Microsoft Edge is enabled by default.extensions from the Chrome Web Store.[112][113] The Windows Insider program is inherited from Windows 10, and preview releases are divided into "Dev" (unstable builds used to test features for future feature updates), "Beta'
(test builds until the next feature update; relatively stable compared to the development channel), and "Release Preview" (pre-release versions for final testing of future feature update; relatively stable compared to the development channel), and "Release Preview" (pre-release versions for final testing of future feature update; relatively stable compared to the development channel).
Education, Enterprise, IoT Enterprise, IoT Enterprise Workstation 21H2 - 22000 October 4, 2021 October 8, 2024 October 10, 2023 October 8, 2024 October 8, 2024 October 8, 2024 October 14, 2025 Legend: Old version, not supported[a] Old version, still supported[b] Current stable version[c] Notes: ^ Expiry date Windows 11 builds with this color have
expired and are no longer supported by Microsoft. ^ Windows 11 builds with this color are to longer the latest version of Windows 11. Supported by Microsoft. ^ Builds of Windows 11 builds with this color are the latest version of Windows 11. Supported by Microsoft. ^ Builds of Windows 11 builds with this color are the latest version of Windows 11. Supported by Microsoft. ^ Builds of Windows 11 builds with this color are the latest version of Windows 11. Supported by Microsoft. ^ Builds with this color are the latest version of Windows 11. Supported by Microsoft. ^ Builds with this color are the latest version of Windows 11. Supported by Microsoft. ^ Builds of Windows 11. Supported by Microsoft. ^ Builds with this color are the latest version of Windows 11. Supported by Microsoft. ^ Builds with this color are the latest version of Windows 11. Supported by Microsoft. ^ Builds with this color are the latest version of Windows 11. Supported by Microsoft. ^ Builds with this color are the latest version of Windows 11. Supported by Microsoft. ^ Builds with this color are the latest version of Windows 11. Supported by Microsoft. ^ Builds with this color are the latest version of Windows 11. Supported by Microsoft. ^ Builds with this color are the latest version of Windows 11. Supported by Microsoft. ^ Builds with this color are the latest version of Windows 11. Supported by Microsoft. ^ Builds with this color are the latest version of Windows 11. Supported by Microsoft. ^ Builds with this color are the latest version of Windows 11. Supported by Microsoft. ^ Builds with this color are the latest version of Windows 11. Supported by Microsoft. ^ Builds with this color are the latest version of Windows 11. Supported by Microsoft. ^ Builds with this color are the latest version of Windows 11. Supported by Microsoft. ^ Builds with this color are the latest version of Windows 11. Supported by Microsoft. ^ Builds with this color are the latest version of Windows 11. Supported by Microsoft. ^ Builds with this color are the late
files (for languages that must be downloaded on supported computers). 38 fully localized language packs (LPs) were available as .appx packages. In Windows 11, this process has changed. Added five new LP
languages - Catalan, Basque, Galician, Indonesian and Vietnamese - bringing the total number of LP languages to 43. Also that's 43can only be matched against lp.cab packages. It is designed to provide a fully supported language mapping and cumulative update. The remaining 67 LXP-based LIP languages will be moved to a self-service model and
can only be added by Windows users themselves through the Microsoft Store and Windows Settings apps, not through the Windows imaging process. Any user, not just an administrator, can now add both the display language and features that can help users in a business environment, but these exact language settings (both LP and LIP) are still OEM
and carrier specific connections. Available for download in at least one region, and "No" if it is not supported in any region of purchase, and wireless carrier[116]. For each manufacturer, the list displays "Yes" if the language is supported or available for download in at least one region, and "No" if it is not supported in any region.
independently available for download by region for all Surface devices from 2021: Danish (English (UK) English (UK) Englis
applicable markets, excluding languages listed above: Americas: Portuguese (Brazilian) EMEA: Czech, Estonian, Croatian, Lithuanian, Hungarian, Portuguese (Portugal), Romanian, Slovak, Slovenian, Turkish, Greek, Bulgarian, Lithuanian, Hungarian, Portuguese (Portugal), Romanian, Slovak, Slovenian, Lithuanian, Hungarian, Portuguese (Portugal), Romanian, Slovak, Slovenian, Lithuanian, Hungarian, Portuguese (Brazilian) EMEA: Czech, Estonian, Croatian, Lithuanian, Hungarian, Portuguese (Brazilian) EMEA: Czech, Estonian, Lithuanian, Hungarian, Lithuanian, Hungarian, Portuguese (Brazilian) EMEA: Czech, Estonian, Lithuanian, Hungarian, Lithuanian, Hungarian, Lithuanian, Hungarian, Lithuanian, Lit
ARMv8.1) 1GHz or higher and 2 or more CPU cores Main Memory (RAM) 4GB or more Unified Extensible Firmware Interface (UEFI) Security Boot system firmware, enabled by default Trusted Platform Module (TPM) v2.0 graphics card Compatible with DirectX 12 or later with WDDM 2.0 driver for each color channel Internet
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(available on Windows 11 Pro and later) Hyper-V Second Level Address Translation (SLAT) DirectX 12 Ultimate Available with supported games and graphics cards Spatial audio Hardware and software support Two-factor authentication Use PIN code, biometric authentication or phone with Wi-Fi or Bluetooth Speech
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are significantly different from Windows 10. Windows 11 only supports 64-bit systems such as ARM64 processors are no longer supported. [106] This makes Windows 11 the first consumer version of Windows NT that did not
support them). The minimum requirements for RAM and memory have also increased; Windows 11 now requires at least 4GB of RAM and 64GB of storage. S mode is only supported on Windows 11 Home Edition.[121] As of August 2021, officially supported processors include Intel Corfee Lake (8th Gen Intel Core) and newer, AMD Zen+ and newer
processors/APUs (including "AF" versions of the Ryzen 1000 processors, which are overclocked Zen+ processors, which are overclocked Zen+ processors, that replace parts of the Ryzen 1000, which could no longer be produced due to processor, the 7th
generation processor used in the Surface Studio 2[124], but only on devices shipped with DCH drivers.[125] Legacy BIOS firmware compatibility is no longer supported; UEFI with Secure Boot and Trusted Platform Module (TPM) 2.0 security coprocessor is now required.[94][126][127][128] In particular, TPM requirements have created confusion
because many motherboards do not support TPM or require a compatible TPM to be physically installed on the motherboard. Many newer processors also include a TPM module implemented at the processor level (AMD refers to it as "fTPM" and Intel as "Platform Trust Technology" [PTT]), which may be disabled by default and must be modified in the
computer's UEFI[ 130 ] firmware or UEFI firmware or UEFI firmware update that changesSettings that reflect these requirements.[131] Original Equipment Manufacturers (OEMs) may continue to ship computers without a TPM 2.0 coprocessor subject to approval from Microsoft.[132][133] Devices with unsupported processors cannot install or run Windows 11;
However, a fresh installation or update using ISO installation media is required as Windows 10.[134] In addition, users must also accept an on-screen statement that they are not covered by the
manufacturer's warranty.[135][136] Third party software security requirements, with the Riot Games Valorant multiplayer game (which it uses to install the forced kernel-level anti-cheat component) being the first such example.[137] Reception of the
Windows 11 preview was positive upon its unveiling, with critics praising the minimum system requirements for Windows 10 requirements for Windows 10 requirements for Windows 10 requirements for Windows 11.[139] The increased system requirements for Windows 10 requirements for Windows 11.[139] The increased system requirements for Windows 1
meant that up to 60 percent of existing Windows 10 PCs could not be upgraded to Windows 11[140], raising concerns that the devices would become e-junk.[141] Microsoft did not explicitly acknowledge this when discussing the exemption, also acknowledge this when discussing the exemption and Specter had a significant
impact on 6th and 7th Gen Intel Core processors, and that newer processors produced since then have increased mitigation damage. against bed bugs. [90][142] In an interview with IT agency CRN, several independent solution providers said they believe in Windows 11atake a step forward in security and agree with Microsoft's strategy to put
security first." user experience and strive to make the entire stack better and more secure. and claiming that Microsoft has "[put] serious effort" into making the user aspects of Windows 10), other "helpful fixes" and its requirements.
system security has brought more public attention to the hardware security features in modern computers. t only Microsoft services), taskbars functionality and customization for each file type
separately), and Microsoft's unclear rationale for processor compatibility criteria. Cunningham concluded, "When I dug into [Windows 11] and found out its subtleties for this review, I'm starting to feel more comfortable with it," but claimed that the operating system suffers from the same "public perception" problems that both Windows Vista and
However, noted that version 11 did not have as many performance issues or bugs as Vista at its release, and it wasn't as "inconsistent" as version 8, and advises users who aren't sure about upgrading to stay with Windows. 10 until further upgrades to 11.[90] Tom Warren of The Verge described Windows 11 as a house under renovation, but "actually
Windows 11 has been around for years."didn't feel as contentious as I expected" — praising the updated UI as more modern and reminiscent of iOS and Chrome OS, a new Start menu that's less cluttered than the Windows 10 iteration, updates to some of its stock apps and Snap Assist Warren noted that rarely widget panel or Microsoft Teams, he said
he prefers the weather view offered by the latest version of Windows 10 and doesn't use Teams to communicate with friends and family. He also credited the expansion of the Microsoft Store to include more "traditional" desktop applications. However, he felt that Windows 11 still felt like a work in progress and noticed inconsistencies in the user
interface (e.g. dark mode and new context menu designs that are not the same in dialogs and apps, e.g. contains the control panel for older application, and a clock that appears on the primary display only in
multi-monitor configurations) and promised features (like dynamic refresh rate support and universal microphone mute button) that aren't part of the original release. Overall, he concluded that "I wouldn't rush an upgrade to Windows 11, but I wouldn't avoid it either. After all, Windows 11 is still familiar, and beneath all the interface changes, it's the
same Windows we've had for decades." [143] PC World was more critical, claiming Windows 11 "sacrifices productivity for personality, but no cohesion," commenting on changes like the inability to use local "offline" accounts in Windows 11 Home, regression to the taskbar, a "functionally inferior" Start menu, a Microsoft Teams integration that
compromises privacy and is a trick, to force users to switch to the service, a file browser that offers general functions under obscure icons with a "terribly rotten" to discourage the transition from Microsoft Edge as the default web browser and that the operating system "unofficially feels less responsive, slow and heavy than Windows 10". It said that
Windows 11 "feels practical and productive, but in many ways smaller than its predecessor" while its best features were either "hidden deeper" or required special hardware (DirectStorage, Auto HDR) or were unavailable at the time of the premiere. (Android application support). [144] See also List of references to operating systems ^ Warren, Vol
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Source: ". Page 2 Mobile broadband standard. 5G3GPP logo 5G Developed by 3GPPILaunched July 2016 (July 2016) Industrial Telecoms Part of the Mobile Telecoms Part of the M
launched in 2019 and is the planned successor to 4G networks, providing connectivity for most modern mobile phones. According to the GSM Association and Statista, 5G networks, like their predecessors, are cellular
networks in whichThe area is divided into small geographic areas called cells. All 5G wireless devices in a cell are connected to the Internet and the telephone network via radio waves via a local antenna in the cell. The new networks have higher download speeds, eventually reaching 10 gigabits per second (Gbps).[3] 5G is not only faster than existing the cell. The new networks have higher download speeds, eventually reaching 10 gigabits per second (Gbps).[3] 5G is not only faster than existing the cell.
networks, but also has more bandwidth, allowing more different devices to be connected, improving internet service quality in congested areas[4]. Due to the increased capacity of networks, they are expected to increasingly be deployed as universal internet service providers (ISPs) for laptops and desktops, competing with existing internet providers
such as cable internet and enabling new uses of things (IoT) machines. - Areas of the machine. 4G-only mobile phones cannot use 5G networks in which the coverage area is divided into small geographic areas called cells. All 5G wireless devices in a cell communicate over radio waves with a mobile base
station through fixed antennas using frequency channels assigned by the base station. Base stations, called nodes, are connected to switches in the telephone networks, a mobile device moving from one cell to another is that provide access to the Internet over high-capacity fiber optic or wireless backhaul links. As in other cellular networks, a mobile device moving from one cell to another is that provide access to the Internet over high-capacity fiber optic or wireless backhaul links.
automatically and seamlessly handed over. 5G is expected to support up to a million devices per square kilometer. The consortium setting industry standards for 5G, the Third Generation Partnership Project (3GPP), defines "5G" as any system that uses 5G NR (5G New Radio) software, a definition that came into common use in late 2018. Millimeter
waves called FR2 in 5G terminology for additional capacity and higher bandwidth. Millimeter waves also have more trouble penetrating building walls. Millimeter wave antennas are smaller than the large antennas used in earlier
cellular networks. Some of them are only a few centimeters long. The increased data rate is achieved in part through the use of additional high frequency bands: low,
medium and high. The 5G network can be deployed in the low, mid, or high millimeter wave bands from 24 GHz to 54 GHz. Low-band 5G uses the same frequency band as 4G cell phones, 600-900 MHz, and allows download speeds slightly faster than 4G: 30-250 megabits per second (Mbps).[5] Short-range cell towers have similar range and coverage
as 4G towers. Midrange 5G uses microwaves in the 1.7 to 4.7 GHz frequency range and offers speeds of 100 to 900 Mbit/s, with each cell tower providing service within a radius of several kilometers. This level of service is the most widespread and was introduced in many urban areas in 2020. Some regions do not implement low band, so the
minimum level of service is medium band. The 5G radio frequencies from 24-47 GHz, which is close to the lower end of the millimeter wave band, although higher frequencies may be used in the future. Download speeds often reach gigabits per second (Gbps), which is comparable to wired Internet. However, millimeter waves
(mmWave or mmW) have a more limited range and require many small cells. They can become blocked or blocked by materials in walls or windows.[7] Due to their higher cost, these cells are only intended for use in densely populated urban areas and crowded areas such as sports stadiums and convention centers. The above speeds are from actual
testing in 2020 and speeds are expected to increase during deployment.[5] Spectrum in the 24.25 to 29.5 GHz range was licensed the most and 5G mmWave spectral range in the world. The introduction of 5G technology has sparked controversy over its security and relations with Chinese suppliers. He has also been the subject of health concerns and
misinformation, including discredited conspiracy theories linking him to the COVID-19 pandemic. ITU-R has identified three main applications (URLLC), and Massive Machine Type Communications (mMTC).[8] In 2020, only
eMBB will be implemented; In most places, the difference between URLLC and mMTC is several years.[9] Enhanced Mobile Broadband (eMBB) uses 5G as an extension of 4G LTE mobile broadband, offering faster connections, higher bandwidth and more capacity. This will benefit high traffic areas such as stadiums, cities and concert halls.[10] Ultra
Reliable Low Latency Communication (URLLC) refers to the use of networks in critical applications that require uninterrupted and reliable data exchange. Short burst data transmission is used to meet the reliability and latency requirements of wireless networks. Mass Machine Type Communication (mMTC) will be used to connect to a large number
of devices. 5G will connect some of the 50 billion connected IoT devices[11]. Most will use cheaper Wi-Fi. Drones transmitting over 4G or 5G mobile coverage for many services. Autonomous cars do not need 5G because they need to
work where they are not connected to the network.[12] However, most autonomous vehicles are also equipped with teleoperations of events that may not contain them. Information must be verifiable and based on reliable published
sources. Help us improve it by removing unapproved speculative content. (Jan 2022) (Learn how and when to remove this message template) 5G speeds will range from around 50Mbps to 1000Mbps (1Gbps) depending on RF channel and BS load. The fastest 5G speed would be in mmWave bands and can reach 4 Gbit/s with carrier aggregation and
MIMO (assuming a perfect channel and no extra BS load). Sub-6 GHz 5G (midband), which is the most common, can provide 10 to 1000 Mbps; it will have a much greater range than mmWave bands. In bands below 6, C-Band (n77/n78) will be introduced by various US carriers in 2022. Verizon and AT&T planned to introduce C-Band in early January
2022, but that was delayed due to reported security concerns. Federal Aviation Administration concerns [15] [16] Low bands (such as n5) offer greater range and thus greater coverage for a given location, but are slower than mid and high bands. Latency In a 5G network, the ideal "transmission latency" is around 8-12 milliseconds, i.e. no delays
caused by HARQ retransmissions, handovers, etc. In order to make valid comparisons, the retransmission delay must be added to the "transmission latency". . Verizon reported 30ms latency is much higher
between 50 and 500 milliseconds depending on the type of transfer. Reducing transmission downtime is an ongoing area of research and development. 5G uses an adaptive modulation and coding scheme (MCS) to maintain a very low bit error rate exceeds a (very low) threshold, the transmister will switch to a lower
MCS that will be less prone to errors. In this way, speed is sacrificed to ensure a near-zero error rate. The extent of 5G coverage depends on many factors: Power, Frequency and Interference an
Given the marketing hype surrounding what 5G has to offer. Mobile operators use simulators and driving tests to accurately measure 5G performance. Standards The term was originally associated with the International Telecommunication Union's IMT-2020 standard, which required, among other things, a theoretical top speed of 20 gigabits per
 second in download and an upload speed of 10 gigabits per second. The 3GPP Industry Standards Group then selected 5G NR (New Radio) along with LTE as their proposal for submission at IMT-2020. 5G NR may include lower frequencies (FR1) below 6 GHz and higher frequencies (FR2) above 24 GHz. However, speed and latency in early FR1
deployments with 5G NR software on 4G hardware (non-standalone) are only marginally better than newer 4G systems, estimated to be 15% to 50% better.[20][21] The packet protocol for mobility management (connection establishments) are only marginally better than newer 4G systems, estimated to be 15% to 50% better.[20][21][22] The packet protocol for mobility management (connection establishments) are only marginally better than newer 4G systems, estimated to be 15% to 50% better.[20][21][22] The packet protocol for mobility management (connection establishments) are only marginally better than newer 4G systems, estimated to be 15% to 50% better.[20][21][22] The packet protocol for mobility management (connection establishments) are only marginally better than newer 4G systems, estimated to be 15% to 50% better.[20][21][22] The packet protocol for mobility management (connection establishments) are only marginally better than newer 4G systems.
and movement between base stations) and session management (connection to networks and network segments) is described in TS 24.501.[26] Specifications for key data structures can be found in TS 23.003.[27] Covering multiple areas of 5G, the IEEE fronthaul network mainly focuses on wired connections between the Remote Radio Head (RRH)
and the Base Unit (BBU). The 1914.1 standards focus on the network architecture and divide the connection between the RRU and the BBU into two main parts. The Radio Unit (RU), the NGFI-II, allowing for a more diverse and
economical network. NGFI-I and NGFI-II share certain properties which need to be compiled in order to be able to transport different types of traffic according to the ITU definition. [required page] The IEEE 1914.3 standard creates a new Ethernet frame format that can transport IQ data much more efficiently, depending on the functional separation
used. This is based on the definition of 3GPP functional areas. [Required page] 5G NR Main article: 5G NR 5G NR (New Radio) is a new radio interface developed for 5G network. [29] Pre-5GTF Implementations: The 5G network deployed by US carrier
Verizon for fixed wireless access in late 2010 uses a pre-spec called 5GTF (Verizon 5G NR. According to Verizon, there are plans to upgrade 5GTF to 5G NR "once [it] meets our stringent specifications for our customers." [30] [Update required?] 5G-SIG:
Preliminary 5G specification from KT Corporation. Participation in the 2018 Winter Olympics in Pyeongchang. Internet of Things (IoT), 3GPP intends to introduce the advancement of NB-IoT and eMTC (LTE-M) as 5G technologies for LPWA (Low Power Wide Area) use case.[32] See also: List of 5G NR networks Deutsche Telekom
3.5 GHz 5G cellular site in Darmstadt, Germany Vodafone 3.5 GHz 5G cellular site in Karlsruhe, Germany unlicensed spectrum) (5G NR radio with 4G core) up to Offline operational readiness (SA) with a 5G core network. [34] As of April 2019, the Global Mobile Service Providers Association has identified 224 network operators in 88 countries
worldwide.that have demonstrated, are testing or testing 5G technologies or are licensed to conduct field trials, are deploying 5G networks or have announced the launch of services[35]. The corresponding figures in November 2018 are 192 operators in 81 countries[36]. The first country to deploy 5G on a large scale was South Korea in April 2019.
Swedish telecommunications giant Ericsson has predicted that up to 65% of the world's population will be covered by 5G by the end of 2025[37]. The company also plans to invest 1 billion reais ($238.30 million) in Brazil to build a new fifth-generation (5G) technology assembly line for its Latin American operations. [38] When South Korea rolled out its
5G network, all operators used base stations and equipment from Samsung, Ericsson, and Nokia, with the exception of the LG U Plus, which also used Huawei equipment. [39][40] Samsung was the largest supplier of 5G base stations in South Korea at the time of launch, supplying 53,000 of the 86,000 base stations installed across the country at the
time.[41] The first relatively large implementations took place in April 2019. In South Korea, SK Telecom reached 38,000 base stations, KT Corporation 30,000 and LG U Plus 18,000; 85% of them are located in six large cities[42]. They use 3.5 GHz (sub-6) spectrum in non-standalone (NSA) mode and tested speeds increased from 193 to 430 Mbps.
[43] 260,000 registered in the first month and 4.7 million by the end of 2019.[44] T-Mobile US was the first company in the world to launch a commercially available standalone 5G NR network.[45] Nine company in the world to launch a commercially available standalone 5G NR network.[45] Nine company in the world to launch a commercially available standalone 5G NR network.[45] Nine company in the world to launch a commercially available standalone 5G NR network.[45] Nine company in the world to launch a commercially available standalone 5G NR network.[45] Nine company in the world to launch a commercially available standalone 5G NR network.[45] Nine company in the world to launch a commercially available standalone 5G NR network.[45] Nine company in the world to launch a commercially available standalone 5G NR network.[45] Nine company in the world to launch a commercially available standalone 5G NR network.[45] Nine company in the world to launch a commercially available standalone 5G NR network.[45] Nine company in the world to launch a commercially available standalone 5G NR network.[45] Nine company in the world to launch a commercially available standalone 5G NR network.[45] Nine company in the world to launch a commercially available standalone 5G NR network.[45] Nine company in the world to launch a commercial standalone 5G NR network.[45] Nine company in the world to launch a commercial standalone 5G NR network.[45] Nine company in the world to launch a commercial standalone 5G NR network.[45] Nine company in the world to launch a commercial standalone 5G NR network.[45] Nine company in the world to launch a commercial standalone 5G NR network.[45] Nine company in the world to launch a commercial standalone 5G NR network.[45] Nine company in the world to launch a commercial standalone 5G NR network.[45] Nine company in the world to launch a commercial standalone 5G NR network.[45] Nine company in the world to launch a commercial standalone 5G NR network.[45] Nine company in the world to launch a commercial
Oualcomm, Samsung, and ZTE.[46][47][48][49][50] [51][52] Spectrum A large number of new radio frequencies (5G NR frequency bands) have been allocated to 5G.[53] For example, in July 2016, the US Federal Communications Commission (FCC) released a large amount of bandwidth in unused broadband spectrum. The 5G Spectrum Frontiers
Proposal (SFP) doubled the amount of unlicensed millimeter wave spectrum at 14 GHz and created four times the amount of flexible spectrum for mobile use than the FCC had previously licensed. In March 2018, European Union lawmakers agreed to open the 3.6 and 26 GHz bands by 2020.[55] As of March 2019[update] 52 countries, territories,
special administrative regions, disputed territories and dependent territories are said to be formally considering the introduction of specific frequency allocated spectrum for 5G, reserved spectrum. for 5G have announced plans to auction spectrum or have already allocated spectrum for 5G.
use.[56] 5G devices In March 2019, the Global Mobile Device Suppliers Association released the first database tracking the deployment of 5G devices with 33 different devices, including regional options. Seven 5G device form factors were announced
(phones (Ã12 devices), access points (Ã4), indoor and outdoor customer premises devices (Ã8), modules (Ã5), snap-on dongles and adapters (Ã2) and USB plugs (Ã Ã1 ))[58] As of October 2019, the number of announced 5G devices has grown to 129 in 15 designs from 56 vendors.[59] In terms of 5G IoT chipsets, there were four commercial 5G modem
chipsets and one commercial processor/platform as of April 2019, with more launches expected in the near future. [60] On March 6, 2020, the world's first smartphone with full 5G support, the Samsung Galaxy S20, was released. According to Business Insider, 5G turns out to be more expensive compared to 4G; The lineup starts at $1,000, starting
with the Samsung Galaxy S10e, which starts at $750. On March 19, HMD Global, the current maker of Nokia phones, announced the Nokia 8.3 5G, which is rumored to have a longer range. SG compatible than any other phone released at the time. A mid-range model with a starting price in the Eurozone of 599 euros. It is said to support all 5G bands
from 600 MHz to 3.8 GHz.[62] Many phone manufacturers support 5G. Apple iPhone 12 and later supports 5G.[63][64] Google Pixel phones support this since version 5.[65] New RF Technology See also: 5G NR frequency bands The 5G radio interface defined by 3GPP is known as New Radio (NR) and the specification is divided into two frequency
bands: FR1 (below 6 GHz) and FR2 (24 GHz). 54 GHz) Band 1 (< 6 GHz) Also known as sub-6, the maximum channel bandwidth specified for FR1 is 100 MHz due to the limited contiguous spectrum in this crowded frequency band. In this range, the most used band for 5G is 3.3-4.2 GHz. Korean operators use the n78 band at 3.5 GHz. Some parties
have used the term "midband" to refer to the higher part of this frequency range not used in previous generations of mobile communications. Frequency Band 2 (24-54 GHz) The minimum channel supported in 3GPP Release 15. The higher the
frequency, the more likely it is to maintain a maximum. data rate. Signals at this frequency are described as mmWave. FR2 coverage in the 5G band of 24 GHz or more uses higher frequency 5G signals cannot be transmitted over long distances (more than a few hundred meters), unlike 4G signals or low-frequency 5G signals
(below 6 GHz). ). To use higher frequency bands, 5G base stations must be placed every few hundred meters. In addition, these high frequency 5G signals cannot easily penetrate solid objects such as cars, trees, and walls due to the inherent nature of these high frequency electromagnetic waves. 5G cells could be intentionally designed to be as
inconspicuous as possible, which will find usesuch as restaurants and shopping malls. Cell Types Deployment Environment Max Number "Users" Output Power (mW) Max Distance from Base Station 5G NR FR2 Femtocell Public places such as
Malls, Malls, Skyscrapers 64-128V Indoor: 100 -250 Outdoor: 1000-5000 dozen meters Microcell Urban areas to fill 128-256 coverage gaps Outdoor: 10,000 - 20,000 Hundred meters Wi-Fi (for comparison) Homes, businesses under 50
Indoor: 20-100 Outdoor: 200-1000 tens of meters Massive MIMO See also: Multi-user MIMO MIMO systems use multiple antennas at the Ends of transmitter and receiver of wireless link communication system. Multiple antennas at the Ends of transmitter and receiver of wireless link communication systems.
of the system. Massive multiple input, multiple output (MIMO) antennas increase sector throughput and capacity density when using a large number of antennas. These include single-user MIMO (MU-MIMO). Each antenna is individually controlled and may contain radio transmitter and receiver components. [link needed] Edge
Computing Main article: Multiple Access Edge Computing Edge computing is provided by computer service availability[69]. Small Cell Main article: Small Cell Small Cel
unlicensed spectrum from 10 meters to several kilometers. Small cells are essential for 5G networks because 5G radio waves cannot travel long distances due to 5G's higher frequencies. [70][71][72][73] Beamforming Main article: Beamforming There are two typesdigital and analog. Digital beamforming sends data in multiple streams (layers), while
analog beamforming shapes the radio waves to point in a specific direction. The analog BF technique combines the operation of the elements of the antenna system in such a way that signals directed at certain angles cause destructive interference. This improves the signal
quality in a given direction, as well as the data transmission speed. [citation needed] 5G uses both digital and analog beamforming to improve system performance. [74] Wi-Fi and cellular network functions to reduce cost, bandwidth and complexity.
LTE aims to converge with Wi-Fi band/technology through various means such as License Assisted Access (LAA; 5G signal in unlicensed frequency bands also used by Wi-Fi) and LTE WLAN aggregation (LWA; convergence with Wi-Fi) band/technology through various means such as License Assisted Access (LAA; 5G signal in unlicensed frequency bands also used by Wi-Fi) and LTE WLAN aggregation (LWA; convergence with Wi-Fi) band/technology through various means such as License Assisted Access (LAA; 5G signal in unlicensed frequency bands also used by Wi-Fi) and LTE WLAN aggregation (LWA; convergence with Wi-Fi) and LTE WLA
However, significant improvements in cellular performance specifications for 5G coupled with migration from a distributed radio access network (D-RAN) to the cloud or centralized RAN (C-RAN) and the introduction of mobile small cells could potentially reduce the gap between Wi-Fi and mobile networks in densely and internally distributed. Radio
convergence can lead to sharing, from the aggregation of cellular and Wi-Fi channels to the use of a single silicon device for multiple access) NOMA (Non-Orthogonal Multiple access) method for future power distributed cellular systems. [citation needed]
SDN/NFV Main Articles: Software Defined Networking, SD-WAN, Network Function Virtualization, and 5G Network Sharing Early cellular technologies is driving the development of a new set of
applications. This set of applications consists of various areas such as the Internet of Things (IoT), networked autonomous vehicles, remotely controlled robots, and heterogeneous sensors combined to support universal applications. [76] In this context, network sharing has proven to be a key technology for the successful implementation of this new
market model[77]. Channel Coding Channel coding methods in 5G NR have changed from turbo codes in 4G to polar codes for control channels. Unlicensed Spectrum Operations In December 2018, 3GPP began work on unlicensed spectrum specifications known as 5G NR-U for 3GPP
Release 16. Qualcomm has submitted a similar proposal for LTE in unlicensed spectrum. 5G Advanced is the name of 3GPP Release 18, which has been conceptually in development since 2021 [update]. Security Issues See also: Concerns about China's involvement in 5G wireless networks and criticism of Huawei §
Espionage and security issues A report released by the European Commission and Eur
manufacturers of 5G equipment.) On October 18, 2018, a research team from ETH Zurich, the University of Lorraine and the University of Dundee published a paper "5G Authentication Formal Analysis". [86] He warned that 5G technology could usher in a new era of security threats. The article describes the technology as "immature and
insufficiently tested" and as "providing movement and accessmuch larger amounts of data, thereby increasing the attack surface." At the same time, networks [89] and Voxility[90] advised against the use of personalized and hybrid mass DDoS attacks after the upcoming
deployment of 5G IoT Analytics estimates that the number of 5G-enabled IoT devices will increase from 7 billion in 2018 to 21.5 billion in 2018 to 21.5 billion in 2025. [91] This may significantly increase the attacks may increase proportionately. [86] Due to concerns about
potential Chinese hardware vendors spying on users, several countries (including the UK as of early 2019)[92] have taken steps to restrict Chinese devices on their 5G networks. en or eliminate. Chinese retailers and the Chinese government have denied the allegations of espionage. [Clarification needed] On October 7, 2020,
brie, the UK Parliament's Defense Committee issued a report that provided clear evidence of collusion between Huawei and the Chinese state and the Chinese
Weather Forecast Parts of this article (concerning powered systems; is this happening?) need to be updated. Please help update this article to reflect current events or new information. (January 2022) The spectrum used by various 5G proposals, in particular the n258 band centered on 26 GHz, will be close to passive remote sensing spectrum such as
weather and earth observation satellites, especially water vapor monitoring 23.8 GHz frequency. ] This proximity can cause disruption, the impact of which could be significant without effective control. Increasehave already occurred in some other previous cases of using a narrow belt. Satellite disruptions reduce the effectiveness of numerical
weather forecasting, with significant adverse economic and public safety implications in areas such as commercial aviation. The concern prompted US Secretary of Communications Communications (FCC) to delay some proposals for spectrum auctions in February
2019, which were rejected. The chairmen of the House Budget Committee and Science Committee wrote separate letters to FCC Chairman Ajit Pai asking for further review and consultation with NOAA, NASA and the Department of Defense and warning of adverse national security implications. NOAA Acting Director Neil Jacobs testified before a
House committee in May 2019 that 5G out-of-band emissions could result in a 30 percent reduction in weather forecast accuracy and that the resulting performance degradation of ECMWF -model would result in the unpredictable trajectory and hence the effects of a Super Hurricane Sandy in 2012. In March 2019, the US Navy drafted a
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memorandum warning of deterioration and presented technical proposals, to control, field test and deploy interband restrictions and coordinate the wireless industry and regulators with the Weather Forecasting Organization.[101] At the biannual World Radiocommunication Conference (WRC) in 2019, atmospheric scientists advocated a strong 55
dBW buffer, European regulators agreed to a 42 dBW recommendation, and US regulators (FCC) recommended a 55 dBW limit. 20 dBW, which allows 150 times stronger signals to be transmitted than the European proposal. The ITU has chosen an average level of 33 dBW until September 1, 2027 and a standard of 39 dBW thereafter.[102] This is
close to the European recommendation, but even the delayed higher standard is much weaker than atmospheric scientists expect, prompting a warning from the World Meteorological Organization (WMO). The ITU standard, which is 10 times less stringent than its recommendations, includes "the potential to significantly reduce the accuracy of
collected data."[103] A spokesperson for the American Meteorological Society (AMS) also warned of the disruption[104] and the European Center for Medium-Range Weather Forecasts (ECMWF) strongly warned that the public risked "history repeating itself" by ignoring scientists' warnings about atmospheric effects (referring to global warming that
monitoring could be compromised).[105] In December 2019, the US House Science Committee sent a bipartisan request to the Government Accountability Office (GAO) to investigate why there is such a large discrepancy between US rederal Aviation
Administration (FAA) has warned that aircraft radar altimeters operating in the 4.2 to 4.4 GHz band may be affected by 5G traffic in the 3.7 to 3.98 GHz band. This is especially a problem in Europe, where 5G uses lower frequencies between
3.4 and 3.8 GHz.[109] However, the DGAC in France also expressed similar concerns and recommended that 5G phones be turned off or switched to airplane mode during flight.[110] On December 31, 2021, US Transportation Secretary Pete Buttigieg and FAA Administrator Steve Dickinson asked the CEOs of AT&T and Verizon to delay the 5G
rollout due to aviation-related concerns. Government officials have asked for a two-week delay, beginning on January 5, 2022, while an investigation into the impact on radar altimeters continues. Government transport officials have also asked mobile operators to suspend new 5G services near 50 priority airports to minimize disruption to air traffic
that could be caused by some planes being banned from landing in bad conditions. Following an agreement with government officials the day before, [112] Verizon and AT&T activated their 5G networks on January 19, 2022, except for a few towers near 50 airports. [113] AT&T reduced its deployment even more than required under the FAA contract.
The FAA quickly tested and certified jamming radar altimeters to allow aircraft to make instrument for 45% of the US fleet, and by January 20, 78%.[115] Airlines have complained about the avoidable impact on their operations, and
commentators have suggested that the case challenges the FAA's authority.[116] Several international airlines diverted various aircraft to avoid problems landing at scheduled airports, and about 2% of flights (320) were canceled by the evening of 19 January.[117] Further information: C-band satellite (IEEE) More 5G networks deployed in the 3.3-3.6
GHz radio frequency band are expected to cause interference to C-band satellite stations operating on satellite stations operating o
to unlicensed applications, allowing the deployment of unlicensed 5G-NR, versions of 5G LTE in unlicensed spectrum, and Wi-Fi 6e. . However, if different standards coexist in a frequency band, interference may occur[119]. Exaggeration There are concerns about the development of 5G. There are questions about whether 5G will actually change the
customer experience, [120] the ability of the 5G mmWave signal to provide significant coverage, [121] [122] exaggerating the capabilities of 5G, or misattributing "5G" to ongoing technological improvements [123]. absence the use case that network operators could benefit from [124] misfocusing on direct benefits to individual consumers rather than
IoT devices, or addressing the last mile problem[125] and obscuring the possibility that this could happen in some respects may lead to other, more appropriate technologies . [126] Such concerns have also led consumers to mistrust the information provided by wireless service providers on the matter.[127] Misinformation and controversy Main
article: Misinformation related to 5G technology. Health See also: Radiation and wireless signals that predate 5G technology have had a long history of fear and concern. Concerns about 5G are similar to those of the 1990s and 2000s. They focus on trivial claims that non-ionizing radiation poses a threat to human health.[128] Unlike
ionizing radiation, non-ionizing radiation cannot remove electrons from atoms. The CDC says, "Exposure to intense amounts of direct non-ionizing radiation can cause tissue damage due to heat. This is uncommon and is of particular concern in the workplace for those working with large sources of non-ionizing radiation equipment and instruments."
[129] Some health advocates argue that regulatory standards are too low and influenced by lobby groups.[128] Anti-5G sticker in Luxembourg Many popular books of dubious merit have been published on the subject, including Joseph Mercola's book, which claims wireless technology causes diseases ranging from ADHD to heart disease and brain
tumors. Mercola has come under fire for its anti-vaccination policies during the COVID-19 pandemic, and has been warned by the FDA to stop selling fake COVID-19 drugs through an online alternative medicine business. According to The New York Times, one of The reason for the 5G health controversy was a flawed, unpublished study in 2000 by
physicist Bill P. Curry to the Broward County School Board and which states that external microwaves generated by brain tissues increase with frequency microwaves because they cannot penetrate the skin and reach internal organs. Curry
confused in vitro and in vivo studies, However, Curry's research has been widely shared on the internet. William Broad wrote for The New York Times in 2019 that RT America began airing shows linking 5G to adverse health effects that "have no scientific basis," such as "brain cancer, infertility, autism, heart tumors and Alzheimer's." Broad claimed
claims have increased. As of mid-April 2019, RT America had seven programs on the subject, but only one for all of 2018. The network's reach has grown to hundreds of blogs and websites. In April 2019, the city of Brussels, Belgium blocked 5G trials due to radiation regulations.[133] In Geneva, Switzerland, a planned upgrade to 5G was shelved for
the same reason.[134] The Swiss Telecommunications Union (ASUT) stated that studies had not shown any health effects from 5G frequencies.[135] According to CNET[136], "Dutch MPs are also urging the government to take a closer look at 5G. Several US congressional leaders have written a letter to the FCC expressing concerns about potential
health risks. The Mill Valley City Council in California has blocked the rollout of new 5G cells. A statement from the U.S. The Food and Drug Administration is quoted as "continuing to believe that current safety limits for exposure to RF energy from cellular phones remain acceptable to protect public health." Totnes, Brighton and Hove, Glastonbury
and Frome passed resolutions against itfor future 5G infrastructure, although these decisions do not affect of microwaves on gene expression in plants.[146] COVID-19 conspiracy theories and arson Main article: COVID-19
misinformation § 5G mobile networks The World Health Organization has released a myth-busting infographic to counter the COVID-19 and 5G conspiracy theories. As the introduction of 5G technology coincided with the COVID-19 and 5G. [147] This led to dozens
of arson attacks on telecommunications towers in the Netherlands (Amsterdam, etc.), Ireland (Cork, [148] and others), Cyprus, Great Britain (Dagenham, Huddersfield, Birmingham, Belfast, etc.). ), Liverpool. [149] [150], Belgium (Pelt), Italy (Madaloni), Croatia (Bibinje[151]) and Sweden. [152] This has resulted in at least 61 suspected
telephone pole burnings in the UK alone[153] and more than twenty in the Petherlands. In the early months of the pandemic, anti-lockdown protesters held anti-5G placards at protests against the response to the COVID-19 pandemic, anti-lockdown protesters held anti-5G placards at protests against the response to the pandemic.
equipment. There are two versions of the 5G-COVID-19 conspiracy theory:[128] The first version claims that radiation weakens the immune system and makes the body more susceptible to SARS-CoVID-19. The second version claims that radiation weakens the immune system and makes the body more susceptible to SARS-coVID-19.
disease caused by 5G radiation, or that Covid-19 originated in Wuhan because the city was a "5G guinea pig city." Marketing of non-5G services. Main articles: 5G Evolution, LTE Advanced Pro, and LTE Advanced Carriers in different parts of the world.branded technologies such as "5G Evolution, LTE Advanced Pro, and LTE Advanced Pr
networks using "5G technology".[154] However, these pre-5G networks are enhancements to existing LTE networks that are not 5G-only. While the technology promises faster speeds and is described by AT&T as "the foundation of our 5G evolution, advancing 5G standards," it cannot be considered true 5G. When AT&T announced 5G Evolution, 4x4
MIMO, the technology AT&T uses to deliver faster speeds, T-Mobile was already adopting 5G without the brand name. Such branding is believed to be a marketing ploy that will confuse consumers as it does not explain that such enhancements are not truly 5G.[155] History This section needs to be updated. Please help update this article to reflect
 current events or new information that becomes available. (April 2019) This article is presented as a list, but reads better in prose. If needed, you can help by translating this article. Editing assistance available. (March 2022) In April 2008, NASA partnered with Jeff Brown and Machine-to-Machine Intelligence (M2Mi) Corp to develop an approach to
fifth-generation communications technology, albeit primarily for nanosatellites. In 2008, an IT research and development program "5G Mobile Communication Systems Based on Beam Split Multiple Access and Group Cooperative Relay" was established in South Korea. In August 2012, New York University launched NYU Wireless, a multidisciplinary
academic research center that pioneered 5G wireless communications.[158] On 8 October 2012, the University of Surrey in the UK was awarded £35 million for a new 5G research facility, co-funded by the UK Research Partnership Investment Fund (UKRPIF) and a consortium of major international mobile operators and infrastructure providers,
including Huawei and Samsung., TelephonyFujitsu Laboratories Europe, Rohde & Schwarz and Aircom International. It will provide a testbed for mobile operators who want to develop a wireless standard that uses less power and radio frequencies while offering faster speeds than current 4G, with the goal of having the new technology ready within
ten years.[159][160][159]].] [160][159]].] [160][161][162] On 1 November 2012, the EU project "Mobile and Wireless Communication Enablers for the Twenty Information Society" (METIS) launched its activities to define 5G. METIS achieved an early global consensus on these systems. In this sense, METIS played an important role in building consensus
among other key external stakeholders prior to the initiation of global standardization activities. This was done by initiating and carrying out work in relevant global forums (eg ITU-R) and national and regional regulators.[163] The EU iJOIN project was also launched in November 2012, focusing on "small cell" technology, which is essential for the
use of scarce and strategic resources such as radio spectrum. According to Günther Oettinger, EU Commissioner for Digital Economy and Society (2014-2019), "innovative use of frequencies" is one of the most important factors for the success of 5G. Oettinger further described it as "an essential source of wireless connectivity that will be the main
driver of 5G".[164] iJOIN was selected by the European Commission as one of the landmark 5G research projects to present the first results of the technology at Mobile World Congress 2015 (Barcelona, Spain). In February 2013, ITU-R Working Group 5D (WP 5D) launched two research topics: (1) exploring the IMT vision for 2020 and beyond; (2)
Study of future technology trends for ground-based IMT systems. Both aim to better understand the future technical aspects of mobile communications in order to define the next generation of mobile telephony. [165] On May 12, 2013, Samsung Electronicsthat they have developed a "5G" system. The underlying technology has a maximum speed of
tens of Gbps (gigabits per second). In speed tests for 5G networks, they were sent at 1.056 Gbps over distances of up to 2 kilometers using MIMO 8*8.[168][167] In July 2013, India and Israel agreed to cooperate in the development of fifth generation (5G) telecommunications technologies.[168] On October 1, 2013, NTT (Nippon Telegraph and
Telephone), the same company that launched the world's first 5G network in Japan, receives the CEATEC Minister of the Interior and Communications Award for 5G research and development. [169] On November 6, 2013, Huawei announced plans to invest at least US$600 million to research and development.
speeds up to 100 times faster than today's LTE networks.[170] On April 3, 2019, South Korea's Claims of being the first country in the world with a 5G network, as apparently South Korea's 5G service was
originally only available to six South Korean celebrities. . may claim to be the world's first 5G network on launch day[173]. In June 2019, the Philippines became the first country in Southeast
Asia to roll out 5G after Globe Telecom launched commercial 5G data plans for customers. AT&T will make 5G services available to consumers and businesses in December 2019, ahead of plans to offer 5G in the US in the first half of 2020. Other Applications Automotive 5G The Automotive Association is promoting C-V2X communication technology,
which will be the first to be used in 4G. Provides communication between vehicles and infrastructure.[177] Digital twins Real-time digital twins Real-
5G for public safety is expected to improve critical short-range communications (MCPTT) and critical video and data.[180] Fixed wireless connections Fixed wireless connections Fixed wireless connections will provide an alternative to fixed broadcast
applications Sony is testing the possibility of using 5G local networks to replace the SDI cables currently used in TV cameras. [184] 5G transmission tests started around 2020 (Orkney, Bavaria, Austria, Central Bohemia) based on FeMBMS (Advanced Multimedia Broadcast Service). [185] The goal is to support an unlimited number of mobile or desktop
 devices with video (TV) and audio (radio) streams without consuming data traffic or even network authentication. See also 1G 2G 3G 4G 5G wireless power 6G wireless power 6G wireless radiation and health References ^ "A Positive Look at COVID-19 5G: What Does It Mean for Avid Gamers?". Interactive Forest. Retrieved November 13, 2020. ^ "Global Mobile
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title=5G&oldid=1118745453"Page 3 The first widespread digital cellular network. For other uses, see 2G (disambiguation). Part of a series dedicated to the generations of mobile phones. Cellular Network, a group of
technology standards used in mobile networks. Radiolinja (now part of Elisa Oyj) introduced 2G commercially in Finland in 1991 using the GSM standards used in mobile networks are analog, the radio signals in 2G networks are digital, although
both systems use digital signaling to connect cell towers to the rest of the world outside of Japan and North America. In North America AMPS digital amplifiers (IS-54 and IS-136). ) and cdmaOne (IS-95). The
advantages of 2G networks over their 1G predecessors were: digitally encrypted phone and the mobile phone base station, but not necessarily in the rest of the network. Significantly more efficient use of the radio frequency spectrum allowing more users in each frequency band. Data services for mobile
devices, from SMS text messages to multimedia messaging service (MMS). With General Packet Radio Service (MMS). With EDGE (Enhanced Data Rates for GSM Evolution), the theoretical maximum transfer rate is 384 kbit/s (48 kB/s).[2] Evolution mobile network standards and
generation timeline. 2.5G (GPRS) See also: General Packet Radio Service 2.5G ("second and a half generation"[3]) is used to describe 2G systems that implement a packet-switched domain in addition to the circuit-switched domain. This does not necessarily mean faster service because the timeslot is also used for circuit switched data (HSCSD)
 services. 2.75G (EDGE) See also: Upgrading Data Rates GSM Evolution GPRS networks have become EDGE networks through the introduction of 8PSK coding. Although the symbol contained three bits instead of one. Enhanced Data Rate GSM Evolution (EDGE), Enhanced GPRS
(EGPRS), or IMT Single Carrier (IMT-SC) is a backward compatible digital mobile phone technology that provides higher data rates as an extension of the GSM standard. EDGE has been introduced to GSM networks since 2003, originally by AT&T in the US. Phase-out See also: GSM §§ The discontinued 2G, understood as GSM and CDMA, has been
replaced by newer technologies such as 3G (UMTS/CDMA2000), 4G (LTE/WiMAX) and 5G (5G NR); However, 2G networks are still used in most countries in Europe, Africa, Central and South America, [4][5][6] and it is known that many modern LTE-enabled devices still use 2G for phone calls, especially in rural areas. terrain. [7] Successor to 3G
technology in the US, Japan, Australia and other countries or have already taken 2G services offline so that network operators can restore these radio frequency bands and reuse newer technologies (eg 4G, 5G). [11][12] In 2022, Android 12 introduced a system setting to disable 2G connectivity for a device, ostensibly to prevent security issues
 associated with 2G networks.[13] Criticism In some parts of the world, including the UK, 2G is still widely used for phones and the Internet.Devices of Things (IoT) where high patent licensing devices.[14][8][15] Disruption of 2G services could
leave vulnerable people who rely on 2G infrastructure unable to access emergency contacts, leading to preventable deaths.[15] Legacy 2G networks national network end date Standard Notes Australia Optus 2017-08-01 GSM 2G was switched off in WA and NT on 3 April 2017.[16][17] Telstra 2016-12-01 GSM [18] Vodafone 2018-06-30 GSM Bahrain
Batelco 2021-11-30 GSM [19] Belgium Orange < 2030 GSM [20] Erunei DSTCom 2021-06-01 GSM [21][22] Canada Bell 2019-04-30 Shutdown of cdmaOne CDMA transmitters began in 2017 in remote areas, followed by an official announcement in June 2018. that 2G devices
will soon be discontinued.[23][24] Rogers Wireless 2021-12-31 GSM [25][26] SaskTel 2017-07-31 cdmaOne [27][28] Telus Mobility 2017-05-31 cdmaOne [29][30] Cayman Islands Digicel 2020-06-16 cdmaOne (27)[28] Telus Mobility 2017-05-31 cdmaOne [27][28] Telus Mobility 2017-05-31 cdmaOne [
will also be discontinued. [36] Colombia Claro 2023-02-?? GSM [37][38] Tigo 2022-11-01 GSM [39] France Orange 2025-12-31 GSM [40] SmarTone 2022-10-14 GSM [41] Israel < 2025 GSM by government announcement[42] GSM FLOW H2 2022 shutdown in Jamaica started Q2 2022.[43] Japan au KDDI 2008-03-
31 cdmaOne NTT Docomo 2012-03-31 PDC [44] Softbank 2010-03-31 PDC [45] Luxembourg Orange < 2030 GSM [20] Macau China Telecom 2010 [46] -01 GSM service for domestic customers was discontinued on June 4, 2015, and the service was retained for roaming users. [47][46] 3 2019-08-01 The GSM service for domestic customers was discontinued on June 4, 2015, and the service was retained for roaming users.
 June 4, 2015, and the service for roaming users remained. [47][46] For local SmarTone customers 2019-08-01 GSM service will be terminated on June 4thwhile the service for roaming users remained. [47][46] For local SmarTone customers 2019-08-01 GSM (and the service for roaming users remained on June 4thwhile the service remains in roaming mode for users.
 [50] New Zealand 2 degrees to 0 30 degrees -15 GSM [51] Spark 2012-07-31 cdmaOne [52][53] Norway Telenor 2025 GSM [54] Telia 2025 GSM [55] Singtel 18.04.2017 GSM [55] StarHub 2017-04-18 GSM [55] Sintmaarten TelCell 2019 -01-01
maintain CSFB functionality. [65] Sunrise 2022-12-31 GSM With the introduction of S-RAN in 2018, the phase-out was postponed until 2022. [66] [70] Taiwan Chunghwa Telecom 30.06.2017 GSM [72] FarEasTone 30.06.2017. GSM [72] FarEasTone 30.06.2017. GSM [72] FarEasTone 30.06.2017.
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First widely used digital cellular network. For other uses, see 2G (disambiguation). Part of a series about cell phone generations Mobile telecommunications Analogue 0G 1G Digital 2G 2.5G 3.75G 3.95G 4.5G/4.9G 5G 6G vte 2G is an abbreviation for second generation mobile network, group technological standards
used in mobile networks. Radiolinja (now part of Elisa Oyj) in 1991 [1] After 2GAfter launch, previous cellular wireless network systems were retroactively referred to as 1G. While the radio signals on 2G networks are digital, although both systems use digital signaling to connect cell towers to the rest of
the cellular network. The most widespread 2G technology was the GSM Time Division Multiple Access (TDMA) standard, used in most parts of the world outside of Japan and North America. ) and cdmaOne (IS-95) were the main systems. The advantages of 2G networks over their 1G predecessors were: digitally encrypted phone calls, at least between
the mobile phone and the cell phone base station, but not necessarily in the rest of the network. Significantly more efficient use of the radio frequency band. Data services for mobile devices, from SMS text messaging to Multimedia Messaging Service (MMS). Using General Packet
Radio Service (GPRS), 2G offers a theoretical maximum transmission speed of 40 kbps (5 kbps)[2]. With EDGE (Enhanced Data Rate for GSM Evolution), the theoretical maximum transmission speed is 384 kbps (48 kbps)[2].
2.5G ("second and a half generation" [3]) refers to 2G systems that implement a packet-switched domain in addition to a circuit-switched domain. This does not necessarily result in faster service as slot aggregation is also used for circuit switched data services (HSCSD). 2.75G (EDGE) See also: Improved data transfer speed GSM Evolution GPRS
networks became EDGE networks with the introduction of 8PSK coding. While the symbol rate stayed the samesamples per second, each symbol had three bits instead of one. Enhanced Data Rate GSM Evolution (EDGE), Enhanced Data Rate Evolution (EDGE), Enhanced Data Rate Evolution (EDGE), Enhanced Data Rate Evolution (EDGE), Enha
that allows for increased data rates as an extension of standard GSM. EDGE has been introduced to GSM networks since 2003, originally by AT&T in the United States. Phase-out 2G, understood as GSM and CDMA, has been replaced by newer technologies such as 3G (UMTS/CDMA2000), 4G (LTE/WiMAX), and 5G (5G)
NR): However, 2G networks are still used in most of Europe, Africa, Central and South America, and many modern LTE-enabled devices still use 2G calls, especially in rural areas, [7] Instead of 2G, the successor 3G is switched off in some places - Vodafone had previously announced that it would switch off 3G in Europe in 2020, but will continue to
keep 2G as a backup service. [8] Meanwhile, in the United States, T-Mobile is currently phasing out 3G services but maintaining its 2G GSM network. Various carriers have announced that 2G technology is currently being phased out or have shut down 2G services in the United States, Japan, Australia and elsewhere so that carriers can reclaim these
radio bands and make way for newer technologies (eg 4G, 5G). ) can be reused ).[11][12] In 2022, Android 12 introduced a system choice to disable 2G connectivity for a device, ostensibly to address concerns about the security of 2G networks. Criticism In some parts of the world, including the UK, 2G is still common in fixed lines and Internet of
Things (IoT) devices, where patent licensing costs for newer technologies such as smart meters, eCall systems and vehicle tracking devices are high.[14] [8] 15] Discontinuance of 2G services could leave vulnerable people who rely on 2Gwithout being able to access emergency contacts, resulting in preventable deaths.[15] Previous 2G Networks
National Network Shutdown Date Standard Notes  Australia Optus August 1, 2017 Western and Northern Australia 2G GSM Shutdown April 3, 2017 [16] [17] Telstra 12/01/2016 GSM [21][22] ] Â Canada Bell 2019-04-30 cdmaOne CDMA transmitter shutdown began in remote areas in 2017, followed by an official
announcement in June 2018 that 2G devices would soon stop working. Rogers Wireless December 31, 2021 GSM [25][26] SaskTel July 31, 2017 cdmaOne [27][28] Telus Mobility May 31, 2017 cdmaOne [27][28] Tel
2020 cdmaOne CDMA2000 1xRTT, EV-DO Rev. A/B (3G) also stops working. [36] Colombia Claro 2023-02-?? GSM [37][38] Tigo 01/11/2022 GSM [39] France Orange 31/12/2025 GSM [20] Hong Kong 3 30/09/2021 GSM [40] SmarTone 14/10/2022 GSM [41] Israel
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