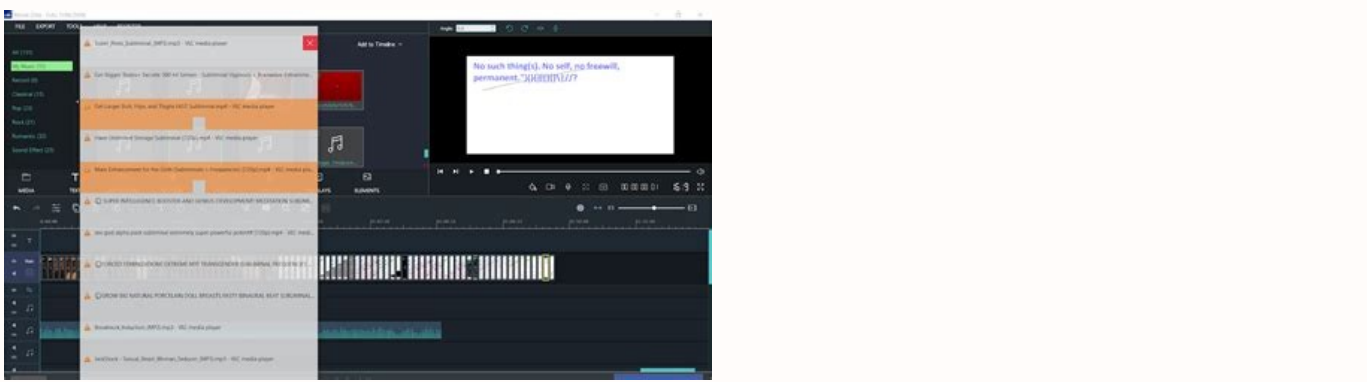
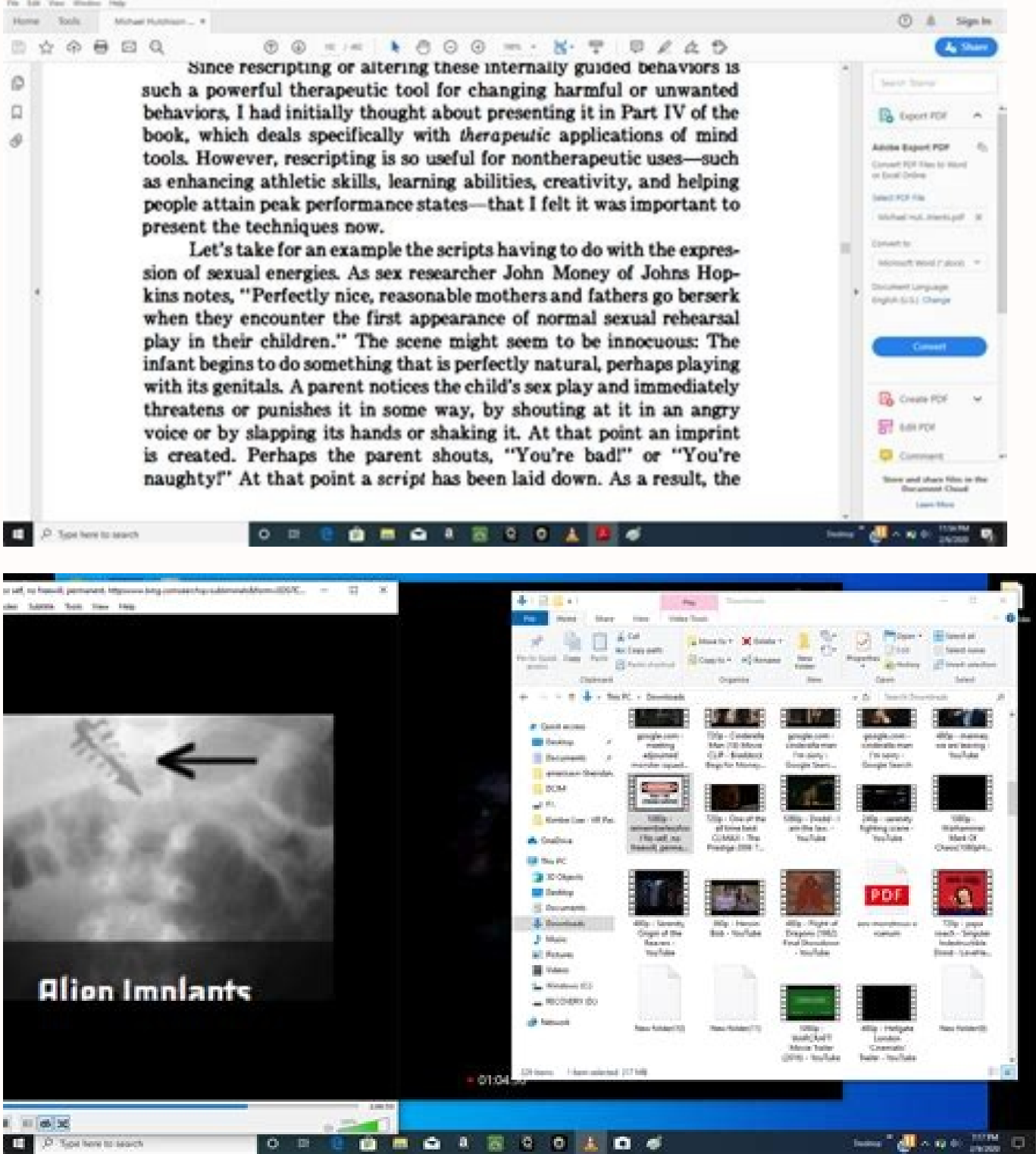


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For other uses, see Firefox (disambiguation). "Phoenix (web browser)" redirects here. For the early-1990s web browser developed at the University of Chicago, see Phoenix (tkWWW-based browser). Mozilla FirefoxFirefox 100 on Windows 11Developer(s) Mozilla Foundation and its contributors Mozilla Corporation Initial releaseSeptember 23, 2002; 19 years ago (2002-09-23)Stable release(s) [±]Standard103.0.111 / 1 August 2022; 2 days ago (1 August 2022)Extended Support Release 1102.1.0.oesr[2] / 26 July 2022; 8 days ago (26 July 2022)Extended Support Release 291.12.oesr[3] / 26 July 2022; 8 days ago (2022-07-26)Preview release(s) [±]Beta & Developer Edition104.Obeta[4] / 26 July 2022; 8 days ago (26 July 2022)Nightly105.0a1[5] / 25 July 2022; 9 days ago (25 July 2022) Repositoryhg.mozilla.org/mozilla-central/ Written inC++, C, Rust,[16] Assembly and others[7] JavaScript (and HTML, CSS) for UIEnginesGecko, Quantum, SpiderMonkeyOperating systems LinuxmacOS Sierra or laterWindows 7 or laterAndroid Lollipop or later[9]OS 13 or laterUnofficial ports:FreeBSD,[9] OpenBSD,[10] NetBSD,[11] illumos,[12] [13] Solaris[14] [15] OpenVMS[16] Included withVarious Unix-like operating systemsStandard(s)HTML5, CSS3, AtomAvailable in? languages[17]TypeWeb browserLicenseMPL 2.0[18][19]Websitewww.mozilla.org/en-US/firefox/new/ Mozilla Firefox, or simply Firefox, is an extensible free and open-source[20] web browser developed by the Mozilla Foundation and its subsidiary, the Mozilla Corporation. It uses the Gecko rendering engine to display web pages, which implements current and anticipated web standards.[21] In 2017, Firefox began incorporating new technology under the code name Quantum to promote parallelism and a more intuitive user interface.[22] Firefox is available for Windows 7 and later versions, macOS, and Linux. Its unofficial ports are available for various Unix and Unix-like operating systems, including FreeBSD,[9] OpenBSD,[10] NetBSD,[11] illumos,[12] and Solaris Unix.[14] It is also available for Android and iOS. However, as with all other iOS web browsers, the iOS version uses the WebKit layout engine instead of Gecko due to platform requirements. An optimized version is also available on the Amazon Fire TV, as one of the two main browsers available with Amazon's Silk Browser.[23] Firefox was created in 2002 under the code name "Phoenix" by the Mozilla community members who desired a standalone browser, rather than the Mozilla Application Suite bundle. During its beta phase, it proved to be popular with its testers and was praised for its speed, security, and add-ons compared to Microsoft's then-dominant Internet Explorer 6. It was released on November 9, 2004,[24] and challenged Internet Explorer's dominance with 60 million downloads within nine months.[25] It is the spiritual successor of Netscape Navigator, as the Mozilla community was created by Netscape in 1998 before their acquisition by AOL.[26] Firefox usage share grew to a peak of 32.21% in November 2009,[27] with Firefox 3.5 overtaking Internet Explorer 7, although not all versions of Internet Explorer as a whole.[26][29] its usage then declined in competition with Google Chrome.[27] As of July 2022[update], according to StatCounter, it has 7.8% usage share as a desktop web browser (the fourth-most popular desktop web browser after Google Chrome (66.93%), Microsoft Edge (10.63%), and Safari (8.95%)[30] while its usage share across all platforms is lower at 3.26% in fourth place, after Google Chrome (65.87%), Safari (16.61%), and Edge (4.13%).[31] [32] [33] [34] [35] [36] [37] [38] [39] [40] [41] [42] [43] [44] [45] [46] [47] [48] [49] [50] [51] 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OS/2 was available through the Ctrl-Esc hotkey combination, allowing the user to select among multitasked text-mode sessions (or screen groups; each can run multiple programs).[14] Communications and database-oriented extensions were delivered in 1988, as part of OS/2 1.0 Extended Edition: SNA, X.25/APPC/LU 6.2, LAN Manager, Query Manager, and more. OS/2 1.1 was the first version to feature the Presentation Manager GUI. The promised user interface was introduced with OS/2 1.1 in code after 1988. It has similar user interface to Windows 2.1, which was released in May of that year. The interface was replaced in versions 1.2 and 1.3 by a look closer to appearance to Windows 3.0. The Extended Edition of 1.1, sold only through IBM sales channels, introduced distributed database support to IBM database systems and SNA communications support to IBM mainframe mainframes. In 1989, Version 1.2 introduced Installable Filesystems and, notably, the HPFS filesystem. HPFS provided a number of improvements over the older FAT file system, including long filenames and a form of alternate data streams called Extended Attributes.[16] In addition, extended attributes were also added to the FAT file system.[17] Installation Disk A of Microsoft OS/2 1.3 (3½-inch floppy disk) The Extended Edition of 1.2 introduced TCP/IP and Ethernet support. OS/2 and Windows-related books of the late 1980s acknowledged the existence of both systems and promoted OS/2 as the system of the future.[18 19]ure: Breakup The collaboration between IBM and Microsoft unravelled in 1990, between the releases of Windows 3.0 and OS/2 1.3. During this time, Windows 3.0 became a tremendous success, selling millions of copies in its first year.[19] Much of its success was because Windows 3.0 (along with MS-DOS) was bundled with most new computers.[20] OS/2, on the other hand, was available only as an additional stand-alone software package. In addition, OS/2 lacked device drivers for many common devices such as printers, particularly non-IBM hardware.[21] Windows, on the other hand, supported a much larger variety of hardware. The increasing popularity of Windows prompted Microsoft to shift its development focus from cooperating on OS/2 with IBM to building its own business based on Windows.[22] Several technical and practical reasons contributed to this breakup. The two companies had significant differences in culture and vision. Microsoft favored the open hardware system approach that contributed to its success on the PC. IBM sought to use OS/2 to drive sales of its own hardware, and urged Microsoft to drop features, such as fonts, that IBM's hardware did not support. Microsoft programmers also became frustrated with IBM's bureaucracy and its tight lines of code to measure programmer productivity.[23] IBM developers complained about the terseness and lack of comments in Microsoft's code, while Microsoft developers complained that IBM's code was bloated.[24] The two products have significant differences in API. OS/2 was announced when Windows 2.0 was near completion, and the Windows API already defined. However, IBM requested that this API be significantly changed for OS/2.[25] Therefore, issues surrounding application compatibility appeared immediately. OS/2 designers hoped for source code conversion tools, allowing complete migration of Windows application source code to OS/2 at some point. However, OS/2 1.x did not gain enough momentum to allow vendors to avoid developing for both OS/2 and Windows in parallel. OS/2 1.3 was the final 16-bit only version of OS/2, and the last to be sold by Microsoft. OS/2 1.x targets the Intel 80286 processor and DOS fundamentally doesn't. IBM insisted on supporting the 80286 processor, with its 16-bit segmented memory mode, because of commitments made to customers who had purchased many 80286-based PS/2s as a result of IBM's promises surrounding OS/2.[26] Until release 2.0 in April 1992, OS/2 ran in 16-bit protected mode and therefore could not benefit from the Intel 80386's much simpler 32-bit flat memory model and virtual 8086 mode features. This was especially painful in providing support for DOS applications. While, in 1988, Windows/386 2.1 could run several cooperatively multitasked DOS applications, including expanded memory (EMS) emulation, OS/2 1.3, released in 1991, was still limited to one 640 kb "DOS box". Given these issues, Microsoft started to work in parallel on a version of Windows which was more future-oriented and more portable. The hiring of Dave Cutler, former VAX/VMS architect, in 1988 created an immediate competition with the OS/2 team, as Cutler did not think much of the OS/2 technology and wanted to build on his work on the MICA project at Digital rather than creating a "DOS plus". His NT OS/2 was a completely new architecture.[27] IBM grew concerned about the delays in development of OS/2 2.0. Initially, the companies agreed that IBM would take over maintenance of OS/2 1.0 and development of OS/2 2.0, while Microsoft would continue development of OS/2 3.0. In the end, Microsoft decided to recast NT OS/2 3.0 as Windows NT, leaving future OS/2 development to IBM. From a business perspective, it was logical to concentrate on a consumer line of operating systems based on DOS and Windows, and to prepare a new high-end system in such a way as to keep good compatibility with existing Windows applications. While it waited for this new high-end system to develop, Microsoft would still receive licensing money from Xenix and OS/2 sales. Windows NT's OS/2 heritage can be seen in its initial support for the HPFS filesystem, text mode OS/2 1.x applications, and OS/2 LAN Manager network support. Some early NT materials even included OS/2 copyright notices embedded in the software.[citation needed] One example of NT OS/2 1.x support is in the WIN2K resource kit. Windows NT could also support OS/2 1.x Presentation Manager and AVIO applications with the addition of the Windows NT Add-On Subsystem for Presentation Manager.[28] 1992: 32-bit era OS/2 2.0 was the first 32-bit release of OS/2, and the first to feature the Workplace Shell. OS/2 2.0 was released in April 1992. At the time, the suggested retail price was US\$195, while Windows retailed for \$150.[29] OS/2 2.0 provided a 32-bit API for native programs, though the OS itself still contained some 16-bit code and drivers. It also included a new OOUI (object-oriented user interface) called the Workplace Shell. This was a fully object-oriented interface that was a significant departure from the previous GUI. Rather than merely providing an environment for program windows (such as the Program Manager), the Workplace Shell provided an environment in which the user could manage programs, files and devices by manipulating objects on the screen. With the Workplace Shell, everything in the system is an "object" to be manipulated. DOS compatibility OS/2 2.0 was touted by IBM as "a better DOS than DOS and a better Windows than Windows".[30] It managed this by including the fully-licensed MS-DOS 5.0, which had been patched and improved upon. For the first time, OS/2 was able to run more than one DOS application at a time. This was so effective, that it allowed OS/2 to run a modified copy of Windows 3.0, itself a DOS extender, including Windows 3.0 applications. Because of the limitations of the Intel 80286 processor, OS/2 1.x could run only one DOS program at a time, and did this in a way that allowed the DOS program to have total control over the computer. A problem in DOS mode could crash the entire computer. In contrast, OS/2 2.0 could leverage the virtual 8086 mode of the Intel 80386 processor to create a much safer virtual machine in which to run DOS programs. This included an extensive set of configuration options to optimize the performance and capabilities given to each DOS program. Any real-mode operating system (such as 8086 Xenix) could also be made to run using OS/2's virtual machine capabilities, subject to certain direct hardware access limitations. The OS/2 2.0 upgrade box Like most 32-bit environments, OS/2 could not run protected-mode DOS programs using the older VCPi interface, unlike the Standard mode of Windows 3.x; it only supported programs written according to DPMI. (Microsoft discouraged the use of VCPi under Windows 3.1, however, due to performance degradation).[31] Unlike Windows NT, OS/2 always allowed DOS programs the possibility of masking real hardware interrupts, so any DOS program could deadlock the machine in this way. OS/2 could, however, use a hardware watchdog on selected machines (notably IBM machines) to break out of such a deadlock. Later, release 3.0 leveraged the enhancements of newer Intel 80486 and Intel Pentium processors—the Virtual Interrupt Flag (VIF), which was part of the Virtual Mode Extensions (VME)—to solve this problem. Further information: VME (CONFIG.SYS directive) Windows 3.x compatibility Compatibility with Windows 3.0 (and later Windows 3.1) was achieved by adapting Windows user-mode code components to run inside a virtual DOS machine (VDM). Originally, a nearly complete version of Windows code was included with OS/2 itself. Windows 3.0 in OS/2 2.0, and Windows 3.1 in OS/2 2.1. Later, IBM developed versions of OS/2 that would use whatever Windows version the user had installed previously, patching it on the fly, and sparing the cost of an additional Windows license.[32] It could either run full-screen, using its own set of video drivers, or "seamlessly", where Windows programs would appear directly on the OS/2 desktop. The process containing Windows was given fairly extensive access to hardware, especially video, and the result was that switching between a full-screen Windows/2 session and the Workplace Shell could occasionally cause issues.[33] Because OS/2 only runs the user-mode system components of Windows, it is incompatible with Windows device drivers (VxDs) and applications that require them. Multiple Windows applications run by default in a single Windows session - multitasking cooperatively and without memory protection - just as they would under native Windows 3.x. However, to achieve true isolation between Windows 3.x programs, OS/2 can also run multiple copies of Windows in parallel, with each copy residing in a separate VDM. The user can then optionally place each program either in its own Windows session - with preemptive multitasking and full memory protection between sessions, though not within them - or allow some applications to run together cooperatively in a shared Windows session while isolating other applications in one or more separate Windows sessions. At the cost of additional hardware resources, this approach can protect each program in any given Windows session (and each instance of Windows itself) from every other program running in any separate Windows session (though not from other programs running in the same Windows session).[34] Whether Windows applications are running in full-screen or windowed mode, and in one Windows session or several, it is possible to use DDE between OS/2 and Windows applications, and OLE between Windows applications only.[35] IBM's OS/2 for Windows product, also known as "OS/2, Special Edition", was interpreted as a deliberate strategy "of cashing in on the pervasive success of the Microsoft platform" but risked confusing consumers with the notion that the product was a mere accessory or utility running on Windows such as Norton Desktop for Windows when, in fact, it was "a complete, modern, multi-tasking, pre-emptive operating system", itself hosting Windows instead of running on it. Available on CD-ROM or 18 floppy disks, the product documentation reportedly suggested Windows as a prerequisite for installing the product, also being confined to its original FAT partition, whereas the product apparently supported the later installation of Windows running from an HPFS partition, particularly beneficial for users of larger hard drives. Windows compatibility, relying on patching specific memory locations, was reportedly broken by the release of Windows 3.11, prompting accusations of arbitrary changes to Windows in order to perpetrate "a deliberate act of Microsoft sabotage". IBM's product [34] 1994: OS/2 Warp OS/2 Warp Connect 3.0, showing the Windows 3.1 Program Manager, OASIS in a DOS window and the LaunchPad (bottom center) Released in 1994, OS/2 version 3.0 was labelled as OS/2 Warp to highlight the new performance benefits, and generally to freshen the product image. "Warp" had originally been the internal IBM name for the release. IBM claimed that it had used Star Trek terms as internal names for prior OS/2 releases, and that this one seemed appropriate for external use as well. At the launch of OS/2 Warp in 1994, Patrick Stewart was to be the Master of Ceremonies; however Kate Mulgrew[36] of the then-upcoming series Star Trek: Voyager substituted him at the last minute.[37][38]p. 108 OS/2 Warp offers a host of benefits over OS/2 2.1, notably broader hardware support, greater multimedia capabilities, Internet-compatible networking, and it includes a basic office application suite known as IBM Works. It was released in two versions: the less expensive "Red Spine" and the more expensive "Blue Spine" (named for the color of their boxes). "Red Spine" was designed to support Microsoft Windows applications by utilizing any existing installation of Windows on the consumer's hard drive. "Blue Spine" includes Windows support in its own installation, and so can support Windows applications without a Windows installation. As most computers were sold with Microsoft Windows pre-installed and the price was less, "Red Spine" was the more popular product.[citation needed] OS/2 Warp Connect—which has full LAN client support built-in—followed in mid-1995. Warp Connect was nicknamed "Grape".[15] Firefox 3.5 for OS/2 Warp 4 OS/2 Warp 4 desktop after installation in OS/2 2.0, most performance-sensitive subsystems, including the graphics (Gre) and multimedia (MMPM2D) systems, were updated to 32-bit code in a fixpack, and included as part of OS/2 2.1. Warp 3 brought about a fully 32-bit windowing system, while Warp 4 introduced the object-oriented 32-bit GRDDL display driver model. 1996: Warp 4 In 1996, Warp 4 added Java and speech recognition software [39] IBM also released server editions of Warp 3 and Warp 4 which bundled the LAN Server product directly into the operating system installation. A personal mail version of Lotus Notes was also included with a number of template databases for creating mail management, brainstorming, and so forth. The UK-distributed tree-clone CD-ROM of OS/2 Warp essentially contained the entire OS and was easily, even accidentally, cracked[clarification needed], meaning that even people who like dsfs do not have to buy it. This was seen as a backdoor tactic to increase the number of OS/2 users, in the belief that this would increase sales and demand for third-party applications, and thus strengthen OS/2's desktop numbers.[citation needed] This suggestion was bolstered by the fact that this demo version had replaced another which was not so easily cracked, but which had been released with trial versions of various applications.[citation needed] In 2000, the July edition of Australian Personal Computer magazine bundled software CD-ROMs, included a full version of Warp 4 that required no activation and was essentially a free release. Special versions of OS/2 2.11 and Warp 4 also included symmetric multiprocessing (SMP) support. OS/2 sales were largely concentrated in networked computing used by corporate professionals; however, by the early 1990s, it was overtaken by Microsoft Windows NT. While OS/2 was arguably technically superior to Microsoft Windows 95, OS/2 failed to develop much penetration in the consumer and stand-alone desktop PC segments; there were reports that it could not be installed properly on IBM's own Aptiva series of home PCs.[40] Microsoft made an offer in 1994 where IBM would receive the same terms as Compaq (the largest PC manufacturer at the time) for a license of Windows 95, if IBM ended development of OS/2 completely. IBM refused and instead went with an "IBM Firsts" strategy of promoting OS/2 Warp and disparaging Windows, as IBM aimed to drive sales of its own software as well as hardware. By 1995, Windows 95 negotiations between IBM and Microsoft, which were already difficult, stalled when IBM purchased Lotus SmartSuite, which would have directly competed with Microsoft Office. As a result of the dispute, IBM signed the license agreement 15 minutes before Microsoft's Windows 95 launch event, which was later than their competitors' usual early sales of IBM PCs. IBM officials later conceded that OS/2 would not have been a viable operating system to keep them in the PC business.[41][42] Workplace OS This section needs additional citations for verification. Please help improve this article by adding reliable sources. Unsourced material may be challenged and removed. (April 2012) (Learn how and when to remove this template message) arc article: Workplace OS In 1991, IBM started development on an intended replacement for OS/2 called Workplace OS. This was an entirely new product, brand new code, that borrowed only a few sections of code from both the existing OS/2 and AIX products. It used an entirely new microkernel code base, intended (eventually) to host several of IBM's operating systems (including OS/2) as microkernel "personalities". It also included major new architectural features including a system registry, JFS, support for UNIX graphics libraries, and a new driver model.[43] Workplace OS was developed solely for POWER platforms, and IBM intended to market a full line of PowerPCs in an effort to take over the market from Intel. A mission was formed to create prototypes of these machines and they were disclosed to several corporate customers, all of whom raised issues with the idea of dropping Intel. Advanced plans for the new code base would eventually include replacement of the OS/400 operating system by Workplace OS, as well as a microkernel product that would have been used in industries such as telecommunications and set-top television receivers. A partially functional pre-alpha version of Workplace OS was demonstrated at Comdex, where a bemused Bill Gates stopped by the booth. The second and last time it would be shown in public was at an OS/2 user group in Phoenix, Arizona; the pre-alpha code refused to boot. It was released in 1995. But with \$990 million being spent per year on development of this as well as Workplace OS, and no possible profit or widespread adoption, the end of the entire Workplace OS and OS/2 product line was near. Downsizing This section does not cite any sources. Please help improve this section by adding citations to reliable sources. Unsourced material may be challenged and removed. (March 2013) (Learn how and when to remove this template message) A project was launched internally by IBM to evaluate the feasibility of creating a highly streamlined, highly secure OS. The project was named OS/2 Next Generation. The project was led by Mark Hurd and was reported to be "basically, everybody reports to everybody" and Austin. That study, tightly classified as "Registered Confidential" and printed only in numbered copies, identified untenable weaknesses and failures across the board in the Personal Systems Division as well as across IBM as a whole. This resulted in a decision being made at a level above the Division to cut over 95% of the overall budget for the entire product line, end all new development (including Workplace OS), eliminate the Boca Raton development lab, end all sales and marketing efforts of the product, and lay off over 1,300 development individuals (as well as sales and support personnel). \$990 million had been spent in the last full year. Warp 4 became the last distributed version of OS/2 2001: Fading out Although a small and dedicated community remains faithful to OS/2,[44] OS/2 failed to catch on in the mass market and its little used outside certain niches where IBM traditionally had a stronghold. For example, many bank installations, especially automated teller machines, run OS/2 with a customized user interface; French SNCF national railways used OS/2 1.x in thousands of ticket selling machines.[citation needed] Telecom companies such as Nortel used OS/2 in some voicemail systems. Also, OS/2 was used for the host PC used to control the Satellite Operations Support System equipment installed at NPR member stations from 1994 to 2007, and used to receive the network's programming via satellite.[citation needed] Although IBM began indicating shortly after the release of Warp 4 that OS/2 would eventually be withdrawn, the company did not end support until December 31, 2006.[45] Sales of OS/2 stopped on December 23, 2005. The latest IBM OS/2 Warp version is 4.52, which was released for both desktop and server systems in December 2001. IBM is still delivering defect support for a fee.[45][46] IBM urges customers to migrate their often highly complex applications to e-business technologies such as Java in a platform-neutral manner. Once application migration is completed, IBM recommends transitioning to a different operating system, suggesting Linux as an alternative.[47][48][49] Third-party development Main articles: eComStation and ArcaOS ArcaOS is the most recent OS/2-based operating system developed outside of IBM. After IBM discontinued development of OS/2, various third parties approached IBM to take over future development of the operating system. 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On top of this lies the Workplace Shell (WPS) introduced in OS/2 2.0. WPS is an object-oriented shell allowing the user to perform traditional computing tasks such as accessing files, printers, launching legacy programs, and advanced object oriented tasks using built-in and third-party application objects that extended the shell in an integrated fashion not available on any other mainstream operating system. WPS follows IBM's Common User Access user interface standards. WPS represents objects such as disks, folders, files, program objects, and printers using the System Object Model (SOM), which allows code to be shared among applications, possibly written in different programming languages. A distributed version called DSOM allowed objects on different computers to communicate. DSOM is based on CORBA. The object oriented aspect of SOM is similar to, and a direct competitor to, Microsoft's Component Object Model, though it is implemented in a radically different manner; for instance, one of the most notable differences between SOM and COM is SOM's support for inheritance (one of the most fundamental concepts of OO programming)—COM does not have such support. SOM and DSOM are no longer being developed. The multimedia capabilities of OS/2 are accessible through Media Control Interface commands. The last update (bundled with the IBM version of Netscape Navigator plugins) added support for MPEG files. Support for newer formats such as PNG, progressive JPEG, DivX, Ogg, and MP3 comes from third parties. Sometimes it is integrated with the distinal debug del detach dir diskcomp diskcopy doskey dpath eatrc eho endlocal erase exit unzip fdisk fdiskimg fm for format fsaccgo goto grabfile help join keyb keys label makeini mdm men mdkir mode more move patch path picview pmexec print prompt prst recover ren rename replace restore rmdir set setboot setcom40 setlocal share shift sort spool start subst syslog time trace tracecb tracecfm tree ext extdelete unpack verify view vmsdisk vl wcopy Networking This section needs expansion. You can help by adding to it. (April 1919) The TCP/IP stack is based on the open source BSD stack as visible with SCCS with compatible tools. IBM included tools such as ftp and telnet and even servers for both commands. IBM sold several networking extensions including NFS support and an X11 server. Drivers Hardware vendors were reluctant to support device drivers for alternative operating systems including OS/2, leaving users with few choices from a select few vendors. To relieve this issue for video cards, IBM licensed a reduced version of the Scitech display drivers, allowing users to choose from a wide selection of cards supported through Scitech's modular driver design.[63] Virtualization OS/2 has historically been more difficult to run in a virtual machine than most other legacy x86 operating systems because of its extensive reliance on the full set of features on the x86 CPU; in particular, OS/2 runs the fault handling system (a VxD application was not serving the window managers, the entire GUI system would get stuck and a reboot was required. The problem was causally reduced in later Warp 4 packs and refined by Warp 4, by taking control over the application after the OS was restarted. It also provided "additional" code which greatly improves host-guest OS interactions in OS/2. The additions are not provided with the current version of VirtualPC, but the version still included with a release may still be useful. Note that OS/2 runs only as a guest on those versions of VirtualPC that use virtualization (x86 based hosts) and not those doing full emulation (VirtualPC for Mac). VirtualBox from Oracle Corporation (originally InnoTek, later Sun) supports OS/2 1.x, Warp 3 through 4.5, and eComStation as well as "Other OS/2" as guests. However, attempting to run OS/2 and eComStation can still be difficult, if not impossible, because of the strict requirements of VT-x/AMD-V hardware-enabled virtualization and only ACP2/MCP2 is reported to work in a reliable manner.[66] ArcaOS supports being run as a virtual machine guest inside VirtualBox, VMware ESXi and VMware Workstation.[67] It ships with VirtualBox Guest Additions, and driver improvements to improve performance as a guest operating system.[68] The difficulties in efficiently running OS/2 have, at least once, created an opportunity for a new virtualization company. A large bank in Moscow needed a way to use OS/2 on newer hardware that OS/2 did not support. As virtualization software is an easy way around this, the company desired to run OS/2 under a hypervisor. Once it was determined that VMware was not a possibility, it hired a group of Russian software developers to write a host-based hypervisor that would officially support OS/2. Thus, the Parallels, Inc. company and their Parallels Workstation product was born.[69] Security niche OS/2 has few native computer viruses:[70] while it is not invulnerable by design, its reduced market share appears to have discouraged virus writers. There are, however, OS/2-based antivirus programs, dealing with DOS viruses and Windows viruses which could pass through an OS/2 server.[71] Problems Some problems were classic subjects of comparison with other operating systems. Synchronous input/output (SI/O) application was not serving the window managers, the entire GUI system would get stuck and a reboot was required. The problem was causally reduced in later Warp 4 packs and refined by Warp 4, by taking control over the application after the OS was restarted for several seconds.[72][73]:365 No unified object handles (OS/2 v2.11 and earlier) The availability of threads probably led system designers to overlook mechanisms which allow a single thread to wait for different types of asynchronous events at the same time, for example the keyboard and the mouse in a "console" program. Even though select was added later

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