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Nintendo 64

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The Nintendo 64 (N64) is a home video game console developed and marketed by Nintendo. It was released in Japan on June 23, 1996, in North America on September 29, 1996, and in Europe and Australia on March 1, 1997. As the successor to the Super Nintendo Entertainment System (SNES), the N64 was the last major home console to use ROM cartridges as its primary storage medium. As a fifth-generation console, the Nintendo 64 primarily competed with Sony's PlayStation and the Sega Saturn.

Development of the N64 began in 1993 in collaboration with Silicon Graphics, initially codenamed Project Reality and later tested as the Ultra 64 arcade platform. The console was named for its 64-bit CPU. Although its design was largely finalized by mid-1995, the console's release was delayed until 1996 to allow for the completion of the console's launch titles, Super Mario 64, Pilotwings 64, and the Japan-exclusive Saikyō Habu Shōgi.

The N64's original charcoal-gray console was later joined by several color variants. Certain games required the Expansion Pak to boost system RAM from 4 to 8 MB, improving both graphics and gameplay functionality. The console supported saved game storage either on cartridges or the optional Controller Pak accessory. The 64DD magnetic disc peripheral offered additional storage for game content and enabled the Randnet online service. However, due to a delayed launch, the 64DD was a commercial failure and was released exclusively in Japan.

In 1996, Time magazine named the N64 its Machine of the Year, and in 2011, IGN ranked it as the ninth-greatest video game console of all time. Though the N64 sold over 32 million units globally, it was ultimately discontinued in 2002 following the release of its successor, the GameCube. While it was critically acclaimed, the N64 faced commercial challenges; its sales lagged behind the PlayStation, and underperformed in both Japan and Europe, despite strong performance in the United States.

Commodore 64

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The Commodore 64, also known as the C64, is an 8-bit home computer introduced in January 1982 by Commodore International (first shown at the Consumer Electronics Show, January 7–10, 1982, in Las Vegas). It has been listed in the Guinness World Records as the best-selling desktop computer model of all time, with independent estimates placing the number sold between 12.5 and 17 million units. Volume production started in early 1982, marketing in August for US\$595 (equivalent to \$1,940 in 2024). Preceded by the VIC-20 and Commodore PET, the C64 took its name from its 64 kilobytes (65,536 bytes) of RAM.

With support for multicolor sprites and a custom chip for waveform generation, the C64 could create superior visuals and audio compared to systems without such custom hardware.

The C64 dominated the low-end computer market (except in the UK, France and Japan, lasting only about six months in Japan) for most of the later years of the 1980s. For a substantial period (1983–1986), the C64 had between 30% and 40% share of the US market and two million units sold per year, outselling IBM PC compatibles, the Apple II, and Atari 8-bit computers. Sam Tramiel, a later Atari president and the son of Commodore's founder, said in a 1989 interview, "When I was at Commodore we were building 400,000 C64s a month for a couple of years." In the UK market, the C64 faced competition from the BBC Micro, the ZX Spectrum, and later the Amstrad CPC 464, but the C64 was still the second-most-popular computer in the UK after the ZX Spectrum. The Commodore 64 failed to make any impact in Japan, as their market was dominated by Japanese computers, such as the NEC PC-8801, Sharp X1, Fujitsu FM-7 and MSX, and in France, where the ZX Spectrum, Thomson MO5 and TO7, and Amstrad CPC 464 dominated the market.

Part of the Commodore 64's success was its sale in regular retail stores instead of only electronics or computer hobbyist specialty stores. Commodore produced many of its parts in-house to control costs, including custom integrated circuit chips from MOS Technology. In the United States, it has been compared to the Ford Model T automobile for its role in bringing a new technology to middle-class households via creative and affordable mass-production. Approximately 10,000 commercial software titles have been made for the Commodore 64, including development tools, office productivity applications, and video games. C64 emulators allow anyone with a modern computer, or a compatible video game console, to run these programs today. The C64 is also credited with popularizing the computer demoscene and is still used today by some computer hobbyists. In 2011, 17 years after it was taken off the market, research showed that brand recognition for the model was still at 87%.

X86-64

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x86-64 (also known as x64, x86_64, AMD64, and Intel 64) is a 64-bit extension of the x86 instruction set. It was announced in 1999 and first available in the AMD Opteron family in 2003. It introduces two new operating modes: 64-bit mode and compatibility mode, along with a new four-level paging mechanism.

In 64-bit mode, x86-64 supports significantly larger amounts of virtual memory and physical memory compared to its 32-bit predecessors, allowing programs to utilize more memory for data storage. The architecture expands the number of general-purpose registers from 8 to 16, all fully general-purpose, and extends their width to 64 bits.

Floating-point arithmetic is supported through mandatory SSE2 instructions in 64-bit mode. While the older x87 FPU and MMX registers are still available, they are generally superseded by a set of sixteen 128-bit vector registers (XMM registers). Each of these vector registers can store one or two double-precision floating-point numbers, up to four single-precision floating-point numbers, or various integer formats.

In 64-bit mode, instructions are modified to support 64-bit operands and 64-bit addressing mode.

The x86-64 architecture defines a compatibility mode that allows 16-bit and 32-bit user applications to run unmodified alongside 64-bit applications, provided the 64-bit operating system supports them. Since the full x86-32 instruction sets remain implemented in hardware without the need for emulation, these older executables can run with little or no performance penalty, while newer or modified applications can take advantage of new features of the processor design to achieve performance improvements. Also, processors supporting x86-64 still power on in real mode to maintain backward compatibility with the original 8086 processor, as has been the case with x86 processors since the introduction of protected mode with the 80286.

The original specification, created by AMD and released in 2000, has been implemented by AMD, Intel, and VIA. The AMD K8 microarchitecture, in the Opteron and Athlon 64 processors, was the first to implement it. This was the first significant addition to the x86 architecture designed by a company other than Intel. Intel was forced to follow suit and introduced a modified NetBurst family which was software-compatible with AMD's specification. VIA Technologies introduced x86-64 in their VIA Isaiah architecture, with the VIA Nano.

The x86-64 architecture was quickly adopted for desktop and laptop personal computers and servers which were commonly configured for 16 GiB (gibibytes) of memory or more. It has effectively replaced the discontinued Intel Itanium architecture (formerly IA-64), which was originally intended to replace the x86 architecture. x86-64 and Itanium are not compatible on the native instruction set level, and operating systems and applications compiled for one architecture cannot be run on the other natively.

Athlon 64

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The Athlon 64 is a ninth-generation, AMD64-architecture microprocessor produced by Advanced Micro Devices (AMD), released on September 23, 2003. It is the third processor to bear the name Athlon, and the immediate successor to the Athlon XP. The Athlon 64 was the second processor to implement the AMD64 architecture (after the Opteron) and the first 64-bit processor targeted at the average consumer. Variants of the Athlon 64 have been produced for Socket 754, Socket 939, Socket 940, and Socket AM2. It was AMD's primary consumer CPU, and primarily competed with Intel's Pentium 4, especially the Prescott and Cedar Mill core revisions.

The Athlon 64 is AMD's first K8, eighth-generation processor core for desktop and mobile computers. Despite being natively 64-bit, the AMD64 architecture is backward-compatible with 32-bit x86 instructions. The Athlon 64 line was succeeded by the dual-core Athlon 64 X2 and Athlon X2 lines.

Boeing AH-64 Apache

The Hughes/McDonnell Douglas/Boeing AH-64 Apache (/ˈpætʃ-i/ ?-PATCH-ee) is an American twin-turboshaft attack helicopter with a tailwheel-type landing

The Hughes/McDonnell Douglas/Boeing AH-64 Apache (?-PATCH-ee) is an American twin-turboshaft attack helicopter with a tailwheel-type landing gear and a tandem cockpit for a crew of two. Nose-mounted sensors help acquire targets and provide night vision. It carries a 30 mm (1.18 in) M230 chain gun under its forward fuselage and four hardpoints on stub-wing pylons for armament and stores, typically AGM-114 Hellfire missiles and Hydra 70 rocket pods. Redundant systems help it survive combat damage.

The Apache began as the Model 77 developed by Hughes Helicopters for the United States Army's Advanced Attack Helicopter program to replace the AH-1 Cobra. The prototype YAH-64 first flew on 30 September 1975. The U.S. Army selected the YAH-64 over the Bell YAH-63 in 1976, and later approved full production in 1982. After acquiring Hughes Helicopters in 1984, McDonnell Douglas continued AH-64 production and development. The helicopter was introduced to U.S. Army service in April 1986. The advanced AH-64D Apache Longbow was delivered to the Army in March 1997. Production has been continued by Boeing Defense, Space & Security. As of March 2024, over 5,000 Apaches have been delivered to the U.S. Army and 18 international partners and allies.

Primarily operated by the U.S. Army, the AH-64 has also become the primary attack helicopter of multiple nations, including Greece, Japan, Israel, the Netherlands, Singapore, and the United Arab Emirates. It has been built under license in the United Kingdom as the AgustaWestland Apache. American AH-64s have served in conflicts in Panama, the Persian Gulf, Kosovo, Afghanistan, and Iraq. Israel has used the Apache to

fight in Lebanon and the Gaza Strip. British and Dutch Apaches were deployed to wars in Afghanistan and Iraq beginning in 2001 and 2003.

T-64

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The T-64 is a Soviet tank manufactured in Kharkiv, and designed by Alexander Morozov. The tank was introduced in the early 1960s. It was a more advanced counterpart to the T-62: the T-64 served in tank divisions, while the T-62 supported infantry in motor rifle divisions. It introduced advanced features including composite armour, a compact engine and transmission, and a smoothbore 125-mm gun equipped with an autoloader to allow the crew to be reduced to three so the tank could be smaller and lighter. In spite of being armed and armoured like a heavy tank, the T-64 weighed only 38 tonnes (42 short tons; 37 long tons).

These features made the T-64 expensive to build, significantly more so than previous generations of Soviet tanks. This was especially true of the power plant, which was time-consuming to build and cost twice as much as more conventional designs. Several proposals were made to improve the T-64 with new engines, but chief designer Alexander Alexandrovich Morozov's political power in Moscow kept the design in production in spite of any concerns about price.

The T-64 formed the design basis of the Soviet T-80, which entered service in 1976. The tank is in use in a few nations or regions as of 2023. The T-64 is undergoing significant factory overhauls and modernization in Ukraine.

Super Mario 64

Super Mario 64 is a platform game developed and published by Nintendo for the Nintendo 64. It was released in Japan and North America in 1996 and PAL

Super Mario 64 is a platform game developed and published by Nintendo for the Nintendo 64. It was released in Japan and North America in 1996 and PAL regions in 1997. It is the first Super Mario game to feature 3D gameplay, combining traditional Super Mario gameplay, visual style, and characters in a large open world. In the game, Bowser invades Princess Peach's castle, kidnaps her and hides the castle's sources of protection, the Power Stars, in many different worlds inside magical paintings. As Mario, the player traverses levels and collects Power Stars to unlock areas of Princess Peach's castle, in order to reach Bowser and rescue Princess Peach.

Director Shigeru Miyamoto conceived a 3D Super Mario game during the production of Star Fox (1993). Development lasted nearly three years: about one year on design and twenty months on production, starting with designing the virtual camera system. The team continued with illustrating the 3D character models—at the time a relatively unattempted task—and refining sprite movements. The sound effects were recorded by Yoji Inagaki and the score was composed by Koji Kondo.

Super Mario 64 was highly anticipated by video game journalists and audiences, boosted by advertising campaigns and showings at the 1996 E3 trade show. It received critical acclaim, with reviewers praising its ambition, visuals, level design, and gameplay, though some criticized its virtual camera system. It is the best-selling Nintendo 64 game, with nearly twelve million copies sold by 2015.

Retrospectively, Super Mario 64 has been considered one of the greatest video games of all time. Numerous developers have cited it as an influence on 3D platform games, with its dynamic camera system and 360-degree analog control establishing a new archetype for the genre, much as Super Mario Bros. did for side-scrolling platform games. It was remade as Super Mario 64 DS for the Nintendo DS in 2004, and has been

ported to other Nintendo consoles since. The game has attracted a cult following, spawning many fangames and mods, a large speedrunning presence, and enduring rumors surrounding game features.

Interstate 64

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Interstate 64 (I-64) is an east–west Interstate Highway in the Eastern United States. Its western terminus is at I-70, U.S. Route 40 (US 40), and US 61 in Wentzville, Missouri. Its eastern terminus is at the Bowers Hill Interchange with I-264 and I-664 at Bower's Hill in Chesapeake, Virginia. I-64 connects Greater St. Louis, the Louisville metropolitan area, the Lexington–Fayette metropolitan area, the Charleston, WV metropolitan area, the Greater Richmond Region, and Hampton Roads.

64-bit computing

In computer architecture, 64-bit integers, memory addresses, or other data units are those that are 64 bits wide. Also, 64-bit central processing units

In computer architecture, 64-bit integers, memory addresses, or other data units are those that are 64 bits wide. Also, 64-bit central processing units (CPU) and arithmetic logic units (ALU) are those that are based on processor registers, address buses, or data buses of that size. A computer that uses such a processor is a 64-bit computer.

From the software perspective, 64-bit computing means the use of machine code with 64-bit virtual memory addresses. However, not all 64-bit instruction sets support full 64-bit virtual memory addresses; x86-64 and AArch64, for example, support only 48 bits of virtual address, with the remaining 16 bits of the virtual address required to be all zeros (000...) or all ones (111...), and several 64-bit instruction sets support fewer than 64 bits of physical memory address.

The term 64-bit also describes a generation of computers in which 64-bit processors are the norm. 64 bits is a word size that defines certain classes of computer architecture, buses, memory, and CPUs and, by extension, the software that runs on them. 64-bit CPUs have been used in supercomputers since the 1970s (Cray-1, 1975) and in reduced instruction set computers (RISC) based workstations and servers since the early 1990s. In 2003, 64-bit CPUs were introduced to the mainstream PC market in the form of x86-64 processors and the PowerPC G5.

A 64-bit register can hold any of 264 (over 18 quintillion or 1.8×10^{19}) different values. The range of integer values that can be stored in 64 bits depends on the integer representation used. With the two most common representations, the range is 0 through 18,446,744,073,709,551,615 (equal to $2^{64} - 1$) for representation as an (unsigned) binary number, and $-9,223,372,036,854,775,808$ (-2^{63}) through 9,223,372,036,854,775,807 ($2^{63} - 1$) for representation as two's complement. Hence, a processor with 64-bit memory addresses can directly access 264 bytes (16 exabytes or EB) of byte-addressable memory.

With no further qualification, a 64-bit computer architecture generally has integer and addressing registers that are 64 bits wide, allowing direct support for 64-bit data types and addresses. However, a CPU might have external data buses or address buses with different sizes from the registers, even larger (the 32-bit Pentium had a 64-bit data bus, for instance).

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