

Nvidia

Nvidia Corporation^[a] (/ɛnˈvɪdiə/, en-VID-ee-ə) is an American multinational corporation and technology company headquartered in Santa Clara, California, and incorporated in Delaware. It is a software and fabless company which designs and supplies graphics processing units (GPUs), application programming interfaces (APIs) for data science and high-performance computing, as well as system on a chip units (SoCs) for mobile computing and the automotive market. Nvidia is also a dominant supplier of artificial intelligence (AI) hardware and software. [6][7][8]

Nvidia's professional line of GPUs are used for edgeto-cloud computing and in supercomputers and workstations for applications in fields such as architecture, engineering and construction, media and entertainment, automotive, scientific research, and manufacturing design. [9] Its GeForce line of GPUs are aimed at the consumer market and are used in applications such as video editing, 3D rendering, and PC gaming. With a market share of 80.2% in the second quarter of $2023.\frac{[10]}{}$ Nyidia leads the market for discrete desktop GPUs by a wide margin. The company expanded its presence in the gaming industry with the introduction of the Shield Portable (a handheld game console), Shield Tablet (a gaming tablet), and Shield TV (a digital media player), as well as its cloud gaming service GeForce Now.[11]

In addition to GPU design and outsourcing manufacturing, Nvidia provides the <u>CUDA</u> software platform and API that allows the creation of massively <u>parallel programs</u> which utilize GPUs. [12][13] They are deployed in supercomputing sites around the world. [14][15] In the late 2000s, Nvidia had moved into the mobile computing market, where it produces <u>Tegra</u> mobile processors for smartphones and tablets as well as vehicle navigation and entertainment systems. [16][17][18] Its competitors include <u>AMD</u>, Intel, [19] Qualcomm, [20] and AI accelerator companies

Nvidia Corporation





Headquarters in Santa Clara, California, in

2023

Trade name NVIDIA

Company <u>Public</u>

type

Traded as Nasdaq: NVDA (https://www.n

asdaq.com/market-activity/sto

cks/nvda)

Nasdaq-100 component

DJIA component
S&P 100 component
S&P 500 component

Industry Semiconductors

Founded April 5, 1993, in Sunnyvale,

California, U.S

Founders Jensen Huang

Chris Malachowsky

Curtis Priem

Headquarters Santa Clara, California, U.S

Area served Worldwide

Key people Jensen Huang (president and

CEO)

Bill Dally (chief scientist)

Revenue \(\subseteq US\\$60.92 \text{ billion (FY 2024)} \)

such as <u>Cerebras</u> and <u>Graphcore</u>. It also makes AI-powered software for audio and video processing (e.g., Nvidia Maxine). [21]

Nvidia's offer to acquire <u>Arm</u> from <u>SoftBank</u> in September 2020 failed to materialize following extended regulatory scrutiny, leading to the termination of the deal in February 2022 in what would have been the largest semiconductor acquisition. [22][23] In 2023, Nvidia became the seventh public U.S. company to be valued at over \$1 trillion, [24] and the company's valuation has increased rapidly since then as the company became a leader in data center chips with AI capabilities in the midst of the <u>AI boom</u>. [25][26] In June 2024, for one day, Nvidia overtook <u>Microsoft</u> as the world's <u>most valuable publicly traded company</u>, with a market capitalization of over \$3.3 trillion. [27]

Operating income	▲ US\$32.97 billion (FY 2024)	
Net income	▲ US\$29.76 billion (FY 2024)	
Total assets	▲ US\$65.73 billion (FY 2024)	
Total equity	▲ US\$42.98 billion (FY 2024)	
Number of employees	29,600 (FY 2024)	
Subsidiaries	Bright Computing	
	Cumulus Networks	
	DeepMap	
	Mellanox Technologies	
	Nvidia Advanced Rendering	
	Center	
Website	nvidia.com (https://www.nvidia.com/)	
Footnotes / references [1][2]		

History

Founding

Nvidia was founded on April 5, 1993, [28][29][30] by Jensen Huang (who, as of 2024, remains CEO) a Taiwanese-American electrical engineer who was previously the director of CoreWare at LSI Logic and a microprocessor designer at AMD; Chris Malachowsky, an engineer who worked at Sun Microsystems; and Curtis Priem, who was previously a senior staff engineer and graphics chip designer at IBM and Sun Microsystems. [31][32] The three men agreed to start the company in a meeting at a Denny's roadside diner on Berryessa Road in East San Jose. [33][34][35]

At the time, Malachowsky and Priem were frustrated with Sun's management and were looking to leave, but Huang was on "firmer ground", [36] in that he was already running his own division at



The <u>Denny's</u> roadside diner in <u>San</u> <u>Jose, California, c.</u> 2023, where Nvidia's three co-founders agreed to start the company in 1993

LSI.[34] The three co-founders discussed a vision of the future which was so compelling that Huang decided to leave LSI[36] and become the chief executive officer of their new startup.[34]

In 1993, the three co-founders envisioned that the ideal trajectory for the forthcoming wave of computing would be in the realm of accelerated computing, specifically in graphics-based processing. This path was chosen due to its unique ability to tackle challenges that eluded general-purpose computing methods. [36] As Huang later explained: "We also observed that video games were simultaneously one of the most computationally challenging problems and would have incredibly high sales volume. Those two conditions don't happen very often. Video games was our killer app — a flywheel to reach large markets

funding huge R&D to solve massive computational problems." [36] With \$40,000 in the bank, the company was born. [36] The company subsequently received \$20 million of venture capital funding from Sequoia Capital, Sutter Hill Ventures and others. [37]

During the late 1990s, Nvidia was one of 70 startup companies^[38] chasing the idea that graphics acceleration for video games was the path to the future.^[33] Only two survived: Nvidia and <u>ATI</u> Technologies, which merged into AMD.^[33]

Nvidia initially had no name and the co-founders named all their files NV, as in "next version". [36] The need to incorporate the company prompted the co-founders to review all words with those two letters. [36] At one point, Malachowsky and Priem wanted to call the company NVision, but that name was already taken by a manufacturer of toilet paper. [34] Huang suggested the name Nvidia, [34] from "invidia", the Latin word for "envy". [36] The company's original headquarters office was in Sunnyvale, California. [36]

First graphics accelerator

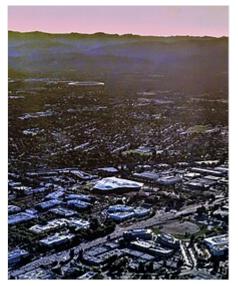
Nvidia's first graphics accelerator product, the <u>NV1</u>, was optimized for processing quadrilateral primitives (forward texture mapping) instead of the <u>triangle</u> primitives preferred by its competitors. [34] Then <u>Microsoft</u> introduced the <u>DirectX</u> platform, refused to support any other graphics software, [39] and also announced that its graphics software (<u>Direct3D</u>) would support only triangles. [34]

Nvidia also signed a contract with <u>Sega</u> to build the graphics chip for the <u>Dreamcast</u> video game console and worked on the project for a year. Having bet on the wrong technology, Nvidia was confronted with a painful dilemma: keep working on its inferior chip for the Dreamcast even though it was already too far behind the competition, or stop working and run out of money right away. 40

Eventually, Sega's president at the time, <u>Shoichiro Irimajiri</u>, came to visit Huang in person to deliver the news that Sega was going with another graphics chip vendor for the Dreamcast. However, Irimajiri still believed in Huang, and "wanted to make Nvidia successful". Despite Nvidia's disappointing failure to deliver



Nvidia's former headquarters which was home to the company through most of its pre-Al period (still in use)



Aerial view of Endeavor, the first of the two new Nvidia headquarters buildings, in Santa Clara, California, in 2017. Apple Park is visible in the distance.



Entrance of Endeavor headquarters building in 2018

on its contract, Irimajiri somehow managed to convince Sega's management to invest \$5 million into Nvidia. Years later, Huang explained that this was all the money Nvidia had left at the time, and that Irimajiri's "understanding and generosity gave us six months to live". [40]

In 1996, Huang laid off more than half of Nvidia's employees—then around 100—and focused the company's remaining resources on developing a graphics accelerator product optimized for processing triangle primitives: the RIVA 128. [34][39] By the time the RIVA 128 was released in August 1997, Nvidia was down to about 40 employees [33] and only had enough money left for about one month of payroll. [34] The sense of extreme desperation around Nvidia during this difficult era of its early history gave rise to "the unofficial company motto": "Our company is thirty days from going out of business". [34] Huang routinely began presentations to Nvidia staff with those words for many years. [34]

Nvidia sold about a million RIVA 128s in about four months [34] and used the revenue to develop its next generation of products. In 1998, the release of the RIVA TNT solidified Nvidia's reputation for developing capable graphics adapters.

Public company

Nvidia went public on January 22, 1999. [42][43][44] Investing in Nvidia after it had already failed to deliver on its contract turned out to be Irimajiri's best decision as Sega's president. After Irimajiri left Sega in 2000, Sega sold its Nvidia stock for \$15 million. [40]

In late 1999, Nvidia released the <u>GeForce 256</u> (NV10), its first product expressly marketed as a GPU, which was most notable for introducing onboard <u>transformation and lighting</u> (T&L) to consumer-level 3D hardware. Running at 120 MHz and featuring four-pixel pipelines, it implemented advanced video acceleration, motion compensation, and hardware sub-picture alpha blending. The GeForce outperformed existing products by a wide margin.

Due to the success of its products, Nvidia won the contract to develop the graphics hardware for Microsoft's Xbox game console, which earned Nvidia a \$200 million advance. However, the project took many of its best engineers away from other projects. In the short term this did not matter, and the GeForce2 GTS shipped in the summer of 2000. In December 2000, Nvidia reached an agreement to acquire the intellectual assets of its one-time rival 3dfx, a pioneer in consumer 3D graphics technology leading the field from the mid-1990s until 2000. [45][46] The acquisition process was finalized in April 2002. [47]

In 2001, <u>Standard & Poor's</u> selected Nvidia to replace the departing <u>Enron</u> in the <u>S&P 500</u> stock index, meaning that <u>index funds</u> would need to hold Nvidia shares going forward. [48]

In July 2002, Nvidia acquired Exluna for an undisclosed sum. Exluna made software-rendering tools and the personnel were merged into the Cg project. In August 2003, Nvidia acquired MediaQ for approximately US\$70 million. On April 22, 2004, Nvidia acquired iReady, also a provider of high-performance TCP offload engines and iSCSI controllers. In December 2004, it was announced that Nvidia would assist Sony with the design of the graphics processor (RSX) for the PlayStation 3 game console. On December 14, 2005, Nvidia acquired ULI Electronics, which at the time supplied third-party southbridge parts for chipsets to ATI, Nvidia's competitor. In March 2006, Nvidia acquired Hybrid Graphics. In December 2006, Nvidia, along with its main rival in the graphics industry AMD (which had acquired ATI), received subpoenas from the U.S. Department of Justice regarding possible antitrust violations in the graphics card industry.

<u>Forbes</u> named Nvidia its *Company of the Year* for 2007, citing the accomplishments it made during the said period as well as during the previous five years. On January 5, 2007, Nvidia announced that it had completed the acquisition of <u>PortalPlayer</u>, Inc. In February 2008, Nvidia acquired <u>Ageia</u>, developer of <u>PhysX</u>, a <u>physics engine</u> and <u>physics processing unit</u>. Nvidia announced that it planned to integrate the PhysX technology into its future GPU products.

In July 2008, Nvidia took a write-down of approximately \$200 million on its first-quarter revenue, after reporting that certain mobile chipsets and GPUs produced by the company had "abnormal failure rates" due to manufacturing defects. Nvidia, however, did not reveal the affected products. In September 2008, Nvidia became the subject of a class action lawsuit over the defects, claiming that the faulty GPUs had been incorporated into certain laptop models manufactured by Apple Inc., Dell, and HP. In September 2010, Nvidia reached a settlement, in which it would reimburse owners of the affected laptops for repairs or, in some cases, replacement. On January 10, 2011, Nvidia signed a six-year, \$1.5 billion cross-licensing agreement with Intel, ending all litigation between the two companies.

In November 2011, after initially unveiling it at Mobile World Congress, Nvidia released its ARM-based system on a chip for mobile devices, Tegra 3. Nvidia claimed that the chip featured the first-ever quadcore mobile CPU. [62][63] In May 2011, it was announced that Nvidia had agreed to acquire Icera, a baseband chip making company in the UK, for \$367 million. [64] In January 2013, Nvidia unveiled the Tegra 4, as well as the Nvidia Shield, an Android-based handheld game console powered by the new system on a chip. [65] On July 29, 2013, Nvidia announced that they acquired PGI from STMicroelectronics. [66]

In February 2013, Nvidia announced its plans to build a new headquarters in the form of two giant triangle-shaped buildings on the other side of San Tomas Expressway (to the west of its existing headquarters complex). The company selected triangles as its design theme. As Huang explained in a blog post, the triangle is "the fundamental building block of computer graphics". $\frac{[67]}{}$

In 2014, Nvidia ported the <u>Valve</u> games <u>Portal</u> and <u>Half Life 2</u> to its <u>Nvidia Shield tablet</u> as Lightspeed Studio. Since 2014, Nvidia has diversified its business focusing on three markets: gaming, automotive electronics, and mobile devices. [70]

That same year, Nvidia also prevailed in litigation brought by the trustee of 3dfx's bankruptcy estate to challenge its 2000 acquisition of 3dfx's intellectual assets. On November 6, 2014, in an unpublished memorandum order, the <u>U.S. Court of Appeals for the Ninth Circuit</u> affirmed the "district court's judgment affirming the bankruptcy court's determination that [Nvidia] did not pay less than fair market value for assets purchased from 3dfx shortly before 3dfx filed for bankruptcy". [71]

2016-2018

On May 6, 2016, Nvidia unveiled the first GPUs of the <u>GeForce 10 series</u>, the GTX 1080 and 1070, based on the company's new <u>Pascal</u> microarchitecture. Nvidia claimed that both models outperformed its <u>Maxwell</u>-based Titan X model; the models incorporate GDDR5X and <u>GDDR5</u> memory respectively, and use a 16 nm manufacturing process. The architecture also supports a new hardware feature known as simultaneous multi-projection (SMP), which is designed to improve the quality of multi-monitor and <u>virtual reality</u> rendering. [72][73][74] Laptops that include these GPUs and are sufficiently thin – as of late 2017, under 0.8 inches (20 mm) – have been designated as meeting Nvidia's "Max-Q" design standard. [75]

In July 2016, Nvidia agreed to a settlement for a <u>false advertising</u> lawsuit regarding its <u>GTX 970</u> model, as the models were unable to use all of their advertised 4 GB of VRAM due to limitations brought by the design of its hardware. <u>[76]</u> In May 2017, Nvidia announced a partnership with <u>Toyota</u> which will use Nvidia's <u>Drive PX-series</u> artificial intelligence platform for its autonomous vehicles. <u>[77]</u> In July 2017, Nvidia and Chinese search giant <u>Baidu</u> announced a far-reaching AI partnership that includes cloud computing, autonomous driving, consumer devices, and Baidu's open-source AI framework PaddlePaddle. Baidu unveiled that Nvidia's Drive PX 2 AI will be the foundation of its autonomous-vehicle platform. <u>[78]</u>

Nvidia officially released the Titan V on December 7, 2017. [79][80]

Nvidia officially released the Nvidia Quadro GV100 on March 27, 2018. Nvidia officially released the RTX 2080 GPUs on September 27, 2018. In 2018, Google announced that Nvidia's Tesla P4 graphic cards would be integrated into Google Cloud service's artificial intelligence. [82]

In May 2018, on the Nyidia user forum, a thread was started [83] asking the company to update users when they would release web drivers for its cards installed on legacy Mac Pro machines up to mid-2012 5,1 running the macOS Mojave operating system 10.14. Web drivers are required to enable graphics acceleration and multiple display monitor capabilities of the GPU. On its Mojave update info website, Apple stated that macOS Mojave would run on legacy machines with 'Metal compatible' graphics cards^[84] and listed Metal compatible GPUs, including some manufactured by Nyidia.^[85] However, this list did not include Metal compatible cards that currently work in macOS High Sierra using Nvidiadeveloped web drivers. In September, Nvidia responded, "Apple fully controls drivers for macOS. But if Apple allows, our engineers are ready and eager to help Apple deliver great drivers for macOS 10.14 (Moiave)."[86] In October, Nvidia followed this up with another public announcement, "Apple fully controls drivers for macOS. Unfortunately, Nvidia currently cannot release a driver unless it is approved by Apple,"[87] suggesting a possible rift between the two companies.[88] By January 2019, with still no sign of the enabling web drivers, Apple Insider weighed into the controversy with a claim that Apple management "doesn't want Nvidia support in macOS". [89] The following month, Apple Insider followed this up with another claim that Nvidia support was abandoned because of "relational issues in the past", [90] and that Apple was developing its own GPU technology. [91] Without Apple-approved Nvidia web drivers, Apple users are faced with replacing their Nvidia cards with a competing supported brand, such as AMD Radeon from the list recommended by Apple. [92]

2019 acquisition of Mellanox Technologies

On March 11, 2019, Nvidia announced a deal to buy Mellanox Technologies for \$6.9 billion [93] to substantially expand its footprint in the high-performance computing market. In May 2019, Nvidia announced new RTX Studio laptops. The creators say that the new laptop is going to be seven times faster than a top-end MacBook Pro with a Core i9 and AMD's Radeon Pro Vega 20 graphics in apps like Maya and RedCine-X Pro. [94] In August 2019, Nvidia announced Minecraft RTX, an official Nvidia-developed patch for the game Minecraft adding real-time DXR ray tracing exclusively to the Windows 10 version of the game. The whole game is, in Nvidia's words, "refit" with path tracing, which dramatically affects the way light, reflections, and shadows work inside the engine. [95]

In May 2020, Nvidia announced it was acquiring <u>Cumulus</u> <u>Networks</u>. Post acquisition the company was absorbed into Nvidia's networking business unit, along with Mellanox.

In May 2020, Nvidia's developed an <u>open-source ventilator</u> to address the shortage resulting from the global <u>coronavirus pandemic</u>. On May 14, 2020, Nvidia officially announced their Ampere GPU microarchitecture and the Nvidia A100 GPU accelerator. In July 2020, it was reported that Nvidia was in talks with <u>SoftBank</u> to buy <u>Arm</u>, a UK-based chip designer, for \$32 billion.



Nvidia Yokneam office (former Mellanox Technologies) in Yokneam Illit, Israel, March 2023

On September 1, 2020, Nvidia officially announced the <u>GeForce</u> 30 series based on the company's new <u>Ampere microarchitecture</u>. [101][102]

On September 13, 2020, Nvidia announced that they would buy Arm from SoftBank Group for \$40 billion, subject to the usual scrutiny, with the latter retaining a 10% share of Nvidia. [103][104][105][106]

In October 2020, Nvidia announced its plan to build the most powerful computer in <u>Cambridge</u>, England. The computer, called Cambridge-1, launched in July 2021 with a \$100 million investment and will employ AI to support <u>healthcare research</u>. [107][108] According to Jensen Huang, "The Cambridge-1 supercomputer will serve as a hub of innovation for the UK, and further the groundbreaking work being done by the nation's researchers in critical healthcare and drug discovery."[109]



Nvidia GeForce RTX 2080 Ti, part of the <u>RTX 20 series</u>, which is the first generation of Nvidia RTX

Also in October 2020, along with the release of the <u>Nvidia RTX</u> A6000, Nvidia announced it is retiring its workstation GPU brand

Quadro, shifting its product name to Nvidia RTX for future products and the manufacturing to be $\underline{\text{Nvidia}}$ Ampere architecture-based. [9]

In August 2021, the proposed takeover of Arm was stalled after the UK's <u>Competition and Markets Authority</u> raised "significant competition concerns". [110] In October 2021, the <u>European Commission</u> opened a competition investigation into the takeover. The Commission stated that Nvidia's acquisition could restrict competitors' access to Arm's products and provide Nvidia with too much internal information on its competitors due to their deals with Arm. SoftBank (the parent company of Arm) and Nvidia announced in early February 2022 that they "had agreed not to move forward with the transaction because of significant regulatory challenges". [111] The investigation is set to end on March 15, 2022. [112][113] That same month, Nvidia was reportedly compromised by a cyberattack. [114]

In March 2022, Nvidia's CEO Jensen Huang mentioned that they are open to having Intel manufacture their chips in the future. This was the first time the company mentioned that they would work together with Intel's upcoming foundry services.

In April 2022, it was reported that Nvidia planned to open a new research center in $\underline{\text{Yerevan}}$, Armenia. [116]

In May 2022, Nvidia opened Voyager, the second of the two giant buildings at its new headquarters complex to the west of the old one. Unlike its smaller and older sibling Endeavor, the triangle theming is used more "sparingly" in Voyager. [117][118]

In September 2022, Nvidia announced its next-generation automotive-grade chip, Drive Thor. [119][120]

In September 2022, Nvidia announced a collaboration with the <u>Broad Institute of MIT and Harvard</u> related to the entire suite of Nvidia's <u>AI</u>-powered <u>healthcare software</u> suite called Clara, that includes Parabricks and MONAI. [121]

Following <u>U.S.</u> Department of Commerce regulations which placed an <u>embargo on exports to China</u> of advanced microchips, which went into effect in October 2022, Nvidia saw its data center chip added to the export control list. The next month, the company unveiled a new advanced chip in China, called the A800 GPU, that met the export control rules. [122]

In September 2023, <u>Getty Images</u> announced that it was partnering with Nvidia to launch Generative AI by Getty Images, a new tool that lets people create images using Getty's library of licensed photos. Getty will use Nvidia's Edify model, which is available on Nvidia's generative AI model library Picasso. [123]

On September 26, 2023, Denny's CEO Kelli Valade joined Huang in East San Jose to celebrate the founding of Nvidia at Denny's on Berryessa Road, where a plaque was installed to mark the relevant corner booth as the birthplace of a \$1 trillion company. By then, Nvidia's H100 GPUs were in such demand that even other tech giants were beholden to how Nvidia allocated supply. Larry Ellison of Oracle Corporation said that month that during a dinner with Huang at Nobu in Palo Alto, he and Elon Musk of Tesla, Inc. and xAI "were begging" for H100s, "I guess is the best way to describe it. An hour of sushi and begging". [125]

In October 2023, it was reported that Nvidia had quietly begun designing <u>ARM-based</u> central processing units (CPUs) for Microsoft's Windows operating system with a target to start selling them in 2025. [126]

2024

In January 2024, *Forbes* reported that Nvidia has increased its lobbying presence in <u>Washington, D.C.</u> as American lawmakers consider proposals to <u>regulate artificial intelligence</u>. From 2023 to 2024, the company reportedly hired at least four government affairs with professional backgrounds at agencies including the <u>United States Department of State</u> and the <u>Department of the Treasury</u>. It was noted that the \$350,000 spent by the company on lobbying in 2023 was small compared to a number of major tech companies in the artificial intelligence space. [127]

As of January 2024, <u>Raymond James Financial</u> analysts estimated that Nvidia was selling the H100 GPU in the price range of \$25,000 to \$30,000 each, while on <u>eBay</u>, individual H100s cost over \$40,000. Tech giants were purchasing tens or hundreds of thousands of GPUs for their data centers to run <u>generative artificial intelligence</u> projects; simple arithmetic implied that they were committing to billions of dollars in <u>capital expenditures</u>.

In February 2024, it was reported that Nvidia was the "hot employer" in Silicon Valley because it was offering interesting work and good pay at a time when other tech employers were downsizing. Half of Nvidia employees earned over \$228,000 in 2023. [129] By then, Nvidia GPUs had become so valuable that

they needed special security while in transit to data centers. <u>Cisco</u> chief information officer Fletcher Previn explained at a CIO summit: "Those GPUs arrive by armored car". [130]

On March 1, 2024, Nvidia became the third company in the history of the United States to close with a market capitalization in excess of \$2 trillion. Nvidia needed only 180 days to get to \$2 trillion from \$1 trillion, while the first two companies, Apple and Microsoft, each took over 500 days. On March 18, Nvidia announced its new AI chip and microarchitecture Blackwell, named after mathematician David Blackwell.

In April 2024, Reuters reported that China had allegedly acquired banned Nvidia chips and servers from Supermicro and Dell via tenders. [132]

In June 2024, the Federal Trade Commission (FTC) and the Justice Department (DOJ) began antitrust investigations into Nvidia, Microsoft and OpenAI, focusing on their influence in the AI industry. The FTC led the investigations into Microsoft and OpenAI, while the DOJ handled Nvidia. The probes centered on the companies' conduct rather than mergers. This development followed an open letter from OpenAI employees expressing concerns about the rapid AI advancements and lack of oversight. [133]



PNY Nvidia Quadro P1000

The company became the world's most valuable, surpassing Microsoft and Apple, on June 18, 2024, after its market capitalization exceeded \$3.3 trillion. [134] [135]

In June 2024, <u>Trend Micro</u> announced a partnership with Nvidia to develop AI-driven security tools, notably to protect the data centers where AI workloads are processed. This collaboration integrates Nvidia NIM and Nvidia Morpheus with Trend Vision One and its Sovereign and Private Cloud solutions to improve data privacy, real-time analysis, and rapid threat mitigation. [136]

Nvidia introduced a family of open-source <u>multimodal large language models</u> in October 2024 called NVLM 1.0, which features a flagship version with 72 billion <u>parameters</u>, designed to improve text-only performance after multimodal training. [137][138]

In November 2024, the company was added to the Dow Jones Industrial Average. <a href="[139][140]

In November 2024, <u>Morgan Stanley</u> reported that "the entire 2025 production" of all of Nvidia's Blackwell chips was "already sold out". [141]

Also in November 2024, the company made an investment in Nebius Group. [142][143]

Fabless manufacturing

Nvidia <u>uses external suppliers for all phases of manufacturing</u>, including wafer fabrication, assembly, testing, and packaging. Nvidia thus avoids most of the investment and production costs and risks associated with chip manufacturing, although it does sometimes directly procure some components and materials used in the production of its products (e.g., memory and substrates). Nvidia focuses its own resources on product design, quality assurance, marketing, and customer support. [144][145]

Corporate affairs

Leadership

Nvidia's key management as of March 2024 consists of: [147]

- Jensen Huang, founder, president and chief executive officer
- Chris Malachowsky, founder and Nvidia fellow
- Colette Kress, executive vice president and chief financial officer
- Jay Puri, executive vice president of worldwide field operations
- Debora Shoquist, executive vice president of operations
- Tim Teter, executive vice president, general counsel and secretary

Sales by business unit (2023)^[146]

Business unit	Sales (billion \$)	Share
Compute & networking	47.4	77.8%
Graphics	13.5	22.2%

Sales by region (2023)[146]

, , ,				
Sales (billion \$)	Share			
27.0	44.3%			
13.4	22.0%			
10.3	16.9%			
10.2	16.8%			
	27.0 13.4 10.3			

Board of directors

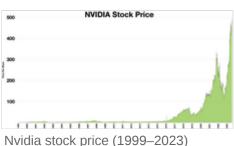
As of November 2024, the company's board consisted of the following directors: [148]

- Rob Burgess (former chief executive officer of Macromedia Inc.)
- Tench Coxe (former managing director of Sutter Hill Ventures)
- John Dabiri (engineer and professor at the California Institute of Technology)
- Persis Drell (physicist and professor at Stanford University)
- Jensen Huang (co-founder, CEO and president of Nvidia)
- Dawn Hudson (former Chief Marketing Officer of the National Football League)
- Harvey C. Jones (managing partner of Square Wave Ventures)
- Melissa B. Lora (former president of Taco Bell International)
- <u>Stephen Neal</u> (lead independent director of Nvidia, former CEO and Chairman Emeritus and Senior Counsel of Cooley LLP)
- Ellen Ochoa (former director of NASA Johnson Space Center)
- Brooke Seawell (venture partner at New Enterprise Associates)
- Aarti Shah (former Senior Vice President & Chief Information and Digital Officer at Eli Lilly and Company)
- Mark Stevens (managing Partner at S-Cubed Capital)

Finances

For the fiscal year 2020, Nvidia reported earnings of US\$2.796 billion, with an annual revenue of US\$10.918 billion, a decline of 6.8% over the previous fiscal cycle. Nvidia's shares traded at over \$531 per share, and its market capitalization was valued at over US\$328.7 billion in January 2021. As of late Q3 2024, Nvidia's market cap is around US\$2.98 trillion. [149][150]

For the Q2 of 2020, Nvidia reported sales of \$3.87 billion, which was a 50% rise from the same period in 2019. The surge in sales and people's higher demand for computer technology. According to the financial chief of the company, Colette Kress, the effects of the pandemic will "likely reflect this evolution in enterprise workforce trends with a greater focus on technologies, such as Nvidia laptops and virtual workstations, that enable remote work and virtual collaboration."[151] In May 2023, Nvidia crossed \$1 trillion in market valuation during trading hours, [152] and grew to \$1.2 trillion by the following November. [153] For its strength, size and market capitalization, Nvidia has been selected to be one of Bloomberg's "Magnificent Seven", the seven biggest companies on the stock market in these regards.



10-year financials (2014-2023)

Year	Revenue (mil. US\$)	Net income (mil. US\$)	Employees
2014	4,682	631	6,384
2015	5,010	614	9,227
2016	6,910	1,666	10,299
2017	9,714	3,047	11,528
2018	11,716	4,141	13,277
2019	10,918	2,796	13,775
2020	16,675	4,332	18,975
2021	26,914	9,752	22,473
2022	26,974	4,368	26,000
2023	60,922	29,760	29,600

Ownership

The 10 largest shareholders of Nyidia in early 2024 were: $\frac{[146]}{}$

- The Vanguard Group (8.280%)
- BlackRock (5.623%)
- Fidelity Investments (5.161%)
- State Street Corporation (3.711%)
- Jensen Huang (3.507%)
- Geode Capital Management (2.024%)
- T. Rowe Price (2.013%)
- JPMorgan Chase (1.417%)
- BlackRock Life (1.409%)
- Eaton Vance (1.337%)

GPU Technology Conference

Nvidia's GPU Technology Conference (GTC) is a series of technical conferences held around the world. $\frac{[154]}{}$ It originated in 2009 in San Jose, California, with an initial focus on the potential for solving computing challenges through GPUs. [155] In recent years, the conference's focus has shifted to various applications of artificial intelligence and deep learning; including self-driving cars, healthcare, highperformance computing, and Nvidia Deep Learning Institute (DLI) training. [156] GTC 2018 attracted over 8400 attendees. [154] GTC 2020 was converted to a digital event and drew roughly 59,000 registrants. [157] After several years of remote-only events, GTC in March 2024 returned to an in-person format in San Jose, California. [158]

Product families

Nvidia's product families include graphics processing units, wireless communication devices, and automotive hardware and software, such as:

- GeForce, consumer-oriented graphics processing products
- RTX, professional visual computing graphics processing products (replacing GTX and Quadro)
- NVS, a multi-display business graphics processor
- Tegra, a system on a chip series for mobile devices
- Tesla, line of dedicated general-purpose GPUs for highend image generation applications in professional and scientific fields



A <u>Shield Tablet</u> with its accompanying input pen (left) and gamepad

- <u>nForce</u>, a motherboard chipset created by Nvidia for Intel (Celeron, Pentium and Core 2) and AMD (Athlon and Duron) microprocessors
- GRID, a set of hardware and services by Nvidia for graphics virtualization
- Shield, a range of gaming hardware including the <u>Shield Portable</u>, <u>Shield Tablet</u> and <u>Shield</u>
 TV
- <u>Drive</u>, a range of hardware and software products for designers and manufacturers of autonomous vehicles. The <u>Drive PX-series</u> is a high-performance computer platform aimed at autonomous driving through deep learning, [159] while Driveworks is an operating system for driverless cars. [160]
- BlueField, a range of data processing units, initially inherited from their acquisition of Mellanox Technologies^{[161][162]}
- Datacenter/server class CPU, codenamed Grace, released in 2023^{[163][164]}
- DGX, an enterprise platform designed for deep learning applications
- Maxine, a platform providing developers a suite of AI-based conferencing software [165]

Open-source software support

Until September 23, 2013, Nvidia had not published any documentation for its advanced hardware, meaning that programmers could not write free and open-source device driver for its products without resorting to reverse engineering.

Instead, Nvidia provides its own <u>binary</u> GeForce graphics drivers for <u>X.Org</u> and an open-source library that interfaces with the <u>Linux</u>, <u>FreeBSD</u> or <u>Solaris</u> kernels and the <u>proprietary</u> graphics software. Nvidia also provided but stopped supporting an obfuscated open-source driver that only supports two-dimensional hardware acceleration and ships with the X.Org distribution. [167]

The proprietary nature of Nvidia's drivers has generated dissatisfaction within <u>free-software communities</u>. In a 2012 talk, <u>Linus Torvalds</u>, in criticism of Nvidia's approach towards Linux, raised <u>the finger</u> and stated "Nvidia, <u>fuck</u> you." Some Linux and BSD users insist on using only open-source drivers and regard Nvidia's insistence on providing nothing more than a binary-only driver as inadequate, given that competing manufacturers such as <u>Intel</u> offer support and documentation for <u>open-source</u> developers and that others (like AMD) release partial documentation and provide some active development. [170][171]

Nvidia only provides x86/x64 and ARMv7-A versions of their proprietary driver; as a result, features like $\underline{\text{CUDA}}$ are unavailable on other platforms. Some users claim that Nvidia's Linux drivers impose artificial restrictions, like limiting the number of monitors that can be used at the same time, but the company has not commented on these accusations. [173]

In 2014, with Maxwell GPUs, Nvidia started to require firmware by them to unlock all features of its graphics cards. [174][175][176]

On May 12, 2022, Nvidia announced that they are opensourcing their GPU kernel modules. [177][178][179] Support for Nvidia's firmware was implemented in nouveau in 2023, which allows proper power management and GPU reclocking for Turing and newer graphics card generations. [180][181]

Deep learning

Nvidia GPUs are used in <u>deep learning</u>, and accelerated analytics due to Nvidia's <u>CUDA</u> software platform and API which allows programmers to utilize the higher number of cores present in GPUs to <u>parallelize BLAS</u> operations which are extensively used in <u>machine learning</u> algorithms. They were included in many Tesla, Inc. vehicles before Musk announced at Tesla Autonomy Day in 2019 that the company developed its own SoC and full self-driving computer now and would stop using Nvidia hardware for their vehicles. These GPUs are used by researchers, laboratories, tech companies and enterprise companies. In 2009, Nvidia was involved in what was called the "big bang" of deep learning, "as deep-learning neural networks were combined with Nvidia graphics processing units (GPUs)". That year, the <u>Google Brain</u> team used Nvidia GPUs to create <u>deep neural networks</u> capable of machine learning, where <u>Andrew Ng</u> determined that GPUs could increase the speed of deep learning systems by about 100 times.

DGX

DGX is a line of supercomputers by Nvidia.

In April 2016, Nvidia produced the <u>DGX-1</u> based on an 8 GPU cluster, to improve the ability of users to use deep learning by combining GPUs with integrated deep learning software. Nvidia gifted its first DGX-1 to <u>OpenAI</u> in August 2016 to help it train larger and more complex AI models with the capability of reducing processing time from six days to two hours. It also developed Nvidia Tesla K80 and P100 GPU-based virtual machines, which are available through <u>Google Cloud</u>, which Google installed in November 2016. Microsoft added GPU servers in a preview offering of its N series based on Nvidia's Tesla K80s, each containing 4992 processing cores. Later that year, AWS's P2 instance was produced using up to 16 Nvidia Tesla K80 GPUs. That month Nvidia also partnered with IBM to create a software kit that boosts the AI capabilities of <u>Watson</u>, 1911 called IBM PowerAI. PowerAI. Nvidia also offers its own

Nvidia Deep Learning software development kit. In 2017, the GPUs were also brought online at the Riken Center for Advanced Intelligence Project for Fujitsu. The company's deep learning technology led to a boost in its 2017 earnings.

In May 2018, researchers at the artificial intelligence department of Nvidia realized the possibility that a robot can learn to perform a job simply by observing the person doing the same job. They have created a system that, after a short revision and testing, can already be used to control the universal robots of the next generation. In addition to GPU manufacturing, Nvidia provides parallel processing capabilities to researchers and scientists that allow them to efficiently run high-performance applications. [197]

Robotics

In 2020, Nvidia unveiled "<u>Omniverse</u>", a virtual environment designed for engineers. Nvidia also open-sourced Isaac Sim, which makes use of this Omniverse to train robots through simulations that mimic the physics of the robots and the real world. [199][200]

In 2024, Huang oriented Nvidia's focus towards <u>humanoid robots</u> and <u>self-driving cars</u>, which he expects to gain widespread adoption. [201][202]

Inception Program

Nvidia's **Inception Program** was created to support startups making exceptional advances in the fields of artificial intelligence and data science. Award winners are announced at Nvidia's GTC Conference. In May 2017, the program had 1,300 companies. [203] As of March 2018, there were 2,800 startups in the Inception Program. [204] As of August 2021, the program has surpassed 8,500 members in 90 countries, with cumulative funding of US\$60 billion. [205]

Controversies

Maxwell advertising dispute

GTX 970 hardware specifications

Issues with the GeForce GTX 970's specifications were first brought up by users when they found out that the cards, while featuring 4 GB of memory, rarely accessed memory over the 3.5 GB boundary. Further testing and investigation eventually led to Nvidia issuing a statement that the card's initially announced specifications had been altered without notice before the card was made commercially available, and that the card took a performance hit once memory over the 3.5 GB limit were put into use. [206][207][208]

The card's back-end hardware specifications, initially announced as being identical to those of the GeForce GTX 980, differed in the amount of L2 cache (1.75 MB versus 2 MB in the GeForce GTX 980) and the number of ROPs (56 versus 64 in the 980). Additionally, it was revealed that the card was designed to access its memory as a 3.5 GB section, plus a 0.5 GB one, access to the latter being 7 times

slower than the first one. [209] The company then went on to promise a specific driver modification in order to alleviate the performance issues produced by the cutbacks suffered by the card. [210] However, Nvidia later clarified that the promise had been a miscommunication and there would be no specific driver update for the GTX 970. [211] Nvidia claimed that it would assist customers who wanted refunds in obtaining them. [212] On February 26, 2015, Nvidia CEO Jen-Hsun Huang went on record in Nvidia's official blog to apologize for the incident. [213] In February 2015 a class-action lawsuit alleging false advertising was filed against Nvidia and Gigabyte Technology in the U.S. District Court for Northern California. [214][215]

Nvidia revealed that it is able to disable individual units, each containing 256 KB of L2 cache and 8 ROPs, without disabling whole memory controllers. This comes at the cost of dividing the memory bus into high speed and low speed segments that cannot be accessed at the same time unless one segment is reading while the other segment is writing because the L2/ROP unit managing both of the GDDR5 controllers shares the read return channel and the write data bus between the two GDDR5 controllers and itself. This is used in the GeForce GTX 970, which therefore can be described as having 3.5 GB in its high speed segment on a 224-bit bus and 0.5 GB in a low speed segment on a 32-bit bus. [216]

On July 27, 2016, Nvidia agreed to a preliminary settlement of the U.S. class action lawsuit, $\frac{[214]}{}$ offering a \$30 refund on GTX 970 purchases. The agreed upon refund represents the portion of the cost of the storage and performance capabilities the consumers assumed they were obtaining when they purchased the card. $\frac{[217]}{}$

GeForce Partner Program

The Nvidia GeForce Partner Program was a <u>marketing</u> program designed to provide partnering companies with benefits such as public relations support, <u>video game bundling</u>, and marketing development funds. [218] The program proved to be controversial, with complaints about it possibly being an <u>anti-competitive</u> practice. [219]

First announced in a blog post on March 1, 2018, [220] it was canceled on May 4, 2018. [221]

Hardware Unboxed

On December 10, 2020, Nvidia told <u>YouTube</u> tech reviewer Steven Walton of Hardware Unboxed that it would no longer supply him with GeForce Founders Edition graphics card review units. [222][223] In a Twitter message, Hardware Unboxed said, "Nvidia have officially decided to ban us from receiving GeForce Founders Edition GPU review samples. Their reasoning is that we are focusing on rasterization instead of ray tracing. They have said they will revisit this 'should your editorial direction change.'"[224]

In emails that were disclosed by Walton from Nvidia Senior PR Manager Bryan Del Rizzo, Nvidia had said:

...your GPU reviews and recommendations have continued to focus singularly on rasterization performance, and you have largely discounted all of the other technologies we offer gamers. It is very clear from your community commentary that you do not see things the same way that we, gamers, and the rest of the industry do. [225]

TechSpot, partner site of Hardware Unboxed, said, "this and other related incidents raise serious questions around journalistic independence and what they are expecting of reviewers when they are sent products for an unbiased opinion." [225]

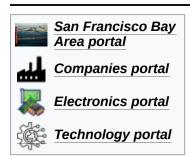
A number of technology reviewers came out strongly against Nvidia's move. Linus Sebastian, of Linus Tech Tips, titled the episode of his weekly WAN Show, "NVIDIA might ACTUALLY be EVIL..." and was highly critical of the company's move to dictate specific outcomes of technology reviews. The review site Gamers Nexus said it was, "Nvidia's latest decision to shoot both its feet: They've now made it so that any reviewers covering RT will become subject to scrutiny from untrusting viewers who will suspect subversion by the company. Shortsighted self-own from NVIDIA." [230]

Two days later, Nvidia reversed their stance. [231][232] Hardware Unboxed sent out a Twitter message, "I just received an email from Nvidia apologizing for the previous email & they've now walked everything back." [233][226] On December 14, Hardware Unboxed released a video explaining the controversy from their viewpoint. [234] Via Twitter, they also shared a second apology sent by Nvidia's Del Rizzo that said "to withhold samples because I didn't agree with your commentary is simply inexcusable and crossed the line." [235][236]

Improper disclosures about cryptomining

In 2018, Nvidia's chips became popular for <u>cryptomining</u>, the process of obtaining crypto rewards in exchange for verifying transactions on distributed ledgers, the <u>U.S. Securities and Exchange Commission</u> (SEC) said. However, the company failed to disclose that it was a "significant element" of its revenue growth from sales of chips designed for gaming, the SEC further added in a statement and charging order. Those omissions misled investors and analysts who were interested in understanding the impact of cryptomining on Nvidia's business, the SEC emphasized. Nvidia, which did not admit or deny the findings, has agreed to pay \$5.5 million to settle civil charges, according to a statement made by the SEC in May 2022. [237]

See also



- Fast approximate anti-aliasing
- General-purpose computing on graphics processing units
- Huang's law
- Molecular modeling on GPUs
- GPU workstations
- Groq

Notes

a. Officially written as **NVIDIA** and stylized in its logo as **NVIDIA** with the lowercase "n" the same height as the uppercase "VIDIA"; formerly stylized as **NVIDIA** with a large italicized lowercase "n" on products from the mid 1990s to early-mid 2000s. [3] Though unofficial, second letter capitalization of **NVIDIA**, i.e. **nVidia**, may be found within enthusiast communities and publications. [4]

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External links

- Official website (https://www.nvidia.com/)
- Nvidia Developer website (https://developer.nvidia.com/)
- Business data for Nvidia: Bloomberg (https://www.bloomberg.com/quote/NVDA:US) Google (https://www.google.com/finance/quote/NVDA:NASDAQ) Reuters (https://www.reuters.com/markets/companies/NVDA.O) SEC filings (https://www.sec.gov/cgi-bin/browse-edgar?action=getcompany&CIK=1045810) Yahoo! (https://finance.yahoo.com/quote/NVDA)

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