Nvidia

Nvidia Corporation[note 1][note 2] (/ɛnˈvɪdiə/, *en-VID-ee-ə*) is an American multinational corporation and technology company headquartered in Santa Clara, California, and incorporated in Delaware.[3] 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 the mobile computing and automotive market. Nvidia is also a dominant supplier of artificial intelligence (AI) hardware and software.[4][5][6]

Nvidia's professional line of GPUs are used for edge-to-cloud computing and in supercomputers and workstations for applications in such fields as architecture, engineering and construction, media and entertainment, automotive, scientific research, and manufacturing design.[7] 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. In the second quarter of 2023, Nvidia had a market share of 80.2% in the discrete desktop GPU market.[8] 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.[9]

In addition to GPU design and manufacturing, Nvidia provides the CUDA software platform and API that allows the creation of massively parallel programs which utilize GPUs.[10][11] They are deployed in supercomputing sites around the world.[12][13] In the late 2000s, Nvidia had moved into the mobile computing market, where it produces Tegra mobile processors for smartphones and tablets as well as vehicle navigation and entertainment systems.[14][15][16] Its competitors include AMD, Intel,[17] Qualcomm[18] and AI accelerator companies such as Cerebras and Graphcore. It also makes AI-powered software for audio and video processing, e.g. Nvidia Maxine.[19]

Nvidia Corporation

Headquarters at Santa Clara in 2023

Trade name	NVIDIA
Company type	Public
Traded as	Nasdaq: NVDA (https://www.nasdaq.com/market-activity/stocks/nvda) Nasdaq-100 component S&P 100 component S&P 500 component
Industry	Computer hardware Computer software Cloud computing Semiconductors Artificial intelligence GPUs Graphics cards Consumer electronics Video games
Founded	April 5, 1993 in Sunnyvale, California, U.S.
Founders	Jensen Huang Curtis Priem Chris Malachowsky
Headquarters	Santa Clara, California, U.S.
Area served	Worldwide

Nvidia's offer to acquire Arm from SoftBank 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.[20][21] In 2023, Nvidia became the seventh public U.S. company to be valued at over $1 trillion,[22] and, as of March 2024, it is the world's third most-valuable company after Microsoft and Apple, with a market capitalization of over $2 trillion.[23]

Key people	Jensen Huang (President and CEO) Bill Dally (Chief scientist)
Products	Graphics processing units Central processing units Chipsets Drivers Collaborative software Tablet computers TV accessories GPU chips for laptops Data processing units
Revenue	▲ US$60.92 billion (FY 2024)
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

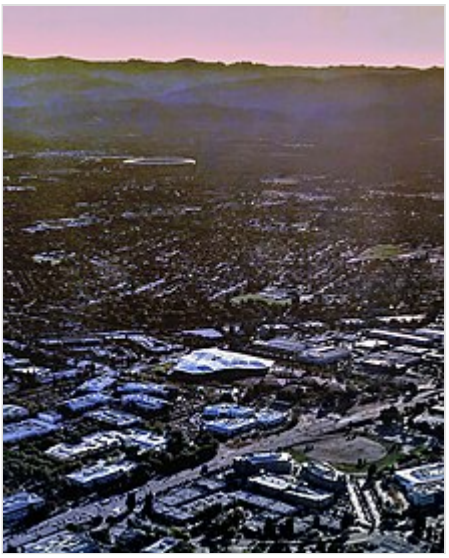
Nvidia was founded on April 5, 1993,[24][25][26] by Jensen Huang (CEO as of 2024), a Taiwanese-American electrical engineer who was previously the director of CoreWare at LSI Logic and a microprocessor designer at AMD; Chris Malachowsky, an engineer who worked at Sun Microsystems; and Curtis Priem, who was previously a senior staff engineer and graphics chip designer at IBM and Sun Microsystems.[27][28] The three men founded the company in a meeting at a Denny's roadside diner in East San Jose (just off Interstate 680 at the Berryessa Road interchange).[29][30]

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.[31] They also observed that video games were simultaneously one of the most computationally challenging problems and would have incredibly high sales volume; the two conditions do not happen very often.[31] Video games became the company's flywheel to reach large markets and fund huge R&D to solve massive computational problems.[31] With $40,000 in the bank, the company was born.[31] The company subsequently received $20 million of venture capital funding from Sequoia Capital and others.[32]

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

Nvidia initially had no name and the co-founders named all their files NV, as in "next version".[31] The need to incorporate the company prompted the co-founders to review all words with those

two letters, leading them to "invidia", the Latin word for "envy".[31] The company's original headquarters office was in Sunnyvale, California.[31]



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.

First graphics accelerator

Nvidia's first graphics accelerator product, the NV1, was optimized for processing quadratic primitives instead of the triangle primitives preferred by its competitors.[30] Then Microsoft introduced the DirectX platform, refused to support any other graphics software,[33] and also announced that its graphics software (Direct3D) would support only triangles.[30] 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.[30][33] By the time the RIVA 128 was released in August 1997, Nvidia only had enough money left for about one month of payroll.[30] The sense of 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".[30] Nvidia sold about a million RIVA 128s in about four months[30] and used the revenue to develop its next generation of products.[33] In 1998, the release of the RIVA TNT solidified Nvidia's reputation for developing capable graphics adapters.

Entrance of Endeavor headquarters building in 2018

Public company

Nvidia went public on January 22, 1999.[34][35][36]

In late 1999, Nvidia released the GeForce 256 (NV10), its first product expressly marketed as a GPU, which was most notable for introducing onboard transformation and lighting (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.[37][38] The acquisition process was finalized in April 2002.[39]

In 2001, Standard & Poor's selected Nvidia to replace the departing Enron in the S&P 500 stock index, meaning that index funds would need to hold Nvidia shares going forward.[40]

In July 2002, Nvidia acquired Exluna for an undisclosed sum. Exluna made software-rendering tools and the personnel were merged into the Cg project.[41] In August 2003, Nvidia acquired MediaQ for approximately US$70 million.[42] On April 22, 2004, Nvidia acquired iReady, also a provider of high-performance TCP/IP and iSCSI offload solutions.[43] In December 2004, it was announced that Nvidia would assist Sony with the design of the graphics processor (RSX) in 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.[44] In March 2006, Nvidia acquired Hybrid Graphics.[45] 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.[46]

2007–2014

Forbes 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.[47] On January 5, 2007, Nvidia announced that it had completed the acquisition of PortalPlayer, Inc.[48] In February 2008, Nvidia acquired Ageia, developer of PhysX, a physics engine and physics processing unit. Nvidia announced that it planned to integrate the PhysX technology into its future GPU products.[49][50]

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.[51][52] On January 10, 2011, Nvidia signed a six-year, $1.5 billion cross-licensing agreement with Intel, ending all litigation between the two companies.[53]

In November 2011, after initially unveiling it at Mobile World Congress, Nvidia released its Tegra 3 ARM system on a chip for mobile devices. Nvidia claimed that the chip featured the first-ever quad-core mobile CPU.[54][55] In May 2011, it was announced that Nvidia had agreed to acquire Icera, a baseband chip making company in the UK, for $367 million.[56] 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.[57] On July 29, 2013, Nvidia announced that they acquired PGI from STMicroelectronics.[58]

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".[59]

In 2014, Nvidia ported the Valve games *Portal* and *Half Life 2* to its Nvidia Shield tablet as Lightspeed Studio.[60][61] Since 2014, Nvidia has diversified its business focusing on three markets: gaming, automotive electronics, and mobile devices.[62]

2016–2018

Nvidia Titan X, part of the GeForce 10 series

On May 6, 2016, Nvidia unveiled the first GPUs of the GeForce 10 series, the GTX 1080 and 1070, based on the company's new Pascal microarchitecture. Nvidia claimed that both models outperformed its Maxwell-based Titan X model; the models incorporate GDDR5X and GDDR5 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 virtual reality rendering.[63][64][65] 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.[66]

In July 2016, Nvidia agreed to a settlement for a false advertising lawsuit regarding its GTX 970 model, as the models were unable to use all of their advertised 4 GB of RAM due to limitations brought by the design of its hardware.[67] In May 2017, Nvidia announced a partnership with Toyota which will use Nvidia's Drive PX-series artificial intelligence platform for its autonomous vehicles.[68] In July 2017, Nvidia and Chinese search giant Baidu 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.[69]

Nvidia officially released the Titan V on December 7, 2017.[70][71]

Nvidia officially released the Nvidia Quadro GV100 on March 27, 2018.[72] 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.[73]

In May 2018, on the Nvidia user forum, a thread was started[74] 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[75] and listed Metal compatible GPUs, including some manufactured by Nvidia.[76] However, this list did not include Metal compatible cards that currently work in macOS High Sierra using Nvidia-developed 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 (Mojave)."[77] 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,"[78] suggesting a possible rift between the two companies.[79] 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".[80] The following month, Apple Insider followed this up with another claim that Nvidia support was abandoned because of "relational issues in the past",[81] and that Apple was developing its own GPU technology.[82] 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.[83]

2019–acquisition of Mellanox Technologies

On March 11, 2019, Nvidia announced a deal to buy Mellanox Technologies for $6.9 billion[84] 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.[85] 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.[86]

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

2020–2023

In May 2020, Nvidia's top scientists developed an open-source ventilator to address the shortage resulting from the global coronavirus pandemic.[87] On May 14, 2020, Nvidia officially announced their Ampere GPU microarchitecture and the Nvidia A100 GPU accelerator.[88][89] In July 2020, it was reported that Nvidia was in talks with SoftBank to buy Arm, a UK-based chip designer, for $32 billion.[90]

On September 1, 2020, Nvidia officially announced the GeForce 30 series based on the company's new Ampere microarchitecture.[91][92]

On September 13, 2020, it was announced that Nvidia would buy Arm from SoftBank Group for $40 billion, subject to the usual scrutiny, with the latter retaining a 10% share of Nvidia.[93][94][95][96]

In October 2020, Nvidia announced its plan to build the most powerful computer in Cambridge, England. The computer, called Cambridge-1, launched in July 2021 with a $100 million investment and will employ AI to support healthcare research.[97][98] 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."[99]

Also in October 2020, along with the release of the Nvidia RTX 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 Nvidia Ampere architecture-based.[7]

In August 2021, the proposed takeover of Arm was stalled after the UK's Competition and Markets Authority raised "significant competition concerns".[100] In October 2021, the European Commission 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'".[101] The investigation is set to end on March 15, 2022.[102][103] That same month, Nvidia was reportedly compromised by a cyberattack.[104]

In March 2022, Nvidia's CEO Jensen Huang mentioned that they are open to having Intel manufacture their chips in the future.[105] 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 Yerevan, Armenia.[106]

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.[107][108]

In September 2022, Nvidia announced its next-generation automotive-grade chip, Drive Thor.[109][110]

Following U.S. Department of Commerce regulations which placed an embargo on exports to China 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.[111]

In September 2023, Getty Images 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.[112]

2023–present, passing the $1 trillion mark

On September 26, 2023, Denny's CEO Kelli Valade joined Huang in East San Jose to celebrate the founding of Nvidia at the Denny's on Berryessa Road, where a plaque was installed to mark the relevant corner booth as the birthplace of a $1 trillion company.[30][113] 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, 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".[114]

In October 2023, it was reported that Nvidia had quietly begun designing ARM-based central processing units (CPUs) for Microsoft's Windows operating system with a target to start selling them in 2025.[115]

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.[116] Nvidia has had its highest market capitalization on March 8, 2024, with $2.38 trillion, just $230 billion behind Apple Inc. and $645 billion behind Microsoft.[117]

On March 1, 2024, Nvidia became the third company in the history of the United States to close with market capitalization in excess of $2 trillion.[40] 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.[40]

Fabless manufacturing

Nvidia uses external suppliers for all phases of manufacturing, 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.[118][119]

Corporate affairs

Sales by business unit (2023)[120]

Business unit	Sales in billion $	share
Compute & Networking	47.4	77.8%
Other countries	13.5	22.2%

Sales by region (2023)[120]

Region	Sales in billion $	share
United States	27.0	44.3%
Taiwan	13.4	22.0%
China	10.3	16.9%
Other countries	10.2	16.8%

Leadership

Nvidia's key management as of early 2024 consists of:[121]

- 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

Board of directors

As of March 2024, Nvidias board consisted of the following directors:[122]

- 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 Massachusetts 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)
- Michael G. McCaffery (Chairman at Makena Capital Management)
- Stephen Neal (former CEO and Chairman Emeritus and Senior Counsel of Cooley LLP)
- Mark L. Perry (independent consultant)
- 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.[123]

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."[124] In May 2023, Nvidia crossed $1 trillion in market valuation during trading hours,[125] and grew to $1.2 trillion by the following November.[126] 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.

Nvidia stock price (1999–2023)

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 shareholder of Nvidia in early 2024 were:[120]

- 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.[127] It originated in 2009 in San Jose, California, with an initial focus on the potential for solving computing challenges through GPUs.[128] In recent years, the conference focus has shifted to various applications of artificial intelligence and deep learning; including self-driving cars, healthcare, high-performance computing, and Nvidia Deep Learning Institute (DLI) training.[129] GTC 2018 attracted over 8400 attendees.[127] GTC 2020 was converted to a digital event and drew roughly 59,000 registrants.[130]

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

- Nvidia RTX, professional visual computing graphics processing products (replacing GTX and Quadro)
- NVS, multi-display business graphics solution
- Tegra, a system on a chip series for mobile devices
- Tesla, dedicated general-purpose GPU for high-end image generation applications in professional and scientific fields
- nForce, a motherboard chipset created by Nvidia for Intel (Celeron, Pentium and Core 2) and AMD (Athlon and Duron) microprocessors
- Nvidia GRID, a set of hardware and services by Nvidia for graphics virtualization
- Nvidia Shield, a range of gaming hardware including the Shield Portable, Shield Tablet and, most recently, the Shield Android TV
- Nvidia Drive, a range of hardware and software products for designers and manufacturers of autonomous vehicles. The Drive PX-series is a high-performance computer platform aimed at autonomous driving through deep learning,[131] while Driveworks is an operating system for driverless cars.[132]
- Nvidia BlueField, a range of data processing units, initially inherited from their acquisition of Mellanox Technologies[133][134]
- Nvidia Datacenter/Server class CPU, codenamed Nvidia Grace, released in 2023[135][136]

A Shield Tablet with its accompanying input pen (left) and gamepad

Open-source software support

Until September 23, 2013, Nvidia had not published any documentation for its advanced hardware,[137] meaning that programmers could not write free and open-source device driver for its products without resorting to (clean room) reverse engineering.

Instead, Nvidia provides its own binary GeForce graphics drivers for X.Org and an open-source library that interfaces with the Linux, FreeBSD or Solaris kernels and the proprietary 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.[138]

The proprietary nature of Nvidia's drivers has generated dissatisfaction within free-software communities. In a 2012 talk, Linus Torvalds, in criticism of Nvidia's approach towards Linux, raised the finger and stated "Nvidia, fuck you."[139][140] 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 Intel offer support and documentation for open-source developers and that others (like AMD) release partial documentation and provide some active development.[141][142]

Because of the closed nature of the drivers, Nvidia video cards cannot deliver adequate features on some platforms and architectures, given that the company only provides x86/x64 and ARMv7-A driver builds.[143] As a result, support for 3D graphics acceleration in Linux on PowerPC does not exist, nor does support for Linux on the hypervisor-restricted PlayStation 3 console.

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.[144]

In 2014, with Maxwell GPUs, Nvidia started to require firmware by them to unlock all features of its graphics cards.[145][146][147]

On 12 May 2022, Nvidia announced that they are opensourcing their GPU kernel modules.[148][149][150] Support for Nvidia's firmware was implemented in nouveau in 2023, which allows proper power management and GPU reclocking for Turing and newer graphics cards.[151][152]

Deep learning

Nvidia GPUs are used in deep learning, and accelerated analytics due to Nvidia's CUDA software platform and API which allows programmers to utilize the higher number of cores present in GPUs to parallelize BLAS operations which are extensively used in machine learning algorithms.[11] 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.[153][154] These GPUs are used by researchers, laboratories, tech companies and enterprise companies.[155] 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)".[156] That year, the Google Brain used Nvidia GPUs to create Deep Neural Networks capable of machine learning, where Andrew Ng determined that GPUs could increase the speed of deep-learning systems by about 100 times.[157]

DGX

DGX is a line of supercomputers by Nvidia.

In April 2016, Nvidia produced the DGX-1 based on an 8 GPU cluster, to improve the ability of users to use deep learning by combining GPUs with integrated deep learning software.[158] Nvidia gifted its first DGX-1 to OpenAI 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.[159][160] It also developed Nvidia Tesla K80 and P100 GPU-based virtual machines, which are available through Google Cloud, which Google installed in November 2016.[161] 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 Watson,[162] called IBM PowerAI.[163][164] Nvidia also offers its own Nvidia Deep Learning software development kit.[165] In 2017, the GPUs were also brought online at the Riken Center for Advanced Intelligence Project for Fujitsu.[166] The company's deep learning technology led to a boost in its 2017 earnings.[167]

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.[168]

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.[169] As of March 2018, there were 2,800 startups in the Inception Program.[170] As of August 2021, the program has surpassed 8,500 members in 90 countries, with cumulative funding of US$60 billion.[171]

Controversies

Maxwell advertising dispute

GeForce Partner Program

The Nvidia GeForce Partner Program was a marketing program designed to provide partnering companies with benefits such as public relations support, video game bundling, and marketing development funds.[172] The program proved to be controversial, with complaints about it possibly being an anti-competitive practice.[173]

First announced in a blog post on March 1, 2018,[174] it was canceled on May 4, 2018.[175]

Hardware Unboxed controversy

On December 10, 2020, Nvidia told popular YouTube tech reviewer Steven Walton of Hardware Unboxed that it would no longer supply him with GeForce Founders Edition graphics card review units.[176][177] 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.'"[178]

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.[179]

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."[179]

A number of prominent technology reviewers came out strongly against Nvidia's move.[180][181] Linus Sebastian, of Linus Tech Tips, titled the episode of his popular weekly WAN Show, "NVIDIA might ACTUALLY be EVIL..."[182] and was highly critical of the company's move to dictate specific outcomes of technology reviews.[183] The popular 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."[184]

Two days later, Nvidia reversed their stance.[185][186] 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."[187][180] On December 14, Hardware Unboxed released a video explaining the controversy from their viewpoint.[188] 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."[189][190]

Improper disclosures about cryptomining

In 2018, Nvidia's chips became popular for cryptomining, the process of obtaining crypto rewards in exchange for verifying transactions on distributed ledgers, the U.S. Securities and Exchange Commission (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.[191]

See also

San Francisco Bay Area portal

Companies portal

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

Notes

1. 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 ***n*VIDIA** with a large italicized lowercase "n" on products from the mid 1990s to early-mid 2000s. "NVIDIA Logo Guidelines at a Glance" (http://international.download.nvidia.com/partnerforce-us/Brand-Guidelines/NVIDIA_LogoGuidelines.pdf) (PDF). *nvidia.com*. Nvidia. Archived (https://ghostarchive.org/archive/20221009/http://international.download.nvidia.com/partnerforce-us/Brand-Guidelines/NVIDIA_LogoGuidelines.pdf) (PDF) from the original on October 9, 2022. Retrieved March 21, 2018.
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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)
