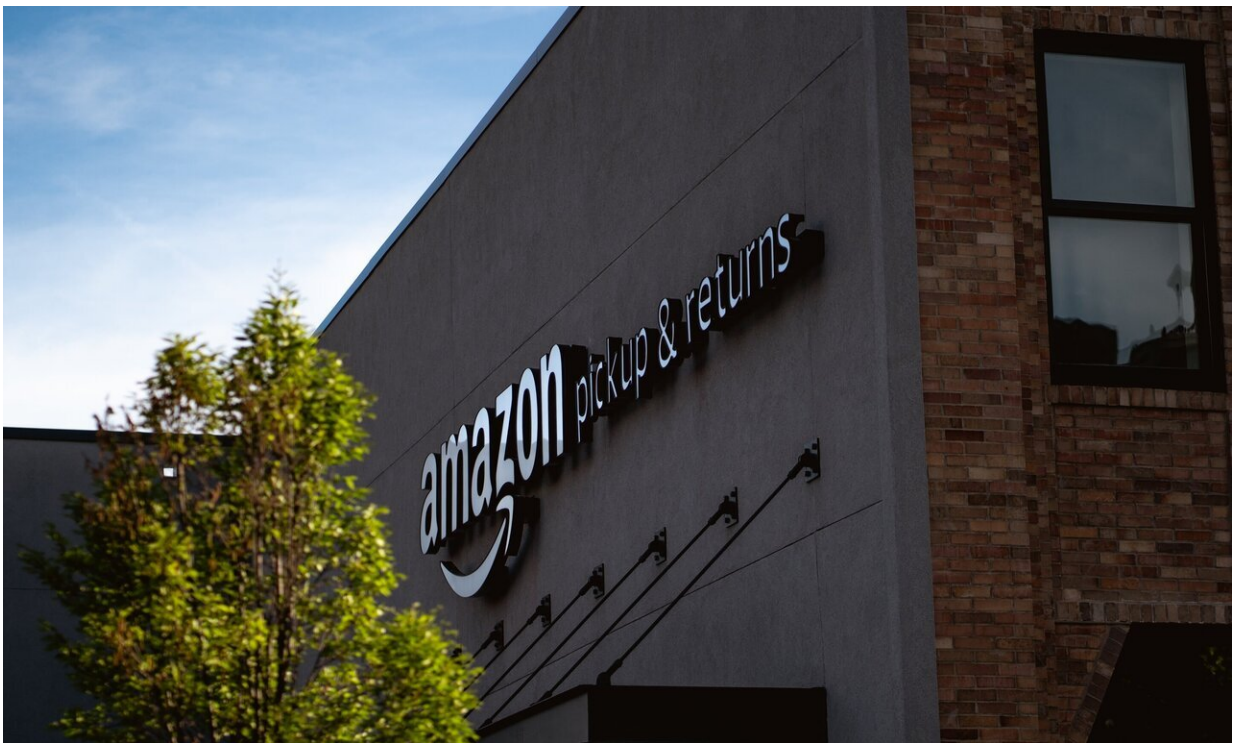


In the 15 years since its launch, Amazon Web Services transformed how companies do business

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It enables glitch-free Netflix streaming. It hosts digital drug-design tools of the kind that led to Moderna's COVID-19 vaccine. The Seahawks use its computing power to analyze game data. It stores a digital repository

of King County's archives. And even The Seattle Times relies on it to make sure the website doesn't crash during surges of reader traffic.

What is it?

It's Amazon Web Services (AWS).

The massively successful Amazon division, which opened for business 15 years ago, doesn't have the same consumer cachet as two-day shipping or Prime Video. "Cloud computing"? Gobbledygook to many.

Yet the importance of AWS to the company, consumers and the global internet economy is difficult to overstate. Internally, the division is Amazon's cash cow, making up 59% of the company's \$22.9 billion profit before interest and taxes in 2020, despite accounting for just 12% of Amazon's revenue. AWS infrastructure also supports Amazon logistics, helping route more than 2.5 billion packages every year to the right address (most of the time), not to mention nearly all of Amazon's other operations.

On a wider scale, the launch of AWS revolutionized the economics of web-based business by creating a \$300 billion industry, [cloud computing](#). Nearly every large company and government agency in the country uses some form of cloud-computing services, according to research firm IDG.

Amazon will elevate AWS CEO Andy Jassy to lead the company when founder Jeff Bezos steps down later this year—a promotion that in part recognizes the centrality of cloud computing to Amazon's business model, industry observers say. Microsoft CEO Satya Nadella also led Microsoft's cloud-computing division before acceding in 2014 to the top post at the Redmond-based software giant.

Meanwhile, AWS booting Parler offline in January over what Amazon has said is the social network's inability to moderate violent content has highlighted the tremendous sway cloud-computing platforms—including AWS, Microsoft's Azure and Google Cloud Platform—hold over their clients.

Cloud-computing services are "gateways," said University of Washington Information School professor Chirag Shah. "Without them, it's really hard to be alive as a business."

Origins of AWS

As AWS has grown, it has developed its own icons and quasi-mythical origin stories—many woven deep in the fabric of Seattle.

One possible starting point for the tale is at the McMenamins Six Arms on Capitol Hill circa 2005, when AWS senior technologist Allan Vermeulen sketched the initial design principles for a key cloud-computing service—the provision of unlimited, pay-as-you-go data storage—on the back of a napkin while drinking a Hammerhead Ale. (Vermeulen retired from the company this month.)

The seeds for what would become AWS, though, had been planted years before, in Amazon's realization that scaling up [computing power](#) and offering internet-based services to [software developers](#) were among its strengths.

In the early 2000s, Amazon software engineers complained that they were spending too much of their time creating and maintaining digital infrastructure.

"Look, you guys think these projects should take two to three months total, but we're spending two to three months just on the storage solution

or the database solution or the computing solution," Jassy, in a 2018 New York Magazine interview, recalled engineers saying to him. "They felt like they were reinventing the wheel with every project."

In part to address its own growing pains, Amazon centralized the process of building reliable, cost-effective data centers and offering services like database management, so its own teams could focus on designing products to draw more consumers to Amazon.com.

Amazon was concurrently making its first forays into marketing digital infrastructure as a service. The company began partnering on web design with retail partners, like Target, in 2001, eventually giving major merchants tools to build their own e-commerce sites on Amazon's platform.

In March 2002, Amazon launched a feature targeted at affiliate marketers—third parties who earn small commissions whenever customers purchase an Amazon.com product via links on their sites—allowing them to receive extensive product data that they could incorporate into the code of their own websites.

Almost immediately, software developers came up with innovative ways to display the ballooning Amazon catalog on their sites, recalled Colin Bryar, the former head of Amazon's affiliate marketing program. One game challenged consumers to name the author, movie or recording artist based on cover art that flashed on the screen. Another page allowed customers to create virtual bookshelves of their favorite Amazon products.

"Literally hours after releasing this feature, I knew that we were onto something big and that our experiment would far exceed our expectations," Bryar said in "Working Backwards," cowritten with another former Amazonian, Bill Carr.

Amazon hosted a conference later that year that brought heavy users of the product data to the company's headquarters, then in the old Pacific Medical Center on Beacon Hill. Eight people attended. One would join Amazon that year, and go on to become the cherubic face of AWS for legions of software developers around the world.

Jeff Barr, who got his start in computing working as a teenage janitor at the Retail Computer Store in Greenlake, is now AWS' explainer-in-chief. Known for a signature purple-haired look he sported between 2017 and 2019, and his deep love of Legos, Barr is the author of thousands of blog posts evangelizing new AWS features, at least one using Lego dioramas as visuals.

"When we gave [affiliate marketers] access to web services, they could build their own really cool graphical visualizations of the catalog," Barr said. "They'd send us traffic, we'd send them money. It created a virtuous circle for the first time in the web services space."

Amazon began putting the pieces of what would become AWS together in 2003.

That summer, executives gathered for a retreat at Bezos' Medina manse to brainstorm new business directions for Amazon. The company's strengths in the as-yet-unnamed world of cloud computing soon came to the fore, Jassy said in a 2017 University of Washington talk. Amazon was already offering limited software tools to developers and businesses. And the company was good at rapidly building the digital infrastructure it needed to run its expanding enterprises.

Jassy, nearing the end of an 18-month stint shadowing Bezos in a chief-of-staff-like role, proposed that Amazon start a new, 57-person division selling digital infrastructure. By that autumn, AWS had been greenlighted, with Jassy at its helm.

Jassy, a gregarious manager with a notable love for chicken wings, put his own mark on the organization. Not an engineer by trade, Jassy has guided the development of new AWS services, former AWS employees say, by nurturing an Amazonian culture of customer obsession.

In 2004, the division released test versions of what would become some of its foundational products. By 2006, AWS had officially opened for business.

"The Lego of the IT world"

AWS rolled out its first mass-market product, Simple Storage Service, or S3, on March 14, 2006. To many at Amazon, that day marked the birth of AWS.

Guided by Vermeulen's back-of-the-napkin blueprint, streamlined in a brainstorming session in a rented room at the Washington State Convention Center, and designed, Amazon chief technology officer Werner Vogels said, over the course of many "long, dark nights" at the Pacific Medical Center, S3 allows developers to store and retrieve "any amount of data, at any time, from anywhere on the web," the company wrote in its initial news release.

"Storage for the internet was—I don't want to say obvious—but so clear that if we had it, customers would find it useful," Barr said. In those early days at Amazon, he shared an office with Rudy Valdez, who now leads Amazon's solutions architecture and training division. "He was literally calling up customers and saying, 'Hey, I'm Rudy from Amazon, would you like some storage?'" Barr said. Many bit.

Within two months, the number of objects—think of them like files—stored on S3 had exceeded Amazon developers' expectations by a factor of 100. Today, objects are stored on S3, an ocean of data

underwriting advances in fields from weather forecasting and genomic research to advertising and facial recognition.

Within the year, Amazon had announced the other technology at the heart of Amazon Web Services: elastic compute, or EC2, giving developers access to on-demand computing power they could use to process and analyze data, among a host of other functions. The idea for the product had been around since 2003, when a rookie Amazon engineer, Benjamin Black, and his boss, Chris Pinkham, circulated a memo advocating that Amazon start selling access to a web-based app allowing developers to run software on computers they didn't own or maintain.

Developed largely in South Africa by a small team led by Pinkham, EC2 was a revolutionary technology—for software developers, akin to replacing snail mail with email. Suddenly, you could program a computer from anywhere.

The dawn of cloud computing, heralded in a 2006 New York Times article proclaiming that the internet was "entering its Lego era," fundamentally changed the economics of opening a computer-dependent business. Early internet entrepreneurs likely spent 70% of their engineering time and effort building data centers and designing and maintaining basic infrastructure software, Vogels estimated, and only 30% of employee energy developing new products.

AWS flipped that ratio on its head. Initially, customers needed only an email address and a credit card to access data storage, computing power and database services, making it easier for people to start businesses online with a minimal infusion of capital. Backed by AWS, app-based startups like Lyft and Airbnb proliferated.

Amazon's head start in cloud computing has made it tough for rivals to

catch up. Microsoft launched its cloud-computing division in 2010, followed by Google in 2011. While AWS' early lead has shrunk in recent years, Amazon still dominates, commanding 31% of market share by revenue, compared with Microsoft's 20% and Google's 7%, according to market research firm Canalys.

Since 2006, Amazon has rolled out hundreds of other AWS applications—so many, in fact, that even AWS engineers can't keep up, said Corey Quinn, the founder of AWS consultancy Duckbill Group.

"Even technically inclined people feel daunted by what this thing is," Quinn said. "We are long since past the point where I can talk to Amazonians and make up services and not get called out on it."

There are database management services, machine learning tools and web hosting. There are also tools to talk to satellites in orbit, a 3D race car simulator and an experimental quantum computing technology.

"Amazon is the Lego of the IT world," Vogels said. "We built very small building blocks. So it allowed developers to stack things together."

For years, AWS has built huge off-site data centers, places where "rows and rows of servers" stretch into the far distance, Vermeulen described in a 2014 interview. But the future of AWS, Vogels said, is local. The company has launched a suite of hardware designed to bring AWS into users' homes and offices—enabling superfast mobile applications that run on 5G—and out into the field where data collection is taking place.

Cloud services have not erased every computing frustration. For a product designed to give developers flexibility and choice, it's often excruciatingly difficult to migrate from one cloud-computing provider to another, Shah said.

"Your services are tangled with the AWS language. You're using special proprietary databases that AWS has," he said, using AWS as an example to describe problems common among cloud platforms. "It's not easy to pack things up and go to a different service provider" like Azure or Google. And while AWS touts its ability to save clients money, cloud computing can be astronomically expensive.

Meanwhile, the degree of power that cloud-computing titans hold over their customers, as evidenced by Amazon's decision to take Parler offline, is concerning, Shah said. "You're handing someone your entire business to run. Can you really trust them?"

Quinn, though, said it's unlikely that a cloud-computing provider like AWS would act against "any reasonable company." Parler, he said, was very much an edge case.

After all, he said, "The National Enquirer attempted to blackmail Bezos and is still an AWS customer."

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