Amazon CTO Details Company's Path to the Cloud Business

Werner Vogels spells out how early problems with IT led to Amazon Web Services

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Werner Vogels, Amazon's chief technology officer, at an event in June.
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Amazon.com Inc.'s dominance in cloud computing is the result of early struggles with its information-technology system as the e-commerce giant sought to expand beyond online book sales, a top executive said.

"If I look back 10 or 15 years ago, I could not have projected where we'd be now," said Werner Vogels, Amazon's chief technology officer.

Amazon holds a commanding lead in the fast-growing cloud market, where tech companies vie to rent computer power and tools to businesses and other organizations over the internet.

Amazon Web Services, the company's cloud-computing unit, has become a key profit driver for Amazon since its 2006 launch. It generated $8.4 billion in sales in Amazon's latest quarter and its operating income was up 29% to $2.1 billion, the company said in July.

According to research firm Gartner Inc., Amazon's $15.5 billion in annual cloud-services sales last year represented roughly half of total revenue across the cloud-computing market. Microsoft Corp., Amazon's closest rival in the cloud market, accounts for an estimated 15% of cloud-market sales, Gartner said. Microsoft launched its Azure cloud service in 2010.

In Amazon's early days, Mr. Vogels said, its IT efforts were hamstrung by a "monolithic" software and database system designed to sell books online and nothing else.

Mr. Vogels, who joined Amazon in 2004 as director of systems research and become CTO the following year, recently shared highlights of the company's ongoing tech evolution with CIO Journal, starting with the key years after the 1995 debut of Amazon's online bookstore.

Breaking IT Into Pieces

By 2000, adding new applications to serve Amazon's growing number of retail customers, among other emerging services, involved rewriting vast amounts of computer code, Mr. Vogels said.

"We basically had one big piece of software and a whole set of databases related to it that were holding us back from moving faster," he said, adding that "any changes made to the database needed to go through 10 levels of approvals, because so many things would be impacted by it."

Timeline: Amazon's Cloud Evolution

Steps that the company took in its early days to manage its growing IT infrastructure became the drivers for Amazon Web Services. Here are debut dates for some key AWS products.

* 2006: Amazon Simple Storage Service (S3)
* 2008: Elastic IPs; Elastic Block Store for Amazon EC2; Amazon CloudFront
* 2014: EC2 Container Service
* 2016: Amazon Rekognition
* 2017: AWS DeepLens

Developing new features such as Amazon Prime, launched in 2005, would have involved multi-year projects—a pace of innovation that would make the company vulnerable to more nimble competitors, Mr. Vogels said.

"We realized we needed to give our teams a bit more independence, and the only way to do that was to break off this big monolith into little pieces," he said.

The company began by separating out its three largest data sets—customers, goods and orders—into separate items, he said. Each of these items was broken down into smaller units, such as login information or security requirements, he said.

That enabled the company's information-technology teams to change one area of IT without having to rework the entire system, Mr. Vogels says.

'Two-Pizza Teams'

Breaking down its software architecture drove other efficiencies, Mr. Vogels said.

Rather than having a few large development teams working on sections of the same application, the new model allowed much smaller teams to tackle specific products, services or features, he said. The company called these "two-pizza teams," or groups small enough to be fed by two pizzas.

But despite the new structure, the pace of innovation was still hampered as each of these new teams devoted time to maintaining their data centers.

"They were all spending time managing their load balances or acquiring capacity and releasing it again, and that became much more of a heavier load as the organization grew," Mr. Vogels said.

To lighten that load, he said, the company developed a "shared services platform" around IT capacity, storage and security. By making internal IT infrastructure a shared system, teams were able to focus on creating innovative new services.

The new system sparked the development of millions of new features every year, up from a few dozen, Mr. Vogels said.

IT Is Getting Cloudy

Alongside these internal initiatives, the company opened up its catalog of products to upstart tech ventures, allowing them to develop their own innovative ways of selling products online through Amazon.com, such as comparison-shopping apps, Mr. Vogels said.

"But most of these companies failed because they couldn't meet the IT requirements," he added.

Taking a page from its internal strategy, Mr. Vogels said, Amazon began offering these ventures the computer systems and tools needed to power their ideas—by renting IT infrastructure and applications online.

"That was the driver for what later became AWS," he said.

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