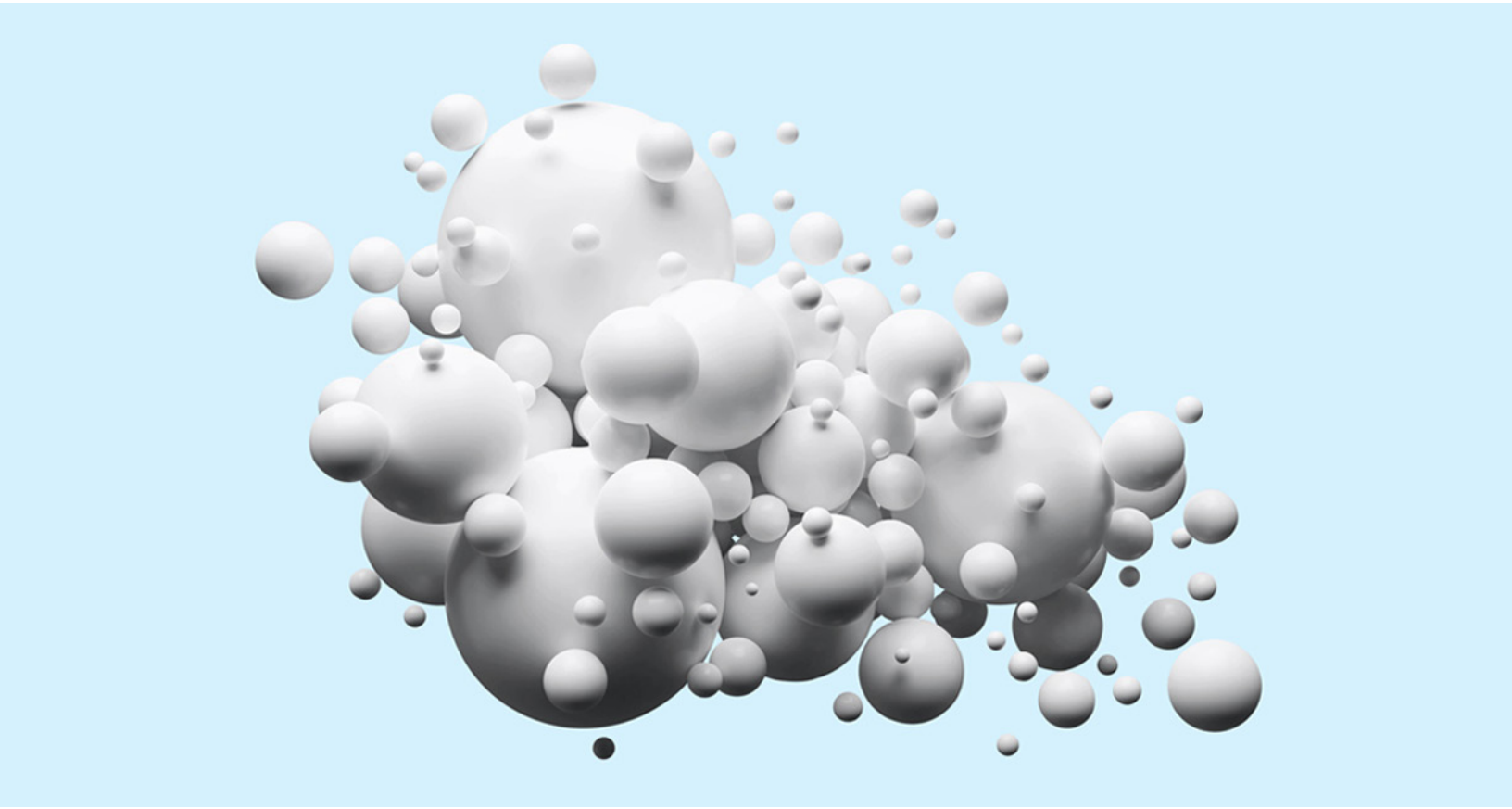
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McKinsey Explainers

What is cloud computing?

Cloud computing allows companies to store their infrastructures remotely via the internet, ultimately reducing costs and creating value.



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Remember when computers were big, hulking objects that dominated the office? Maybe you don't; many digital natives learned to type on svelte laptops, not clunky, plug-in ergonomic keyboards. Here's a little history: when they were first put into use, in the middle of the 20th century, computers could fill a whole room. By the time they started appearing in the households of the tech savvy, they were smaller, about the size of a step stool that could fit under a desk. Now, of course, they fit in our pockets (and some, even in our brains).

The transition from huge to tiny computers has been driven by a number of technological advances. Transistors, integrated circuits, microprocessors, LCD, and lithium-ion batteries have all played a role in the miniaturization of computers since they came on the scene.

The emergence of cloud computing has also played a major role in the evolution of computing over past decades. Previously, organizations and individuals would have to store and run all their data, systems, and applications on their own servers. With cloud computing, organizations engage cloud service providers (CSPs) to host and run their applications on remote servers, using only as much compute power and storage as needed to meet demand. This theoretically allows for cheaper and faster computing because it eliminates the need to purchase, install, and maintain servers.

But, as we'll see, it isn't as simple as a one-and-done migration. Cloud requires a high degree of change, says McKinsey partner James Kaplan: "Even though cloud is by far the superior way to host an application, it requires significant investments in underlying services, in application remediation, in building new organizational capabilities to change the ROI dynamics."

Despite the investment required, there's clear economic potential for organizations looking to migrate to the cloud—to the tune of $3 trillion in global value by 2030, according to McKinsey estimates. Kaplan puts it succinctly: "Part of the reason you hear so much about cloud is because it's the way successful companies will run their technology environments in the future." But how can organizations get from where they are now to achieving some of this sky-high value? Read on to find out.

Learn more about Cloud by McKinsey and the McKinsey Digital and Technology, Media & Telecommunications Practices.

What's behind that $3 trillion number?

McKinsey estimates that cloud adoption could generate $3 trillion in global value by 2030. This number is derived from our analysis of 700 use cases, divided into the following areas:

— *Rejuvenate,* which focuses on improving IT capabilities. This includes value from IT savings ($155 billion), operational cost savings ($311 billion), and digital risk reduction ($407 billion). That adds up to a total of $873 billion.

— *Innovate,* which focuses on generating new revenue. $612 billion comes from innovation-driven growth, and $1.7 trillion comes from accelerated product development and hyperscalability, for a total of $2.3 trillion.

— *Pioneer,* which covers a range of emerging technologies, including new cloud-based business models and integration with technologies like 5G, blockchain, and quantum computing. Because they're so new, the impact can't yet be exactly quantified.

What's the main reason to move to the cloud?

There isn't just one. Cost cutting is typically cited as the primary reason—but while cost reduction is certainly a tantalizing possibility with cloud migration, the potential to innovate is a far larger prize. McKinsey has found that the value cloud generates from enabling businesses to innovate is worth more than five times what is possible by simply reducing IT costs.

Take digital transformation. While it's an ongoing process, cloud computing, among other technologies, can help companies go through the phases of a digital transformation faster and more efficiently. The benefits are faster time to market, simplified innovation and scalability, and reduced risk. The cloud lets companies innovate quickly, providing customers with novel digital experiences. It also enables organizations to use bespoke, cutting-edge analytics not available on legacy platforms.

But to transition to a cloud-first operating model, organizations should make a collective effort that starts at the top. Here are three actions CEOs can take to increase the value their companies get from cloud computing:

— establish a sustainable funding model

— develop a new business technology operating model

— set up policies to attract and retain the right engineering talent

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How to maximize the value of a cloud transformation

In May 2024, McKinsey profiled more than 80 enterprises for its CloudSights database. Forty percent of them found limited value in their cloud programs. Why? It's not always clear. Even for companies well on their way to achieving value from cloud investments, it can be difficult to communicate progress to stakeholders and make a case for new investment. We find that the difficulty often boils down to lack of clarity about what is important to measure and lack of rigor in implementing a tracking program.

As with everything else, you can't manage what you can't measure. Data dashboards and central governance create the kind of transparency that supports data-backed decision making. Here are eight dimensions that are important to almost any cloud transformation; each should have its own corresponding dashboard:

— *Executive summary objectives and key results:* a curated, top-level program to inform overall progress

— *Business value and use cases:* contributes to transparency into business objectives and use cases enabled by cloud adoption; metrics could include speed to market and percent of customers using new solutions

— *Cost performance:* tracks money budgeted, spent, and saved on cloud costs

— *Application and data migration:* measures progress of application portfolio and data transition to cloud

— *Infrastructure modernization:* reporting on infrastructure modernization initiatives, including decommissioning of existing structures being replaced by cloud services

— *Financial operations:* detailed reporting of cloud usage, CSP commitments, and costs; allows teams to optimize spending

— *Security and risk:* assessment against security scorecard to identify cloud risks and vulnerabilities

— *People, products, and operating models:* measurement of people readiness and impact of new operating model and product changes

In our experience, cloud transformation is not easy, not least because it frequently takes unexpected directions. With improved tracking, companies are

better equipped to notice changes at early stages and make the necessary adjustments. (See sidebar "Case study: Lincoln Financial Group's journey from legacy to cloud.")

How has cloud computing evolved?

The COVID-19 pandemic rapidly accelerated organizations' cloud migrations. Prior to the pandemic, enterprises planned to move a mere 45 percent of their IT-hosting expenditures to the cloud by 2021. But 65 percent of the decision makers surveyed by McKinsey in 2021 had actually increased their cloud budgets, and 40 percent of companies expected to pick up the pace of implementation.

Here are two examples of how organizations used cloud computing to adjust quickly to the new reality of pandemic-era lockdowns:

— A fast-casual restaurant chain's online orders multiplied exponentially during the 2020 pandemic lockdowns, ballooning from 50,000 per day to 400,000. The company's online-ordering system could handle the volume—because it had already migrated to the cloud. Thanks to this success, the organization's leadership decided to accelerate its five-year migration plan to less than one year.

— Moderna harnessed cloud computing to deliver the first clinical batch of a COVID-19 vaccine candidate in just 42 days. This success was due in part to the company's use of cloud data storage and computing to facilitate processes ensuring the drug's safety and efficacy.

The COVID-19 pandemic accelerated the widespread migration to cloud, but the cloud revolution had actually been going on for years—more than 20, if

Case study: Lincoln Financial Group's journey from legacy to cloud

In March 2024, McKinsey interviewed two executives from the insurance organization Lincoln Financial Group: Rob Klaczak is senior vice president and divisional chief information officer for life, annuities, and distribution, and Satyendra Kumar is vice president and executive sponsor and program lead. Here's what we learned.

Lincoln's decision to transition to the cloud was, like many other organizations, driven by the goal of cost savings. The costs associated with the organization's legacy platforms were largely fixed, posing a financial challenge. The leadership team embarked on a large-scale transformation program, including 120 complex cloud systems and an accelerated time frame of less than two years to complete the entire program.

The transition was guided by collaboration, security considerations, and data collection and information sharing across the organization. An agile mindset was critical to the ultimate success of the transformation, which Kumar cites as essential for adapting to unknowns, building confidence, and consistently delivering results.

The transformation unsurprisingly faced a number of challenges. Security issues were a major one, says Klaczak, particularly authentication without authorization. Leadership dealt effectively with this challenge by establishing an early working relationship with the chief information security officer. An overall mindset shift was also a challenge, ultimately surmounted by an emphasis on thought leadership and more efficient processes.

What are Kumar and Klaczak's lessons for others looking to undertake cloud transformations? "Careful and detailed planning, along with a SWAT team approach to identify and resolve unknowns, is critical to success," says Kumar, along with ongoing and exhaustive communication. Klaczak believes that "unwavering support from senior management" is critical to success.

you count from the founding of Salesforce, widely seen as the first software-as-a-service company. Today, next-generation cloud capabilities make it easier for software developers to tweak software functions independently and efficiently, which allows for a whole new level of agility.

Learn more about Cloud by McKinsey and the McKinsey Digital and Technology, Media & Telecommunications Practices.

How will generative AI change how organizations use the cloud?

Generative AI (gen AI) has the potential to transform business, the economy, and society at large. That includes, of course, the way organizations engage with the cloud. Put simply, gen AI could make it easier for organizations to derive value from the cloud. Gen AI has the potential to make cloud a more attractive investment, by both dramatically reducing the investment and time needed to adopt cloud and generating new value by supporting new business and tech use cases.

Currently, organizations must remediate existing applications so they can take advantage of cloud capabilities. This is expensive in terms of time and treasure. Early efforts to apply gen AI to application remediation and migration have indicated a 40 percent reduction in time and investment required (though much more analysis is needed).

In the meantime, organizations can incorporate gen AI into their cloud programs in the following ways:

- incorporate gen-AI-enabled business use cases
- accelerate migration of on-premises transactional systems to build end-to-end gen-AI-enabled customer journeys
- use gen AI to transform the ROI of application remediation and migration

For a more detailed look at gen AI's implications for cloud, click here.

How will cloud adoption impact different regions?

Asia has the highest cloud value potential: about $1.3 trillion by 2030. This is because of the large number of oil and gas and banking organizations in Asia with large potential gains due to cloud. As CSPs expand their footprint in Asia over the next few years, they may be able to achieve outsize value.

Organizations based in the Americas have about $1.1 trillion in available cloud value. The Americas lead the world in cloud adoption at present; the value that stands to be captured here is largely through more advanced use cases. North America's top industry in terms of potential value is retail, which stands to capture nearly $162 billion in gains due to cloud by 2030. (See sidebar "Case study: US Centers for Medicare & Medicaid Services' cloud journey.")

McKinsey's latest analysis indicates that the value European organizations have captured from cloud remains in isolated pockets and at subscale. The focus of European companies' cloud efforts, for example, has been disproportionately on improvements to IT, which generates lower rates of return than improvements to business operations.

Cloud adoption in the Middle East has been slower than elsewhere. This is probably due in part to expensive and poor-quality international connectivity in some Middle Eastern countries as well as regulatory uncertainty. Yet we see big potential here: cloud adoption could generate as much as $183 billion of value by 2030. That's roughly the equivalent of 6 percent of the region's current GDP.

Learn more about Cloud by McKinsey and the McKinsey Digital and Technology, Media & Telecommunications Practices.

Case study: US Centers for Medicare & Medicaid Services' cloud journey

In January 2024, McKinsey interviewed Rajiv Uppal, the former CIO of the US Centers for Medicare & Medicaid Services (CMS), and Mark Oh, the organization's director of infrastructure and user services group. Here's what we learned about their cloud transformation journey.

Shortly after starting CMS's cloud migration, says Uppal, leaders started realizing the imperative for a larger business transformation. The project called for a deeper connection between business and tech teams: "It required a fair bit of trust building with CMS's business units."

To help build the kind of trust Uppal and other leaders deemed necessary, CMS set up a program to train stakeholders in human-centered design, product management, and cloud technologies. "It all comes back to leadership emphasis on empathy," says Oh. "If you're not empathetic, you cannot deliver services and solutions that people will use." A mindset of empathy served as the foundation for a culture of enablement, rather than mandate.

CMS also benefitted from a financial operations (FinOps) program in its cloud transformation. Oh estimates that this program contributed to a 15 percent overall savings on annual spend. That's a significant amount for an agency like CMS, where annual spend exceeds $100 million.

CMS leadership is working to apply the lessons they learned from the cloud journey to other technological iteration, including developing gen AI capabilities. Once again, they are not mandating: "We're creating a safe space for people to contribute and collaborate, using best practices," says Oh.

What can European companies do to achieve their cloud growth ambitions?

Here are five strategic priorities for European players looking to adopt cloud at scale:

— *Develop relationships with cloud providers into true partnerships.* European companies should evolve traditional "supplier" relationships; new partnerships can help companies build their own capabilities and train their technical staff.

— *Modernize ways of working.* Companies should focus on three mutually reinforcing elements of effective cloud operations: business value; working quickly in small, cross-functional teams; and building sufficient foundations.

— *Implement financial operations (FinOps) to optimize cloud spend and monitor impact.* Investing early in a spend-management capability can help manage costs.

— *Be clear about ROI trade-offs when scaling.* Once cloud workloads begin to scale, companies should pay close attention to ROI, which can diminish once adoption rates are too high.

— *Bridge existing compliance capabilities with those from CSPs to manage regulatory environments.* Fast-evolving regulations are straining companies' processes. Technology leadership should work with CSPs to ensure up-to-date compliance.

What are some cloud risks?

We've seen that cloud offers huge cost savings and potential for innovation. But the lift-and-shift approach—simply moving existing applications to the cloud—doesn't actually reduce costs in the end. To achieve the kind of value they're looking for, most companies will need to adjust their existing applications to the cloud environment. As we've seen, gen AI tools stand to make this process faster and easier.

For instance, a major financial-services organization wanted to move more than 50 percent of its applications to the public cloud within five years. Its

goals were to improve resiliency, time to market, and productivity. But not all its business units needed to transition at the same pace. IT leadership defined varying adoption archetypes to meet each unit's technical, risk, and operating-model needs.

Security protocols can also pose problems when companies shift to the cloud. The resulting problems, however, can involve misconfigurations rather than inherent cloud security vulnerabilities. One solution? Securing cloud workloads for speed and agility: automated security architectures and processes enable workloads to be processed at a much faster tempo.

Learn more about Cloud by McKinsey and the McKinsey Digital and Technology, Media & Telecommunications Practices.

What kind of cloud talent is needed?

The talent demands of the cloud differ from those of legacy IT. While cloud computing can improve the productivity of your technology, it requires specialized and sometimes hard-to-find talent—including full-stack developers, data engineers, cloud-security engineers, identity- and access-management specialists, and cloud engineers. And your organization's needs will change as you progress on your cloud journey.

Six practical actions can help your organization build the cloud talent you need:

1. Find engineering talent with broad experience and skills.
2. Balance talent maturity levels and the composition of teams.
3. Build an extensive and mandatory upskilling program focused on need.
4. Build an engineering culture that optimizes the developer experience.
5. Consider using partners to accelerate development and assign your best cloud leaders as owners.
6. Retain top talent by focusing on what motivates them.

What are some examples of different organizations benefitting from cloud?

Different industries, unsurprisingly, see dramatically different benefits from the cloud. High-tech, retail, and healthcare organizations occupy the top end of the value capture continuum. Electronics and semiconductors, consumer-packaged-goods, and media companies make up the middle. Materials, chemicals, and infrastructure organizations cluster at the lower end.

Here are some examples of how organizations in diverse industries are benefitting from the cloud:

- a retailer enhancing omnichannel fulfillment, using AI to optimize inventory across channels and to provide a seamless customer experience
- a healthcare organization implementing remote heath monitoring to conduct virtual trials and improve adherence
- a high-tech company using chatbots to provide premier-level support combining phone, email, and chat
- an oil and gas company employing automated forecasting to automate supply-and-demand modeling and reduce the need for manual analysis
- a financial-services organization implementing customer call optimization using real-time voice recognition algorithms to direct distressed customers to experienced representatives for retention offers

— a financial-services provider moving applications in customer-facing business domains to the public cloud to penetrate promising markets more quickly and at minimal cost

— a health insurance carrier accelerating the capture of billions of dollars in new revenues by moving systems to the cloud

Learn more about Cloud by McKinsey and our McKinsey Digital, Financial Services, Healthcare, Retail, and Technology, Media & Telecommunications practices.

What are the biggest cloud myths?

Based on interviews with more than 50 CIOs, chief technology officers, and cloud leaders at top North American organizations on their cloud programs, we isolated the following commonly held myths about the cloud:

— *Cloud is just about cost savings.* Cloud certainly helps reduce the costs of owning and running massive data centers, but businesses should approach cloud as an equally important tool for business enablement.

— *Cloud is a one-and-done replacement for physical infrastructure.* Organization-specific technological challenges, like application migration, security-as-code protocols, and resiliency patterns, require bespoke solutions.

— *Cloud can slot into existing operating models.* Successful cloud migration requires organizational change. Leaders should optimize operating models for maximum agility, and invest in FinOps to track costs.

How large does my organization have to be to benefit from cloud?

Here's one more huge misconception: the cloud is just for big multinational companies. In fact, cloud can help make small local companies *become* multinational. A company's benefits from implementing the cloud are not constrained by its size. In fact, the barrier to entry for cloud implementation is skill, not scale. This means companies of any size can compete if they have people with the right skills. With cloud, highly skilled small companies can take on established competitors. To realize cloud's immense potential value fully, organizations should take a thoughtful approach, with IT and the businesses working together.

For more in-depth exploration of these topics, see McKinsey's Cloud Insights collection. Learn more about Cloud by McKinsey—and check out cloud-related job opportunities if you're interested in working at McKinsey.

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Get to know and directly engage with senior McKinsey experts on cloud computing.

Anand Swaminathan and **Chandra Gnanasambandam** are senior partners in McKinsey's Bay Area office, **Brant Carson** is a senior partner in the Vancouver office, **Kate Smaje** is a senior partner in the London office, **Leandro Santos** is a senior partner in the Atlanta office, and **Will Forrest** is a senior partner in the Chicago office.

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