



Above the cloud: investment opportunities across the value chain

Key takeaways

- The transformative power of the cloud positions it as the catalyst for the fourth industrial revolution.
- The cloud offers a scalable, high-performance, lower cost solution to data storage, and its potential to mobilise data and drive innovation opens up massive investment opportunities over the next 10 years.
- Identifying the investment areas in all three layers of the cloud value chain (enablers, solution providers and beneficiaries) can help to more effectively flag the opportunities and risks for companies positioned to harness the power of the cloud.

Cloud: the catalyst for the fourth industrial revolution

Every prior industrial revolution has had a catalyst followed by transformational change. Steam enabled mechanisation in the first industrial revolution, electricity led to mass production in the second, while technology drove automation in the third. The cloud's transformational power gives it the ability to rewire the global economy and be the catalyst for the fourth industrial revolution.

The broad application of the cloud's transformative innovation opens up massive investment opportunities over the next 10 years.

The future of data

I. Rapid growth and storage capacity

Around the world, more than 300 billion emails are sent and received every day.¹ Elsewhere, a single autonomous vehicle produces about five terabytes of data every hour.² In 2020 alone, 64 zettabytes³ of data was created globally, where 1 zettabyte is 1 billion terabytes.

As our digital data continues to grow at a rapid pace, storage management will become increasingly crucial. The cloud, a source of cheaper and better IT infrastructure and data storage, becomes a viable option as it optimises capacity, so companies only pay for actual usage.

II. Mobilisation of the data pool

While the cloud provides a great solution for data storage, its true potential comes from how the huge amounts of data are analysed and used in a collaborative manner to deliver insights and drive innovation.

We are already seeing the tangible application of data mobilisation in apps like Google Maps. Map co-ordinates, satellite images, photos and data are all stored in the cloud, but the real potential only emerges when an artificial intelligence engine integrates, analyses and synthesises the layers of data and images into usable output. The result has transformed the way we get from A to B.

Ways to invest in the cloud

The implications of the democratisation of data and enablement of cloud technology are vast. So, how do you structure exposure from an investment perspective?

We have identified opportunities along the cloud value chain framework, which breaks down cloud technology into three layers.

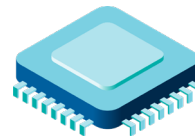
1. As at February 2021. Source: Statista

2. As at January 2020. Source: Dell Technologies (connected car is measured as a car "under task per hour")

3. As at March 2021. Source: IDC

Enablers

Companies making the hardware components that build and power the cloud platform and supporting infrastructure.



Hardware components

Solutions

Infrastructure providers and software companies that offer the cloud as a solution to users.

Cloud infrastructure



Cloud software



Beneficiaries

Innovators using cloud technology to disrupt their own industry. This has the potential to drive growth and create value that simply didn't exist before. This layer has the broadest application as the cloud has the potential to offer solutions across industries old and new.

Energy



Health care



Agriculture



Media



Construction



Utilities

Manufacturing

Education

Transportation

Government

Source: Capital Group

1. Enablers

We are already in the midst of the transition to the cloud. As we see broader migration and adoption, there will be higher demand for the components driving these processes. And as the cloud supports more complex computation and analytics, there is greater demand for higher performance components.

Semiconductors – an attractive industry structure

It's difficult to overstate how important semiconductors have become to the global economy. They are needed in everything from data centres and smartphones to cars and washing machines.

While the semiconductor industry's customer base has expanded, the number of industry participants has consolidated. Today the semiconductor industry has only a few dominant players. Essentially an oligopoly, it is an industry that has demonstrated steady growth, high margins and lower cyclicity. This is a solid set of underlying fundamentals for long-term investment opportunities.



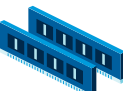


Semiconductor equipment maker ASML and semiconductor manufacturer TSMC are leaders in the industry. Superior technology coupled with strong operational execution has meant TSMC now holds close to 80% market share for leading-edge chip production,⁴ while ASML is essentially the only manufacturer of extreme ultraviolet lithography (EUV) machines used to make advanced chips.

Components

As cloud unlocks greater functionality, more industries and markets will make the case for more devices connected to the cloud. In turn, this increases the need for more components, sensors, connectivity, and storage capacity.

4. Source: The Economist, 29 April 2021

There are several areas in the component space our analysts find particularly interesting. In each area, specialist technical knowledge helps to understand each sub-market and the specific growth dynamics.⁵

Component area ⁵	Market environment	Growth drivers	Key companies
 CPUs 7.8% CAGR	Growth associated with IT infrastructure upgrades	Leading-edge innovation is required for CPUs, the engine at the core of complex artificial intelligence and high-performance computing workloads	Intel and Advanced Micro Devices (AMD)
 GPUs 33.4% CAGR	High growth but high execution risk	Parallel processing means greater speed, which enables modern data centres to accelerate machine learning and high-performance computing workloads	Intel, AMD and Nvidia
 Memory 7.0% CAGR	Moving from cyclical to steady growth	Historically subject to cyclicality, demand for memory is shifting from cyclical to secular	Samsung and Micron
 Microcontrollers 10.6% CAGR	Cloud unlocking new sources of secular demand	Microcontrollers are increasingly needed in cloud-connected internet-of-things	STMicroelectronics and ON Semiconductor
 Data centres 9.9% CAGR	Ongoing demand for capacity, particularly in regional hubs	An acceleration in the shift to cloud has driven up demand for capacity and increased workload complexity	US-based Equinix and Asia-based data centres

Past results are not a guarantee of future results. Examples shown for illustrative purposes only.

2. Solutions

We've covered the hardware components from which the cloud platform is constructed, the next stage looks at the companies that deliver cloud technology as a solution to users.

We divide solutions into two categories: i) infrastructure providers and ii) software providers.

Infrastructure providers

Cloud infrastructure is fairly familiar territory. It includes well-known names such as Amazon's AWS cloud services, which has 33% of the market, Microsoft Azure with a 20% market share and Google Cloud Platform with 9%.⁶ These companies have built a dominant market presence by expanding their product offering and reaching more clients. A market dominated by a few big players means it's a compelling industry structure. While the COVID pandemic has accelerated the shift to the cloud, there is still a potentially long runway of secular growth for the dominant companies.

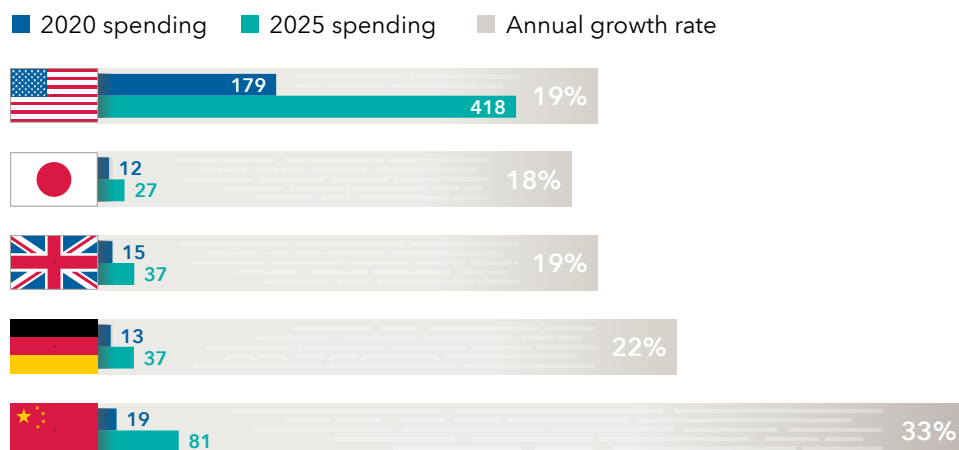
5. Compound annual growth rate (CAGR) for the various hardware segments shown is measured for: 2021-2028 (central processing unit, CPU); 2020-2027 (graphics processing unit, GPU and Microcontrollers); 2020-2026 (Memory chips); 2020-2025 (Data centres). Sources: Globe Newswire, 18 February 2021 (Data centre investment); PR Newswire, 20 April 2021 (CPU); Globe Newswire, 28 January 2021 (GPU); Globe NewsWire, 7 May 2021 (Memory chips); Globe Newswire, 21 October 2021 (Microcontrollers)

6. As at July 2021. Source: Synergy Research Group

There are also pockets of regional growth. In China, Alibaba and Tencent currently only have 6% and 2% of the global market share, respectively.⁷ However, cloud adoption in China is behind other regions and the government's ambition to catch up means its growth trajectory is much steeper. The initiative from the Chinese government is focused on the cost of transition, paying up to 100% of the costs for small- and mid-sized businesses to migrate to the cloud.

There is room for global cloud infrastructure providers to catch up with the US

Public cloud spending worldwide (US\$ billion) and annualised growth rates (2020-2025)



Forecasts shown for illustrative purposes only.

Data as at June 2021. Source: IDC, 'Worldwide Public Cloud Services Spending Guide'

Software providers

If infrastructure is known for its oligopolistic nature, then software could hardly provide more of a contrast. There are over 20,000 software-as-a-service (SaaS) companies⁷ globally but less than 1% of those are valued at more than US\$1 billion⁸. This makes the industry dynamic and exciting but also highlights the need for deep fundamental research to pick the ultimate champions.

The very nature of the cloud – as an analytics and delivery platform – is the cornerstone of the SaaS business model and underpins its high profitability. The lack of hard infrastructure and low marginal cost for additional subscribers are key to the very high margins in the industry.

7. As at 31 March 2021. Source: Crunchbase

8. Total number of SaaS companies valued above US\$1 billion is 140. As at 31 March 2021. Source: Capital IQ

Fundamental: MSCI ACWI Software Index vs. MSCI ACWI

	Software	MSCI ACWI	
5-year revenue growth	8.4%	2.4%	Pricing power and low cyclicality have driven higher revenue growth in software-as-a-service (SaaS)
Gross margins	70.5%	27.5%	Not only higher, but stable gross margin development across the SaaS universe
EBIT margin	27.2%	10.7%	Significant operating leverage due to superior unit economics (i.e. lower fixed costs)
Net debt/EBITDA	N/A	2.2x	Lower financial leverage means an inherently lower risk business model. It also makes these companies more attractive to lenders or investors, should they have additional financing requirements.
FCF margins	28.4%	10.8%	Strong free cash flow generation allows for reinvestment into the business (early stage/high growth) or dividend payments (mature software companies)
ROE	27.6%	9.9%	Higher profitability, lower indebtedness and better capital efficiency provide investors with the potential for higher overall returns

Past results are not a guarantee of future results.

As at 31 December 2020. EBIT: Earnings before interest and taxes. EBITDA: earnings before interest, taxes, depreciation, and amortization. FCF: free cash flow. ROE: return on equity. Software is represented by MSCI ACWI Software Index. Source: FactSet

The potential for enhanced returns in this area means it a crowded marketplace. Companies ranging from established incumbents to innovative start-ups have the ability to deliver very strong returns if their product can gain traction among users.

There are several ways to capture significant market share in software. One is to specialise in a particular industry or sector and serve that market end-to-end. The other is to provide a package with features that serve customers across a wide variety of industries.

Serving an industry end-to-end⁹

Case study: Adobe⁹

Creative software titan Adobe is a company that harnessed the cloud to turn around its business and become the preferred choice in the creative space.

Adobe's business is focused on creative software. Its products include: PDF Acrobat, Adobe Illustrator for graphic design, InDesign for print and digital publishing and Photoshop for photography.

Pre-cloud, the company operated with fixed licences. For about US\$2,000, users would buy a software package for two years after which time they would have to re-new the licence or stop using the product. This practise meant strong product cyclicalilty, created huge amounts of piracy and offered very little visibility of future revenue. At that stage, Adobe had 3 million clients globally (as at 2018).

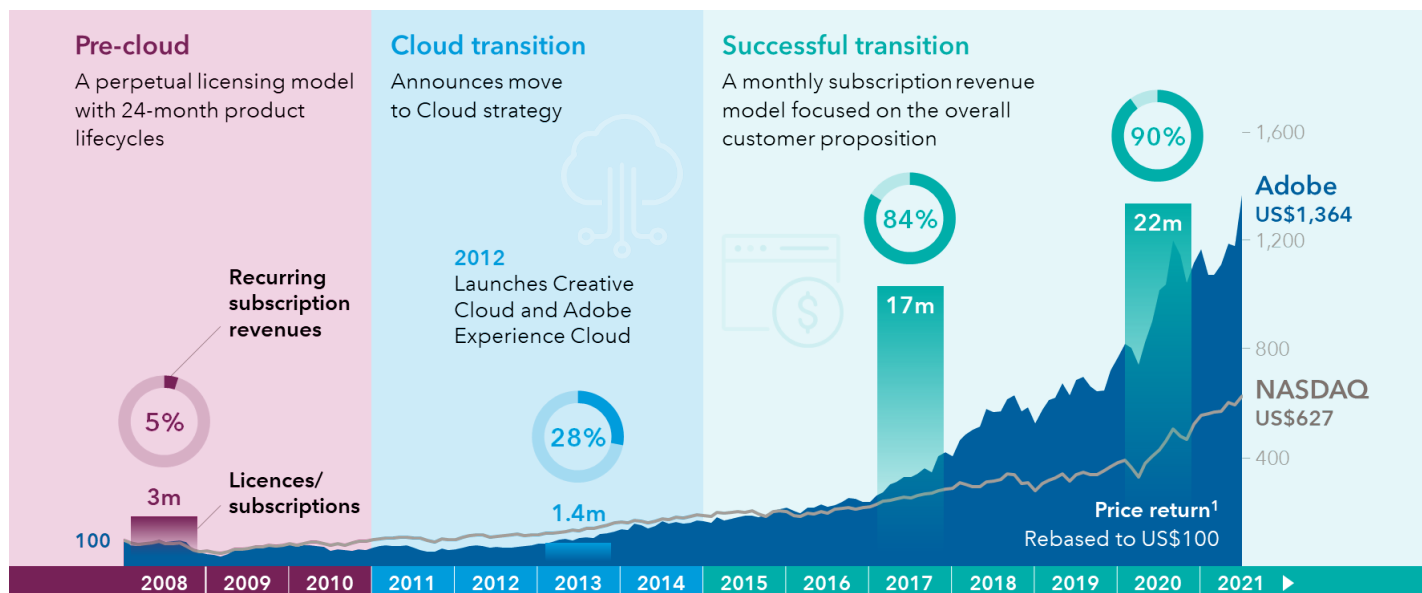
Just over 10-years ago, the company made the bold move to transition to the cloud. Its Creative Suite became the Creative Cloud. Moving to cloud meant that instead of an upfront fee, users would purchase a monthly subscription to the software package for anything from US\$10 to US\$50 a month.

This was not only much more affordable to the user, but also provided a better service because the software was continually upgraded as part of the package. For Adobe, it meant piracy was almost completely eliminated and it had much more visible and regular revenue streams. At 20-22 million, the company's subscriber base is now seven times larger than it was using the licence agreement - all by utilising the cloud as a distribution platform.

A combination of high-quality software and efficient distribution mechanism, Adobe created a software bundle so sticky, it was often too hard for users to migrate to a new product suite. Adobe has become the preferred software choice for the creative industry and is a good example of how a company can serve an industry end-to-end.

9. As at 30 June 2021. Sources: Adobe Inc, Capital Group

The cloud was pivotal to Adobe's successful business transformation



Past results are not a guarantee of future results. Example shown for illustrative purposes only.

Data as at 30 June 2021. Sources: Adobe Inc, Capital Group

1. Price returns shown are from 31 December 2007 and are in US\$. Source: Morningstar

Serving customer needs across industries

Industry specialisation is not the only route to success in software. In any industry, there are some standard business services, which software can address easily and efficiently. For example, Hubspot serves as a one-stop-shop for sales, marketing and customer support, while Ceridian offers a human resources platform. These software packages can be integrated with other platforms and give these companies access to customers across industries and geographies. Similarly, IT services company Shopify provides merchants with a multi-channel ecommerce platform.

There are a myriad of software companies offering innovative cloud-based solutions to address a range of problems and improve efficiency. The diverse and crowded nature of the software industry is where fundamental company research offers a major advantage in trying to identify investment opportunities.

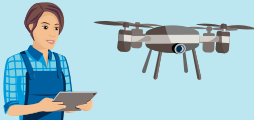



3. Beneficiaries of the cloud

While software infrastructure providers are concentrated in the relatively narrow space of information technology, the beneficiaries of cloud technology could exist in every sector, from traditional 'old economy' sectors like farming and agriculture to those engaged in the most cutting-edge innovation, like medtech and biotech.

The beneficiaries are the innovative companies able to harness the cloud's potential to disrupt their own industry, creating transformational growth that didn't exist before. More beneficiaries will continue to emerge as cloud adoption takes hold, but there are already tangible examples of companies tapping into the cloud's transformative power.

Transforming traditional industries

Cloud-enabled agricultural solutions can drive a significant leap in productivity, but they can also improve environmental outcomes. Some solutions include:

	Drone farming: A cost-effective way to monitor large areas of land, taking remote intervention if needed
	Smart crop and livestock monitoring: The application of smart-monitoring solutions to optimise irrigation, feed or medicine mix
	Autonomous farming machinery: Can be programmed to use precise, targeted and individualised interventions
	Smart-buildings and equipment: More efficient and effective maintenance that adjust to environmental changes, extending the useful life of farm equipment and assets

These changes offer incremental efficiency gains which have a material effect on improving farming performance. It is estimated that more than US\$500 billion in global GDP could be unlocked by agriculture connectivity by 2030.¹⁰

Big data driving gains in renewable energy

The fluid dynamics of wind turbines is a complex problem that mathematical formulas cannot solve with exact precision. However, big data – stored on the cloud – can be used to simulate what happens to wind around the rotors of a wind turbines to help optimise efficiencies.

Critical to the financial success of a wind farm is knowing how much to bid for a project. Engineers take into account the wake effect – the performance loss for a windmill that is downwind (in the direction of the wind) of another – to calculate the energy yield of a potential project. However, energy loss from the blockage effect – the performance loss for a windmill that is upwind (in the opposite direction of the wind) of another – wasn't fully appreciated until more recently.

Off-shore wind specialist Ørsted adapted its methodology for calculating turbine interaction loss, applying greater discipline in its project bidding process. Financial discipline, along with cloud-powered simulations to create predictive algorithms that optimise efficiencies, has helped the company to become a leader in offshore wind.

10. Forecasts shown for illustrative purposes only. As at 2020. GDP: gross domestic product. Source: McKinsey

Case study: Ørsted

How the world's largest offshore wind farm developer is harnessing cloud capabilities



Reduced run-time of simulations

From up to 30 hours to just 30 minutes



Real-time aggregation of data

1,300 wind turbines, each with over 1,000 sensors



Predict optimal operating conditions

Predictive maintenance and ongoing monitoring of wear and tear

Source: Ørsted, Capital Group

Pioneering medical solutions

The application of technology to health care has been well-recognised throughout the COVID-19 pandemic. A key reason that effective vaccines could be rolled out to populations so quickly lay in the cloud.

The ability to decode the DNA of the COVID-19 virus back in the 1990's would have taken months and cost around US\$1 billion dollars. This timeframe was dramatically reduced in the pandemic – almost instantaneous once the technology was in place – and cost less than US\$100. Once decoded, the COVID-19 DNA sequence was available on the cloud and immunology teams around the world could begin the task of finding a viable vaccine.

Cheap and fast DNA sequencing is transforming medical research

Cost of decoding DNA¹

1990s
US\$1 billion

2006
US\$14 million

2020
< US\$100

Time needed to decode DNA²

1986
6-8 weeks

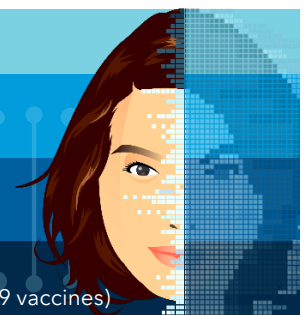
2010
4 hours

2020
Instantaneous

Improvements in delivery time for a new drug³

2015
9 years

2020
9 months (COVID-19 vaccines)



Data as at 30 June 2021, unless otherwise stated.

1. Sources: National Human Genome Research Institute (1990s, 2007) and MIT Technology Review (2020)

2. Sources: Chemical and engineering news (1986), ACS (2010) and Thermo Fisher Scientific (2020)

3. Data as at January 2021. Source: McKinsey

The application of cloud technology is not limited to the drug discovery phase. In COVID-19 clinical trials, big data was used to help select trial candidates and understand data that came out of the results.

Some biotech companies have capabilities around cloud computing and big data, but many will look for outsourced solutions. Thermo Fisher Scientific is well known for supplying instruments to the health care industry, but it also has an outsourced cloud capability where it has 40 exabytes of human genome data stored.¹¹ Offering this service to biotech companies allows them access to the transformational power of the cloud.

11. As at December 2020. XB refers to exabyte, a measurement of data. Source: Deloitte Insights, "Innovating R&D with the cloud"

Looking ahead

The cloud's power spans data storage, distribution platforms, big data analytics, machine learning and artificial intelligence. Identifying different investment areas within the cloud value chain can help more effectively flag the opportunities and risks for companies positioned to harness the power of the cloud.

1. The enablers are key in providing the mechanics that power the cloud's existence.
2. The solution providers unlock the power for users to access data platforms and analytics
3. The beneficiaries are harnessing the cloud to disrupt industry and create powerful growth potential.

It is the broad applications of cloud technology that mean it will be the lifeblood of the future global economy.

Risk factors you should consider before investing:

- **This material is not intended to provide investment advice or be considered a personal recommendation.**
- **The value of investments and income from them can go down as well as up and you may lose some or all of your initial investment.**
- **Past results are not a guide to future results.**
- **If the currency in which you invest strengthens against the currency in which the underlying investments of the fund are made, the value of your investment will decrease. Currency hedging seeks to limit this, but there is no guarantee that hedging will be totally successful.**
- **Depending on the strategy, risks may be associated with investing in fixed income, derivatives, emerging markets and/or high-yield securities; emerging markets are volatile and may suffer from liquidity problems.**

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