



Cloud Computing at an Inflection Point

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Key takeaways

- Information technology leveraging a Cloud infrastructure is becoming a central and strategic priority for most businesses. The structural shift to the Cloud changes the business model, revenue growth and margin trajectory for every IT company.
- The winners are likely to be the established HyperCloud infrastructure providers as well as software application companies with credible cloud-based strategies (SaaS). Most software categories are split between a few dominant players and a long tail of smaller vendors. This fragmentation creates a big opportunity for the largest SaaS vendors to gain share as some of the on-premise vendors are unable to successfully bring to market competitive SaaS solutions.
- The transition to the Cloud will put pressure on hardware vendors, infrastructure software vendors (besides the Cloud infrastructure providers) and select IT-service companies.

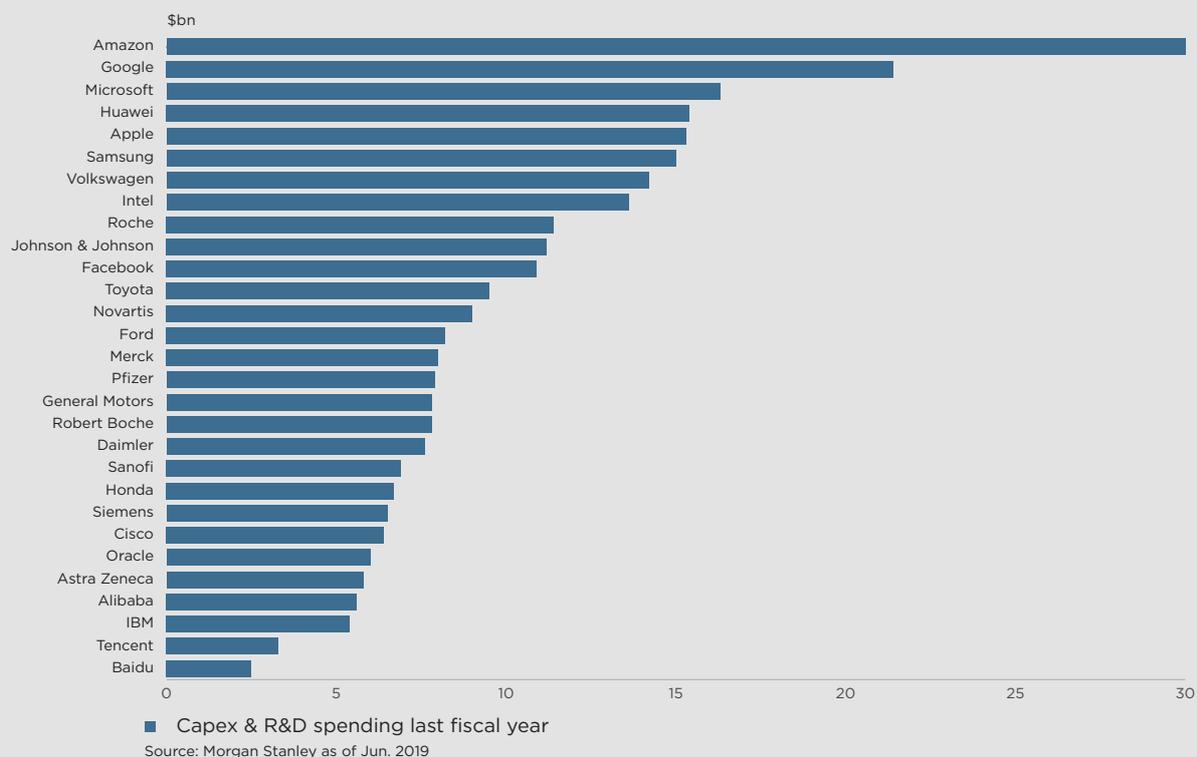
In 2016 we published a White Paper on Cloud Computing. There we concluded that the introduction of Cloud computing was entering a period corresponding to a hundred years ago, when centralized electricity production was introduced. As with the effects of electrification, we are about to see a real world impact everywhere from the adoption of Cloud computing. Lower barriers of entry for companies, access to best-in-class technologies for everyone and accelerating innovation and entrepreneurship leading to much improved productivity will have profound consequences.

In this follow-up paper we provide an update on the progression and try to assess how IoT, A.I. and 5G will grow symbiotically with the Cloud and argue that the Cloud will be the foundation for the digital transformation of enterprises as we enter the Second Machine Age. Information technology leveraging a Cloud infrastructure is becoming a central and strategic priority for most businesses. This is a fundamental change that will play out over many years.

The beginning of the Second Machine Age drives new investments

The central thesis of the so-called Second Machine Age is that the explosion of new digital technologies will drive a step-change in global productivity, at least equivalent to the Industrial Revolution (the 'First Machine Age'). The Second Machine Age is about the automation of knowledge work, thanks to the proliferation of real time, predictive data analytics, captured through the Internet of Things (IoT) – with an estimated 40 billion devices connected to the Internet by 2025 (Source IDC).

Figure 1: Spending on Capex & R&D



We have entered a period of reversion of globalization and rising anxiety about future growth as rivalry between major world powers escalates. As a result, there is skepticism about capex growth as companies - because of the reduced visibility - might scale back on investments. However, we see the opposite, but you must look outside the traditional areas of capex. Many of the largest companies are investing more than ever. As an example, Amazon has tripled investments from less than USD 10 bn in 2014 to 30 bn in 2018, see figure 1 above.



With many winners and losers in this transition, the underlying infrastructure providers (the HyperCloud companies) seem to be the safer bet when judging who will best capitalize on this shift.

We believe that the development of Second Machine Age technologies like robotics, industrial software, artificial intelligence, advanced communication, new mobility services, IoT hardware, semiconductors and the digitalization of the production chain are still in the early stages. While there will be many winners and losers in this transition, the underlying infrastructure providers (the HyperCloud companies) seem to be the safer bet when judging who will best capitalize on this shift.

The different segments of Cloud computing

Cloud computing has different levels of service provision. It is our view that the more basic levels of Infrastructure and Platform as a Service have now reached a sufficient degree of maturation whereby it is possible to identify the long-term winners. It is a completely different situation among the providers of Cloud-based software applications (Software as a Service or SaaS), where the market is still highly fragmented.

The market for basic Cloud infrastructure-service (HyperCloud)

The global public Cloud market grew 27% YoY to USD180 bn in 2018 and will continue to sustain a solid 20% annual growth to USD375 bn by 2022, according to IDC. The infrastructure part will expand the fastest at 30% per year driven by growth in servers, storage, data management software application platforms, data access, analysis and delivery applications.

American enterprises have embraced Cloud computing earlier than other regions, with Europe and China both lagging far behind. However, we expect China to grow faster and gain a larger portion of the market as it rolls out 5G networks and Chinese enterprises aggressively start to utilize the capabilities of its domestic champions like Alibaba Cloud, Tencent Cloud and Baidu Cloud. Currently two Cloud infrastructure providers dominate the market, namely Microsoft and AWS, with some distance down to Google and the other leading Chinese player, Alibaba.

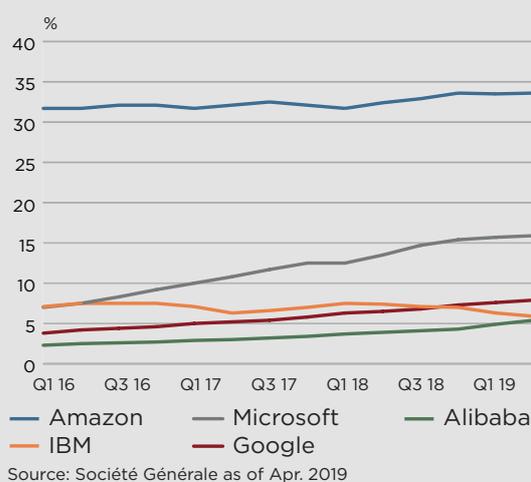


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It appears that HyperCloud computing is a “winner-takes-most” industry with customers typically having a main supplier and a backup provider. IT departments will balance dependence on a few providers with complexity and security, which will reduce the number of counterparties. Furthermore, the enormous amount of capital that it takes to run a global platform of data centers can only be financed by a select few of the largest and best capitalized companies in the world. Therefore, only a handful of Cloud infrastructure providers stand a chance of becoming long-term global players

in basic Cloud infrastructure offerings. Market shares might shift a bit, but the winners have been identified in Cloud infrastructure. Being “the inventor” of Cloud computing Amazon via AWS has maintained a strong market position while Google and especially Microsoft have gained significant market share, as seen below:

Figure 2:
Market share in basic Cloud infrastructure



Cloud-based software applications

It is a completely different story within Cloud-based software applications. Many years ago, entrepreneur investor Marc Andreessen famously quoted that “Software is eating the world”. This continues to be the case. The rise of Cloud-based software applications (SaaS) will only accelerate this trend and lead to previously successful on-premise software companies being eaten by more successful SaaS vendors.

Over recent years, we have seen several announcements of cooperation between Cloud providers and software companies as the software companies transition from a license to a subscription-based model which can bring new offerings more rapidly as well as scale to the market. For instance, SAP, Salesforce and Workday have partnered with AWS to run their respective products on the AWS platform. Large enterprises such as Lafarge Holcim and Royal Dutch Shell have started to upgrade their SAP systems directly to SAP S/4 Hana Public Cloud



running on AWS. This transition is having a profound effect on the software industry.

When running enterprise software applications on-premise, i.e. your own infrastructure, software accounts for approx. 20-25% of the total costs, hardware for 20-25% and internal and external IT services for the remainder (50-60%). As workloads move to the Cloud, software replaces most of the hardware spending as well as a portion of what was spent on-premise on internal and external IT services.

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Therefore, as a rule of thumb, the Cloud vendor's (compared to the on-premise vendor's) revenue increases by 2x to 3x, when workloads move to the Cloud.

The shift away from software on premise to the Cloud has a big effect on revenue for all providers of IT services. The total revenue that HyperCloud infrastructure vendors like AWS, Microsoft Azure and Google Cloud captures is significantly larger compared to what they could expect if the client stays on-premise. Infrastructure providers receive the hardware revenue, plus the infrastructure software revenue, plus a percentage of the service revenue that would otherwise go to the IT service companies.

Furthermore, it is important to note that most software end-markets are split between a few dominant players and a long tail of smaller vendors. As an example, in the Enterprise Resource Planning (ERP) market Oracle and SAP together account for approx. 35% of the total ERP market with the next set of players being much smaller.

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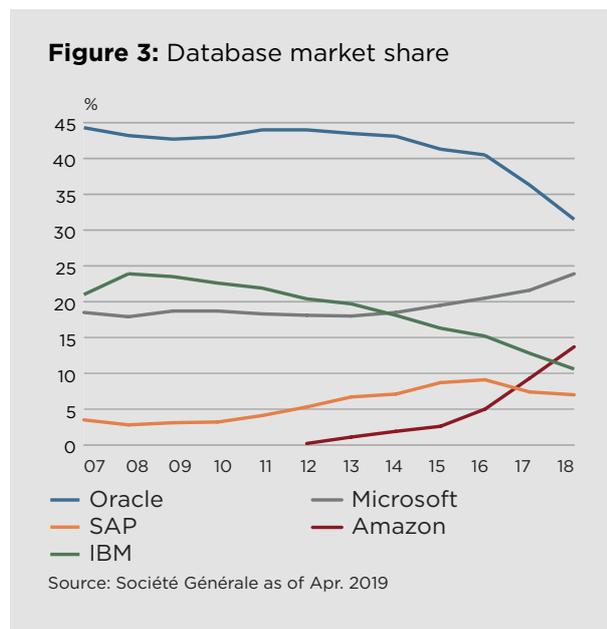
This fragmentation, which includes numerous vendors that do not have any significant SaaS business, creates a big opportunity for the largest SaaS vendors to gain share as some of the on-premise vendors are unable to successfully bring to market competitive SaaS solutions.





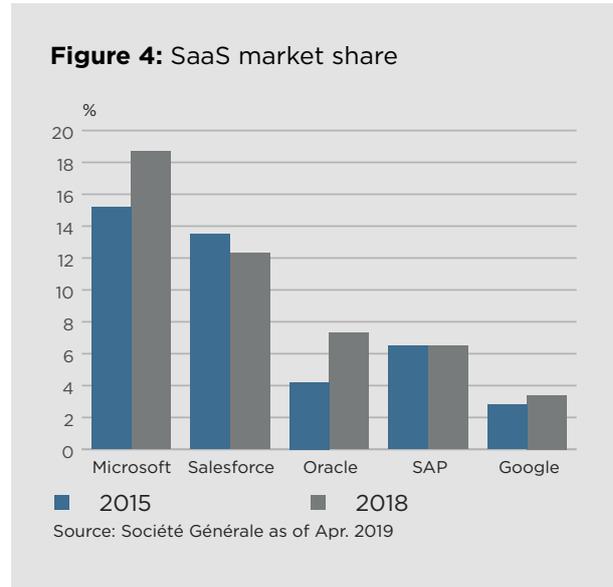
This fragmentation, which includes numerous vendors that do not have any significant SaaS business, creates a big opportunity for the largest SaaS vendors to gain share as some of the on-premise vendors are unable to successfully bring to market competitive SaaS solutions. Oracle is currently badly aligned with the HyperClouds and is losing market share in both infrastructure software and databases to AWS Aurora and Microsoft SQL and eventually SAP Hana as shown in figure 3. As an example, AWS has steadily gone up the value chain into the infrastructure software market, where profitability is higher. AWS is now the No. 3 vendor in the strategic database, effectively leveraging its leadership position in the public Cloud infrastructure market.

In general, the biggest overall losers in the shift to the Cloud will be hardware vendors, infrastructure software vendors (besides the Cloud infrastructure providers) and select IT service companies.



Strategic industry implications

In the longer term, the strategy of the HyperCloud companies is to build an integrated technology stack in the Cloud covering all aspects from infrastructure to software applications. Today, Microsoft is probably the only HyperCloud company that can claim ownership of the full stack, because of its strong position in



enterprise software – see figure 4. The other HyperCloud companies typically have weak SaaS offerings because software applications have never been their starting point. Going forward, we expect Cloud infrastructure providers to target investments towards development and acquisition of software as well as deepening cooperation with industry leading software companies.

There will be symbiotic growth between leading software companies and the HyperClouds. Transition to SaaS will lead to more demand for infrastructure Cloud services, and as the infrastructure part becomes even more competitive, more companies will transition to SaaS.

It is our view that Cloud growth will stay very strong and, furthermore, will be resilient to rising macro headwinds as 1) enterprises have for the last few years successfully tested Cloud architectures with less critical workloads and will in the coming years shift more critical applications to the Cloud, because of strong underlying business logic, and 2) the Second Machine Age requires HyperCloud computing power and advanced applications that can only be delivered from the Cloud. This is a generational shift with secular growth.

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We have a significant exposure to both leading cloud infrastructure providers as well as software companies exposed to the shift to the cloud.



What is HyperCloud computing

HyperCloud computing enables ubiquitous, on-demand network access to a shared pool of computing resources that can be rapidly provisioned. Cloud computing moves IT-infrastructure, platforms and applications to the internet, giving customers much greater flexibility. Some of the advantages are

- Flexibility to scale computing power to current demand
- Applications can be accessed via multiple platforms and across large geographic areas.
- No upfront fixed cost as customers are billed on usage
- Access to innovative and best of breed technologies such as security, AI, blockchain, biometric identification.



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