



## RESEARCH REPORT

March 25, 2019

# Cloud Computing Primer And the Cloud Goes Wild!

Without a doubt, cloud computing is one of the hottest topics in the TMT universe. Being the subject of massive hype, and with two of our U.S. holdings being major players in the space, the TMT team wanted to take a deeper look into the underlying technology and competitive dynamics of cloud computing.

Our research revealed that cloud computing, while experiencing extremely fast growth, may not offer as wide a structural moat as the team initially assumed. There seems to be little truly differentiating the key players in the industry, and companies are engaged in a vicious price war. Furthermore, the migration of computing and software from on-premise to the cloud is diminishing switching costs. Whereas companies used to experience strong vendor lock-in with their on-premise IT infrastructure and software products (e.g. Oracle software and server products), cloud services enable easier migration and interoperability. But despite pricing pressure and narrower moats, margins and growth rates remain extremely high as a result of nascency and general industry growth.

The TMT team now believes it has a sufficient grasp of the industry to make informed decisions on its holdings with significant exposure to the industry. This new knowledge will help the team as it moves to re-evaluate its holdings and re-weight the portfolio.

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## What is Cloud Computing?

Cloud computing is the delivery of on-demand computing resources over the internet. These services vary from servers, storage, databases, software, analytics and more, delivered on a pay-as-you-go basis. Cloud technology helps avoid up-front IT infrastructure costs and reduces operating expenses through the economies of scale achieved by large providers. Increased computing power, speed, lower downtime, and lower maintenance are among the benefits of cloud. Resultantly, an organization can increase their efficiency and productivity by opting to use these services. Cloud services may be limited to a single organization (private), be available to many organizations (public), or offer a mixture of both (hybrid). To understand how an organization uses the cloud, the primary cloud services must be explained. Most cloud services fall into the following categories.

### Infrastructure-as-a-Service (IaaS)

IaaS offers fundamental IT resources over the internet. Providers host the core elements of IT infrastructure such as hardware, servers, and storage, providing businesses the infrastructure to run their services. Businesses use this category for its flexibility. For

example, Instagram uses IaaS to access datacenters.

### Platform-as-a-Service (PaaS)

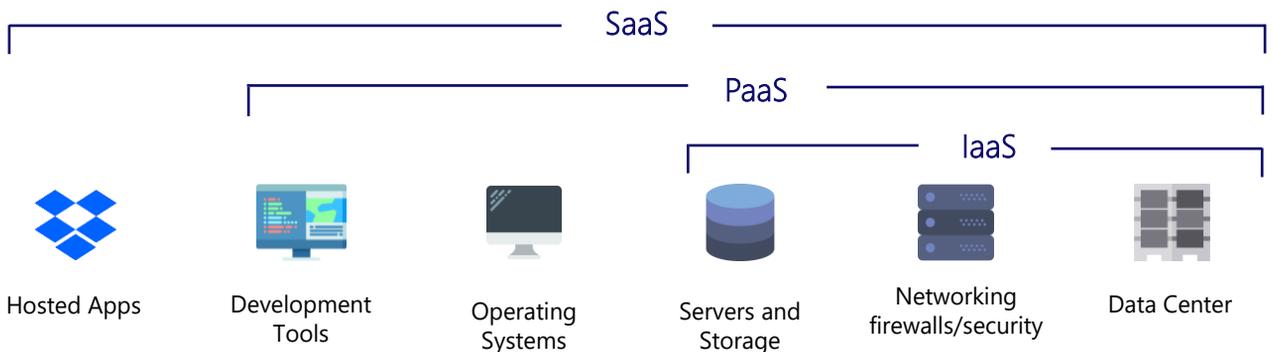
PaaS is a set of cloud-based services that enable users to develop, test, deliver, and manage software applications. PaaS increases developer productivity and efficiency, providing access to a variety of tools on-demand without a need to worry about managing the underlying server infrastructure, storage, network, and databases needed for development. Companies whose business model depends on continuous development and software maintenance usually employ PaaS services. A good example is Shopify, who employs Google Cloud Services to facilitate software development.

### Software-as-a-Service (SaaS)

SaaS offers users access to software that provides end-user solutions. Providers host applications and make them available to customers over the internet, usually on a subscription model. Most of the interactions individuals have with cloud services are through SaaS products. Dropbox, Outlook Online, and Google Apps are all SaaS products.

## EXHIBIT I

Cloud Computing Services Model



Source(s): Microsoft, IBM, Salesforce

## Why Choose the Cloud?

### Overview

Cloud computing allows a company to become more agile and adaptable. Moving infrastructure onto the cloud yields cost, speed, and reliability benefits with drawbacks primarily lying in the company giving up some amount of control over its computing environments. However, businesses are willing to accept this risk given the benefits outlined above, which are becoming increasingly valuable as the speed of innovation and doing business accelerates.

### What is Traditional IT Infrastructure?

Traditionally, data was stored and sent through IT infrastructure owned and operated by the company itself. Companies would purchase hardware and develop software tailored to their own business needs and set up the physical datacentres on-premise or at a separate off-site location.

### Why Traditional IT Infrastructure?

Some businesses have retained traditional IT infrastructure because it gives them full control over the storage and movement of their data. It typically takes an immense amount of time and resources to build dedicated IT infrastructure, and the opportunity cost of abandoning their existing infrastructure may not be worth the switch to cloud computing. These high switching costs may erode in the future as cloud computing technology advances drive adoption rates.

Some companies develop their own infrastructure for competitive reasons. For example, Dropbox, who previously used AWS, decided to bring their infrastructure in-house after assessing the costs and threat of Amazon moving into the file sharing space.

### Speed Differences

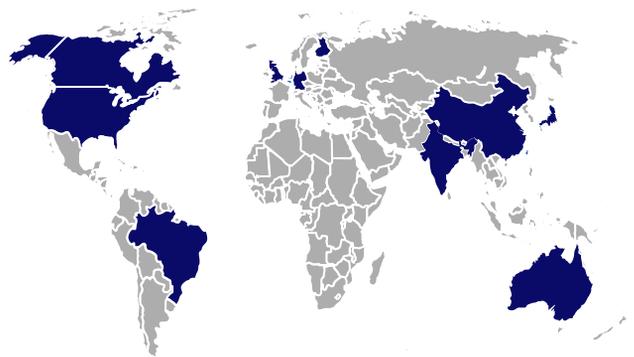
The speed at which data is stored and transferred through infrastructure varies greatly from business to business. However, cloud computing service providers offer customers an extensive global infrastructure

which standardizes and greatly reduces network latency. Compared to traditional infrastructure, cloud computing services typically see greater speeds in communicating data. For example, Google Cloud Services offers customers the same cloud computing capabilities that the company utilizes itself to manage its own products and services. Through this, customers are offered world-class hardware and software that are constantly being maintained and upgraded. It is extremely difficult for other companies to replicate this offering.

Cloud computing streamlines the internal operations processes that businesses would have to deal with if they decided to utilize traditional infrastructure. The time spent managing and upgrading their own servers would be eliminated if they relied on a third-party cloud service provider.

### EXHIBIT II

Google Cloud Datacentre Locations



Source(s): Google Cloud

## Why Choose the Cloud?

### Cost Differences

One of cloud computing's key differentiating factors is its elasticity of service offerings that allow businesses to instantaneously scale up or down their computing needs. Main providers in this industry such as Amazon Web Services (AWS) and Google Cloud are now offering per second billing, enabling customers to pay for only what they use. Cloud computing also eliminates the capital expenditure costs related to developing and managing both hardware and software of IT infrastructure that would be incurred if a company was operating on a traditional infrastructure.

Although building traditional infrastructure is capital intensive, there have been many instances where companies have found that internalizing their IT infrastructure would save money on the long run. Deep Value, a company that develops research-driven trading algorithms found that the EC2 service offered by AWS was 380.0% more expensive than running and managing their own servers.

### Reliability

As highlighted earlier, the global infrastructure cloud computing services offer typically exceeds in quality and speed compared to an individual business' internal IT infrastructure. The global infrastructure offers data access points across the world. When one datacentre falls offline, there will be many more to ensure that downtime for the client is minimized. Competitors in this industry offer uptime rates of over 99.9%, with emphasis on a strong, paid support staff to aid customers with their problems. The industry standard offers strong security protocols in data protection, with AES 256 bit encryption.

The primary concern for businesses is that by adopting cloud computing services, it is giving up a certain portion of control over data management and transmission. Downtime might occur and businesses cannot do much other than trust that their cloud service provider will attend to the issue as soon as

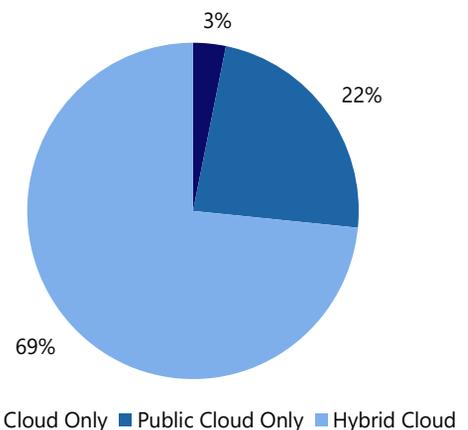
possible. Furthermore, there have been security concerns and data breaches due to error(s) on the cloud service provider's side. In 2017, human error by Amazon caused a major outage for clients on their S3 web hosting service, taking some of the most popular websites in the world down for over four hours.

### Conclusion

There is no "correct" decision when it comes to deciding between a public or private IT infrastructure. Cloud computing offers businesses immense flexibility, scalability and potential cost reductions. It is faster, more adaptable, and constantly innovating due to the healthy competition occurring within this space. Traditional IT infrastructure allows businesses to retain full control over their computing environments and how they transmit data, although typically more costly and slower to change. Most businesses find that the optimal IT infrastructure to power their operations lies somewhere in between cloud and traditional computing (hybrid).

### EXHIBIT III

Type of Cloud Infrastructure Adopted By Businesses



Source(s): Rightscale

## Investible Universe/Key Competitors

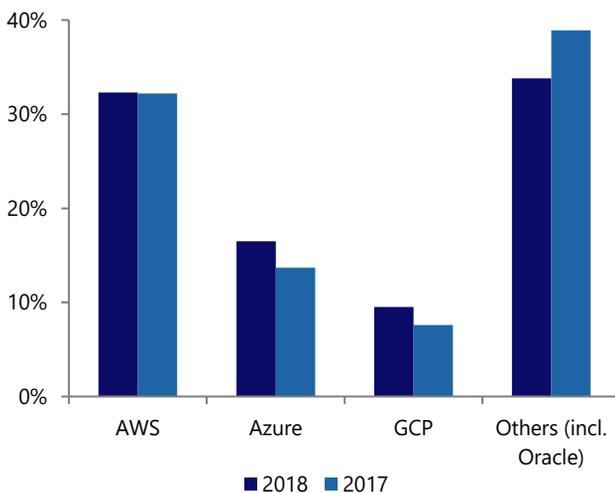
### Overview

The competitive dynamic within the cloud computing environment is an interesting one. With main players engaging in constant pricing wars, the industry is highly competitive yet still experiencing rapid growth, with a CAGR of 48.0% in 2018. Main competitors including Amazon Web Services, Google Cloud, Microsoft Azure, and Oracle Cloud are finding it increasingly difficult to differentiate themselves from one another as switching costs diminish and industry prices continue to fall rapidly.

All competitors offer very similar services to customers, with AWS and Microsoft Azure providing the greatest breadth of offerings. As major players focus on scaling their services, the offerings are becoming relatively commoditized with the value proposition communicated by firms being nearly identical. When assessing reliability, speed, and operational efficiency, the products are indistinguishable as they all hold nearly identical technical specifications.

### EXHIBIT IV

Market Share of Competitors



Source(s): Canalys Cloud Channels

### Amazon Web Services

AWS has reaped the benefits of their first-mover advantage. Starting in 2006, they were one of the first major companies to enter the cloud computing space. With a 32.0% market share in 2018, it is not penetrating further into the market but is enjoying healthy revenue growth as their sales increase with the cloud industry. AWS grew by 47.0% in 2018, in line with the growth of the cloud computing industry's 48%. AWS also contributes to a majority of Amazon's overall operating income, generating \$7.3 billion in 2018 compared to its North American and International segments generating a \$7.3 billion operating profit and \$2.1 billion operating loss respectively. AWS offers per second billing to its customers which consist of companies such as Netflix, Expedia, and Kellogg's.

### Google Cloud

Google has placed a focus on expanding global infrastructure as they grew from a 7.6% to 9.5% market share between 2017 and 2018. Being a late entrant relative to its competitors, the company is trying to leverage its massive advantage in the artificial intelligence and machine learning space in order to create a sustainable competitive advantage. Google Cloud also offers "Sustained Use Discounts", which discount their prices the longer a customer uses an instance on their servers. Google is also the first major public cloud provider to offer a tiered cloud network for its customers: premium and standard tier; with the former providing faster network speeds when transferring data. Google Cloud also offers per second billing to its customers which consist of companies such as Twitter, Target, and PayPal.

## Investible Universe/Key Competitors Continued

### Microsoft Azure

Microsoft's cloud business includes everything from Azure to Office 365 Enterprise subscriptions and LinkedIn services. It is often seen as the main competitor to Amazon's AWS, having grown from 13.7% to 16.5% market share between 2017 and 2018. The company is placing a strong focus on providing its customers services within the artificial intelligence and Internet of Things realm. Microsoft has been able to capture large retailers such as GAP who cannot partner with AWS due to competitive reasons. Additionally, the company is also pushing its Office 365 and Dynamics 365 services to enterprises that would increase the stickiness of its clients given the increase in switching costs. Microsoft's customers include Adobe, HP, and the Seattle Seahawks.

### Oracle Cloud

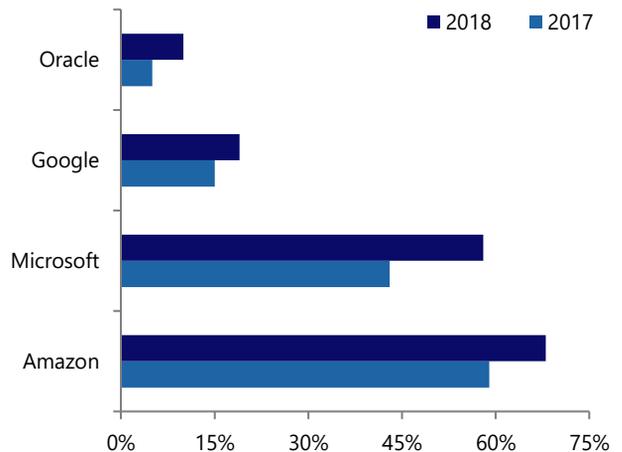
Oracle has considerably lower adoption rates in its cloud computing services when compared to the likes of Amazon, Microsoft, and Google. Oracle is a focused SaaS and Database as a Service (DaaS) provider, with a smaller scope of offerings compared to its competitive counterparts. The company has a lesser focus on PaaS and IaaS as it lost market share to Amazon in those segments. Oracle is focused on machine learning technology to make its cloud services more automated. This, coupled with its focus on DaaS is how the company hopes to differentiate itself and grow into a bigger player amongst its competitors.

### Differentiating Factors

As mentioned previously, none of these companies currently have strong sustainable competitive advantages that would insulate them from competition. Amid strong pricing wars, providers are focused on scaling operations by pushing other offerings (such as Google's AI and ML capabilities or Microsoft's productivity suite). Another differentiating factor may be brand name, with start-ups or small and mid-sized companies choosing a set of cloud computing solutions depending on what the "industry

### EXHIBIT V

Enterprise Public Cloud Adoption



Source(s): Rightscale

standard" is. The team's anecdotal experience and interviews with start-ups supports this view.

Amazon started as a pure IaaS and PaaS provider, slowly moving into the SaaS market now with large investment in that area. Google and Microsoft, however, have both started with SaaS as they have a large portfolio of software products and are now moving into the IaaS and PaaS fields. As major competitors try to tailor their services to satisfy the largest market possible, switching costs are lowering considerably and companies are able to switch between cloud service providers as they see fit more quickly. However, there does not seem to be any reason strong enough for a majority of businesses to make a switch. Businesses will continue to mix their portfolio of cloud computing services as necessary while key players within the industry try to leverage their other services to create and communicate synergistic opportunities with their cloud computing offerings.

## Investment Implications

Cloud computing is set to replace a significant portion of traditional IT infrastructure and products (on-premise servers, software, etc.). These traditional products, and their associated services (support agreements, upgrades, etc.), have been extremely profitable due to high switching costs (vendor lock-in).

As IT departments shift from legacy systems to the cloud, one might ask “Will the old moats remain intact?” Of course, the answer is unclear and complicated. Cloud computing is a young industry, and there is insufficient data to determine what the competitive and pricing dynamics are likely to be in the long-term. Analyzing current competitive dynamics can only reveal so much, given the pace at which the industry is evolving. However, it is the best we can do at the moment without making wild assumptions.

Cloud services have varying degrees of switching costs. For example, one can contrast file storage (such as Dropbox, Google Drive and OneDrive) with function-

as-a-service (FaaS) platforms (such as AWS Lambda and Azure Functions). There is very little effort, risk, and cost associated with moving files from Dropbox to Google Drive to OneDrive to any number of other file storage platforms. The file formats are all the same, and there is little friction in switching providers. Now consider AWS Lambda, Amazon’s serverless code execution platform, and Azure Functions, Microsoft’s equivalent. These platforms allow users to run code through the cloud and automate their execution. See the example provided by Amazon in Exhibit VI. These services have high switching costs due to their tight integration with vendor-specific APIs. Code execution is often automated, with certain functions being triggered by specified events (“triggers”). Triggers are generally configured using vendor APIs that communicate with the vendor’s other cloud services. For example, AWS Lambda can have triggers configured using Amazon’s API Gateway, specific AWS DynamoDB actions, or AWS S3 usage rates. This makes it extremely hard to switch providers.

### EXHIBIT VI

Generic AWS Data Transformation Workflow



Source(s): Amazon Web Services

## Investment Implications Continued

One additional factor that contributes to switching costs is data egress charges. Cloud providers generally do not charge a customer for data ingress (bringing data into the cloud platform), but they generally charge for egress (moving data out). This makes leaving the cloud, or switching providers, significantly more costly. Exhibit VII shows a comparison of data egress charges for the top three cloud providers.

Clearly, there is still room for switching costs in the cloud migration. However, it seems as though they will never be quite as strong or widespread as in the past. In fact, there is an entire sub-industry dedicated to eliminating switching costs. Containerization is a

process which enables developers to encapsulate or package applications into a “container” with its own operating system. Containerization helps improve code portability by, for example, eliminating dependencies. Improvement in containerization technology have enabled IT customers to pursue “multi-cloud” strategies, in which they utilize cloud services from multiple cloud providers. In essence, they reduce developers’ dependence on single IT providers.

### EXHIBIT VII

Top-Tier Cloud Provider Data Ingress/Egress Charges

Provider	Ingress Charge (/GB)	Egress Charge (/GB)
	Free	<ul style="list-style-type: none"> <li>• 1 GB-10 TB – \$0.09</li> <li>• 10-50 TB – \$0.085</li> <li>• 50-150 TB – \$0.07</li> <li>• 150-500 TB – \$0.05</li> <li>• 500+ TB – Contact Amazon</li> </ul>
	Free	<ul style="list-style-type: none"> <li>• 5 GB – 10 TB – \$0.087</li> <li>• 10-50 TB – \$0.083</li> <li>• 50-150 TB – \$0.07</li> <li>• 150-500 TB – \$0.05</li> <li>• 500+ TB – Contact Azure</li> </ul>
	Free	<ul style="list-style-type: none"> <li>• 0-1 TB – \$0.12</li> <li>• 1-10 TB – \$0.11</li> <li>• 10+ TB – \$0.08</li> </ul>

Source(s): NEF Inc.

## Portfolio Implications

### Outlook

Looking forward, the TMT team believes that cloud computing will not be a winner-take-all market. Containerization and open-source development is going to promote a multi-cloud environment, where customers can pick and choose the best functionalities from each provider based on their strengths (security, latency, AI, reliability, etc.).

The three largest, and best positioned, providers are currently Amazon, Microsoft, and Alphabet. While first-mover advantages are rarely true competitive advantages, there is value to being a pioneer in this market. The size of one's datacenter network, the compounding power of ML and AI, and developer familiarity with different ecosystems and APIs all fortify the incumbents' positions. While there is little to differentiate amongst incumbents, the barriers to new-entry overall are very high. The capital investment needed to build a dense datacenter network and

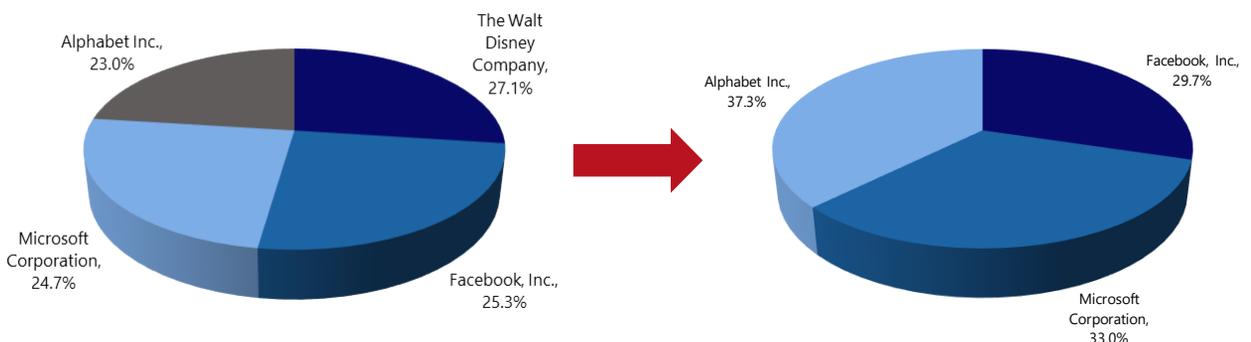
technological expertise required to build innovative products is immense. The market is large, and growing fast, giving each provider ample room to compete. Pricing pressure is high, but margins are still wide.

### Portfolio Movements

The TMT team is currently divesting from Disney, and will allocate 25.0% of the proceeds to increasing its Alphabet stake, with the rest going to cash. The Disney sale reflects our poor outlook for media and streaming. The decision to allocate a quarter of the proceeds to Alphabet was made based on considerations of the relative valuations and fundamental business quality and risks of the remaining holdings. The pro-forma weightings for the TMT U.S. portfolio are ~37.3% in Alphabet, ~33.0% in Microsoft, and ~29.7% in Facebook. The TMT team will re-weight the portfolio as market prices, our appraisal of intrinsic value, and general business developments occur.

## EXHIBIT VIII

### Pro-Forma Portfolio Weightings



Source(s): QUIC, S&P Capital IQ

## References

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1. Amazon Web Services
2. Canals Cloud Channels
3. Docker
4. DZone
5. Google Cloud
6. Google Images
7. IBM
8. Microsoft
9. Net Fiber
10. Rightscale
11. S&P Capital IQ
12. Salesforce