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**Executive Summary**

Cloud computing<sup>23</sup> has been the biggest and most disruptive force in the tech market over the past 15 years and adoption is accelerating. With approximately 90% of businesses using the

cloud to some degree (95%, according to RightScale's 2016 State of the Cloud Survey), it's safe to say the technology has become a mainstay in IT. The public cloud is generally the most well-known and straightforward type and, according to Forrester, offers the "purest expression of cloud's promise" of elastic scalability, self-service, and financial flexibility. Public cloud platforms take several forms, primarily IaaS (Infrastructure-as-a-Service), PaaS (Platform-as-a-Service), and SaaS (Software-as-a-Service), the most widely adopted of these. Forrester's definition of cloud combines elements of IaaS and PaaS, and generally, a natural continued blurring is occurring and is expected to persist.

Keeping in mind differences in segmentation and definition, major market research firms Gartner, IDC, and Forrester all predict healthy growth for the cloud market, ranging from 16.5% CAGR (Gartner) to 28.2% (IDC)<sup>151</sup> over the forecast period through 2020, although a flattening of yearly growth is also projected. Gartner's public cloud services forecast (June 2016) predicts revenue rising to \$382 billion by 2020. IDC (June 2016)<sup>151</sup> forecasts the public cloud IaaS market to more than triple over the next five years, from \$12.6 billion in 2015 to \$43.6 billion in 2020. Forrester (September 2016)<sup>57</sup> predicts that the public cloud market will reach \$236 billion by 2020<sup>127</sup>, growing from \$68 billion in 2014.

The market for cloud IaaS has consolidated significantly around the two leading service providers – AWS and Microsoft (#1 and 2, respectively) – that have separated further from the pack. AWS remains "in a league of its own," almost three times the size of its nearest competitor and with a clear lead. For full-year 2015, Synergy reports AWS share was 31%, followed by Microsoft (9%), IBM (7%), Google (4%), and Salesforce (4%). The dominance of the top vendors<sup>39</sup>, AWS in particular, is expected to continue in the next few years, but it would be hasty to count others out of the picture. Microsoft is seen as having come a long way in the cloud IaaS, and Azure is central to the company's "mobile first, cloud first" strategy<sup>54</sup>.

IDC marked 2015 as the beginning of large-scale enterprise interest in public cloud IaaS, and movement toward the cloud appears to be strong. Gartner has said that cloud computing will be one of the "most disruptive forces of IT spending since the early days of the digital age."<sup>56</sup> Top drivers of cloud adoption revolve around improving resource utilization and staff productivity, cost management, and analytics expansion. Barriers to cloud adoption remain, but they are shifting. Security is still top of mind to many, but it is not always the primary issue anymore. Lack of resources/expertise is now the #1 cloud challenge, according to a RightScale survey, and there are issues around integration<sup>53</sup> and overall confusion. Among key cloud computing trends<sup>28</sup> to watch are enterprise app migrations, microservice-based app designs, open source (including containers), and multi-cloud architectures.

This postgraduate dissertation aims to provide an extended description of the most popular cloud Vendors and their products and also make comparisons among them based on several criteria such as strategy, sales tactics, Go-to-Market approach and pricing. They will be also a focus on the economics of cloud, the pricing of the different cloud products and solutions available and the total cost of ownership for a customer to move to cloud.

## Περίληψη των κυριότερων σημείων

Το Υπολογιστικό Νέφος υπήρξε η μεγαλύτερη και πιο αναστατωτική δύναμη στην αγορά της τεχνολογίας τα τελευταία 15 χρόνια και η υιοθέτησή του από τους πελάτες επιταχύνεται συνεχώς. Με το 90% περίπου των επιχειρήσεων να χρησιμοποιούν το νέφος σε κάποιο βαθμό (95%, σύμφωνα με το 2016 State of Cloud Survey της RightScale), είναι ασφαλές να πούμε ότι η τεχνολογία αυτή έχει γίνει ένας κύριος άξονας της πληροφορικής. Το δημόσιο νέφος είναι γενικά ο πιο γνωστός και απλός τύπος και, σύμφωνα με τη Forrester, προσφέρει την "πιο καθαρή έκφραση της υπόσχεσης του νέφους" για ελαστική κλιμάκωση, αυτοεξυπηρέτηση και οικονομική ευελιξία. Οι δημόσιες πλατφόρμες υπολογιστικού νέφους παίρνουν διάφορες μορφές, κυρίως το IaaS (Infrastructure-as-a-Service), το PaaS (Platform-as-a-Service) και το SaaS (Software-as-a-Service), είναι οι πιο ευρέως διαδεδομένοι από αυτές. Ο ορισμός του νέφους της Forrester συνδυάζει στοιχεία των IaaS και PaaS και, γενικά, παρατηρείται συνεχώς μια φυσική μίξη και υπερκάλυψη αυτών, η οποία αναμένεται να διατηρηθεί.

Λαμβάνοντας υπόψη τις διαφορές στην κατάτμηση και στον ορισμό, οι μεγάλες εταιρίες έρευνας αγοράς Gartner, IDC και Forrester, προβλέπουν όλες υγιή ανάπτυξη της αγοράς του νέφους, η οποία αναμένεται να κυμανθεί από 16.5% CAGR (Gartner) σε 28.2% (IDC) για την περίοδο πρόβλεψης έως το 2020, ενώ προβλέπεται επίσης μείωση του ετήσιου ρυθμού ανάπτυξης. Η πρόβλεψη της Gartner για τις υπηρεσίες του δημόσιου νέφους (Ιούνιος 2016) εκτιμά αυξήσεις εσόδων στα 323 δισεκατομμύρια δολάρια έως το 2020. Η IDC προβλέπει (Ιούνιος 2016) ότι η IaaS αγορά του δημόσιου νέφους θα υπερτριπλασιαστεί στα επόμενα πέντε χρόνια, από 12,6 δισεκατομμύρια δολάρια το 2015 σε 43,6 δισεκατομμύρια δολάρια το 2020. Η Forrester (Σεπτέμβριος 2016) προβλέπει ότι η αγορά του δημόσιου νέφους θα φτάσει τα 236 δισεκατομμύρια δολάρια έως το 2020, αυξάνοντας από τα 68 δισεκατομμύρια δολάρια που είχε πετύχει το 2014.

Η αγορά για IaaS νέφος έχει εδραιωθεί σημαντικά γύρω από τους δύο κορυφαίους παρόχους υπηρεσιών - AWS και Microsoft (# 1 και 2 αντίστοιχα) - που έχουν ξεχωρίσει περαιτέρω από όλους τους υπόλοιπους. Η AWS παραμένει "σε ένα δικό της πρωτάθλημα", με σχεδόν τριπλάσιο μέγεθος σε σχέση με τον πλησιέστερο ανταγωνιστή της και με καθαρό προβάδισμα. Για ολόκληρο το έτος 2015, η Synergy αναφέρει ότι το μερίδιο της AWS ήταν 31%, ακολουθούμενη από την Microsoft (9%), την IBM (7%), την Google (4%) και την Salesforce (4%). Η κυριαρχία των κορυφαίων παρόχων, ειδικότερα του AWS, αναμένεται να συνεχιστεί τα επόμενα χρόνια, αλλά θα ήταν βιαστικό να υπολογίσουμε τους υπόλοιπους ως εκτός του παιχνιδιού. Η Microsoft θεωρείται ότι έχει προχωρήσει πολύ στο κομμάτι του IaaS νέφους, και το Azure αποτελεί το κέντρο της "mobile first, cloud first" στρατηγικής της εταιρίας.

Η IDC σημείωσε το 2015 ως την αρχή του μεγάλου επιχειρηματικού ενδιαφέροντος για το δημόσιο IaaS νέφος, και τη χρονιά όπου οι κινήσεις προς το νέφος φαίνονται πλέον να είναι ισχυρές. Η Gartner έχει δηλώσει ότι το υπολογιστικό νέφος θα είναι μια "από τις πιο ριζοσπαστικές δυνάμεις που θα επηρεάσουν τα έξοδα στον τομέα του IT από την αρχή της ψηφιακής εποχής". Τα κύρια κίνητρα για την υιοθέτηση του νέφους περιστρέφονται γύρω από τη βελτίωση της αξιοποίησης των πόρων και της παραγωγικότητας του προσωπικού, της διαχείρισης του κόστους και της ανάπτυξης των αναλύσεων. Τα εμπόδια στην υιοθέτηση του νέφους παραμένουν, αλλά μετατοπίζονται. Η ασφάλεια είναι ακόμα κορυφαίο εμπόδιο για πολλούς, αλλά δεν είναι πάντα το πρωταρχικό ζήτημα πια. Η έλλειψη πόρων / εμπειρογνωμοσύνης είναι τώρα η # 1 πρόκληση για το νέφος, σύμφωνα με μια έρευνα της RightScale, και υπάρχουν θέματα γύρω από την ενσωμάτωσή του και γενική σύγχυση. Μερικές από τις κύριες τάσεις του υπολογιστικού νέφους που αξίζει να παρακολουθήσει κανείς είναι οι μεταβάσεις στο σύννεφο των επιχειρησιακών εφαρμογών, τα σχέδια εφαρμογών μικρο-υπηρεσιών, οι υπηρεσίες και τα προγράμματα ανοιχτού κώδικα και οι εφαρμογές πολλαπλών νεφών.

Αυτή η μεταπτυχιακή διατριβή στοχεύει να παράσχει μια εκτεταμένη περιγραφή των πιο δημοφιλών προμηθευτών νέφους και των προϊόντων τους και επίσης να κάνει συγκρίσεις μεταξύ τους βάσει αρκετών κριτηρίων όπως η στρατηγική του προμηθευτή, οι τακτικές πωλήσεων του, η στρατηγική μάρκετινγκ του και η τιμολόγηση. Επίσης θα επικεντρωθεί στο οικονομικό κομμάτι του νέφους δηλαδή στην τιμολόγηση των διαφόρων διαθέσιμων προϊόντων και λύσεων νέφους καθώς και το συνολικό κόστος ιδιοκτησίας που απαιτείται για να μεταβεί ένας πελάτης στο νέφος.

## Industry Transformations

Through history, one of the most compelling catalysts behind industry transformation has been economic benefit. If you think about industry transformation, there are always barriers and significant resistance to change, but it's the economic benefits that come with change that have helped push innovation forward. If we use the automotive industry as an example, when the first horseless carriages were produced around 1900, they were first scoffed at being only ever available for the elite, with many economists saying that they were just a fad, and that people would continue to travel by horse. People didn't grasp the profound reductions in cost and complexity of operating them was, and their importance to daily life. The economic benefits seen in the transformation of telecommunications allowed operator models to transform into land line and phone booths, and now into the mobile megatrend we

see every day. IT Computing is going through that same industry transformation today, and although there are barriers, obstacles, and resistance to change, powerful economic benefits are compelling companies to review and take action on industry trends.

### Traditional On-Premise Servers

But before we talk about cloud, first let's take a step back to fully grasp where IT Computing has been over the last 10-15 years. Traditional IT was comprised of On-Premise servers. These were called traditional servers in the Client/Server model. Conceptually these worked just like PCs – there was an OS and there was an application running on them e.g. company's payroll application. And companies would incur large sums of money running their own data centers filled with Traditional Servers – facilities costs, hardware costs, Labor & Support. And these servers had an incredibly low utilization rate in the 5-10% range, with limited visibility into use or consumption.

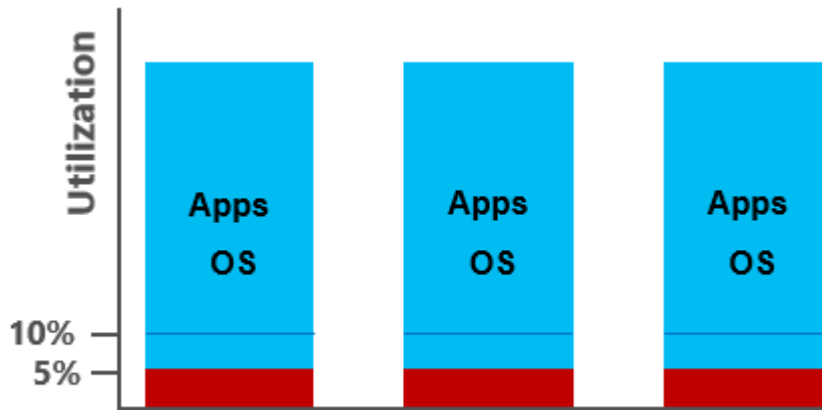


Figure 1: Utilization Rate on On-Premise Servers

### From On-Premise to Virtualization

Then came a trend that swept across the IT industry 6-8 years ago called **Virtualization**. **Virtualization** had a huge impact in reducing hardware costs significantly. Essentially Virtualization allowed you to take 1 server and run multiple environments on it. Each environment would have an OS and an application, and you could run different OS if you needed to, Windows in 1 (expense reporting), Linux in another (LOB application) and so on. So – you now have the computing capacity equivalent of 5 or 10 servers with just one physical server. This lets you consolidate into a much lower number of physical servers and as a consequence it has tremendous savings.

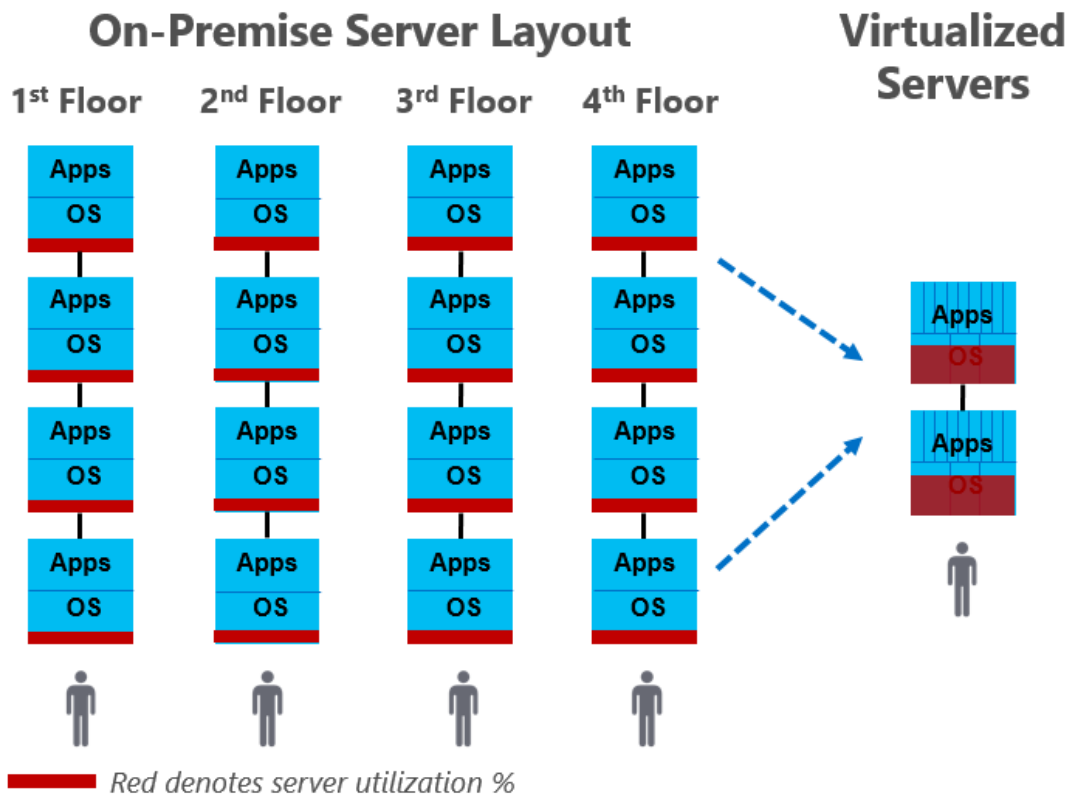


Figure 2: From On-Premise to Virtualization

### From Virtualization to Cloud

So, does Virtualizing mean moving to the cloud? Well, Virtualizing is part of cloud computing in that Virtualizing enables cloud computing. All Cloud Service Providers use virtualization to effectively manage costs, but Virtualization is not cloud computing in itself. So, the question is what differentiates Virtualization from Cloud Computing. First of all, I should mention that there is a lot of confusion about the term "Cloud". People sometimes say that they are in the cloud when they are having their own datacenter, or they are paying IT Services to a provider. None of those statements are accurate in and of themselves. According to Gartner, a datacenter solution is a Cloud solution if it comes with at least these two distinct capabilities:

- **Self-service:**  
That means that the service provisions storage and processing power on-demand. You no longer have to send a mail to your IT department, ask them for a server or storage capacity, then they order it and by the time you get it, it could be days or even weeks. You can do this yourself via an interface.
- **Elasticity:**  
And that means that the service can increase or reduce storage, network bandwidth, and compute capacity almost immediately. So, you don't have to always provision resources for the peak. You can flex them up and down based on the needs of your business.

Let's say you're a big retailer company, and you have a business model where July and February are 10 times greater than the volume of any other month due to sales, having IT Computing be elastic for these months means you don't have to buy Storage & Capacity at the 10x peak demand for the whole year.

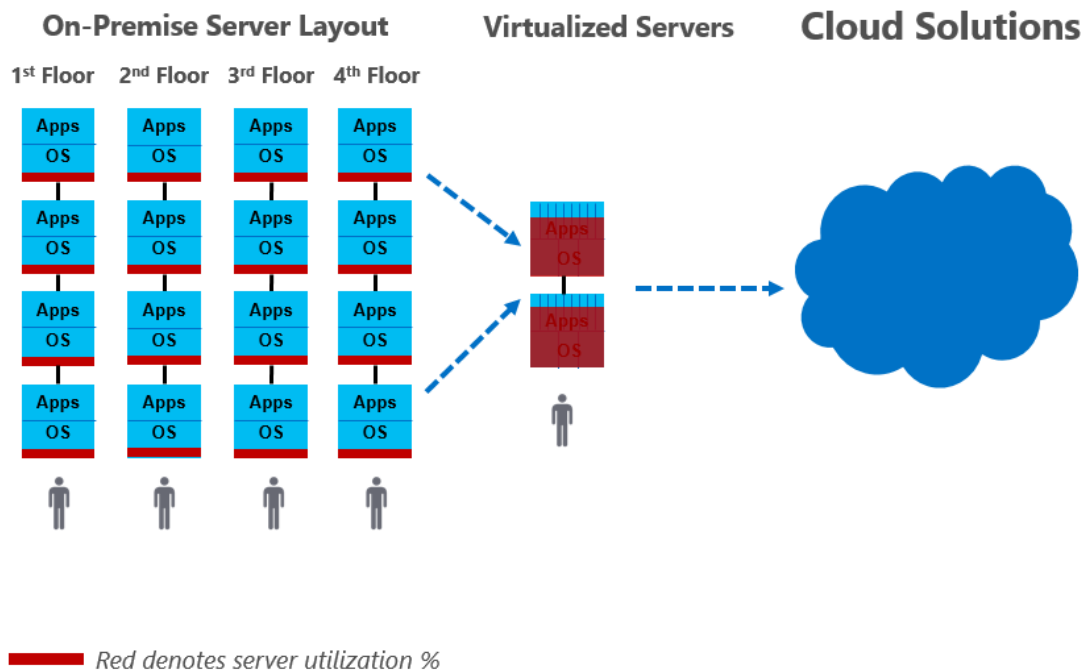


Figure 3: From Virtualization to Cloud

## Background

The generally accepted definition of cloud computing comes from the National Institute of Standards and Technology (NIST), which essentially says that “cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.” Gartner believes, however, that cloud computing will never have a universally agreed-upon definition because it means different things to different people.

Currently, cloud computing types are based on deployment models: private, hybrid, and public. The public cloud is generally the most well-known and straightforward type and, according to Forrester, offers the “purest expression of cloud's promise” of elastic scalability, self-service, and financial flexibility. The private cloud provides a higher degree of peace of mind for businesses concerned about knowing exactly where their data is stored and having complete control over it. The hybrid cloud allows for a “mix and match” approach, enabling the ability to pick and choose various elements from either the public or private cloud, or a combination of the two. While there isn't a specific industry or workload that universally makes sense for each type of cloud, there are certain considerations enterprises should take into account when deciding upon the right fit.

Public cloud platforms take several forms, primarily IaaS (Infrastructure-as-a-Service), PaaS (Platform-as-a-Service), and SaaS (Software-as-a-Service), the most widely adopted of these. With SaaS, a provider licenses an application to customers either as a service on-demand, through a subscription, in a “pay-as-you-go” model, or (increasingly) at no charge when there is opportunity to generate revenue from streams other than the user, such as from advertisement. PaaS is analogous to SaaS except that, rather than being software delivered over the web, it is a platform for the creation of software delivered over the web. IaaS is a way of delivering cloud computing infrastructure (servers, storage, network, and operating systems) as an on-demand service. Forrester's definition of cloud combines elements of IaaS and PaaS, recognizing the reality of application development in the cloud and generally, a natural continued blurring is occurring and is expected to persist.

The underlying concept of cloud computing can be traced back as far as the 1950s, however the origin of the term is unclear. References to cloud computing in its modern sense



appeared as early as 1996 in a Compaq internal document. Cloud computing on a large scale became possible as high-speed connectivity and bandwidth increased throughout the 1990s, and the concept has evolved through a number of phases. One of the first key milestones in cloud computing was the launch of Salesforce.com in 1999, which pioneered the concept of delivering enterprise applications via a simple website. Another early development was the formation of Amazon Web Services (AWS) in 2002, with the intent to offer a suite of cloud-based services. Other key factors that have enabled cloud computing's evolution include the maturing of virtualization technology and universal software interoperability standards.

## A Holistic View of Cloud Computing

For most people, the word “cloud” conjures up an image of massive datacenters run by global providers that are accessible via the internet. And this image isn't wrong—it's just incomplete. There's more to cloud computing than public clouds<sup>73</sup>.

Perhaps the best definition of cloud computing was created several years ago by the US National Institute of Standards and Technology (NIST). In this document, NIST<sup>67</sup> states that cloud computing has a set of essential characteristics, including *on-demand self-service*, *resource pooling*, *rapid elasticity*, and *measured service*. The NIST definition<sup>27</sup> also specifies several possible cloud deployment models, including *public cloud*, *private cloud*, and a combination of the two called *hybrid cloud*. As this definition makes clear, cloud isn't just a place—it's a model that can be applied in multiple ways.

## Private, Public & Hybrid Cloud

If you have these capabilities that were mentioned above **in your data center**, i.e. self-service and elasticity, then you have a true **private Cloud**.

If you consume **data center services for a fee** and the services include these capabilities, then you have a **public Cloud** solution.

And if you have a data center that doesn't include these capabilities, or you pay a fee to a provider who offers data center services that doesn't include these capabilities, then you still have a traditional data center solution. And then there is something called **Hybrid Cloud**. For most people, hybrid Cloud means I have some of my portfolio running in public Cloud and some of my portfolio in my traditional datacenter<sup>149</sup>.

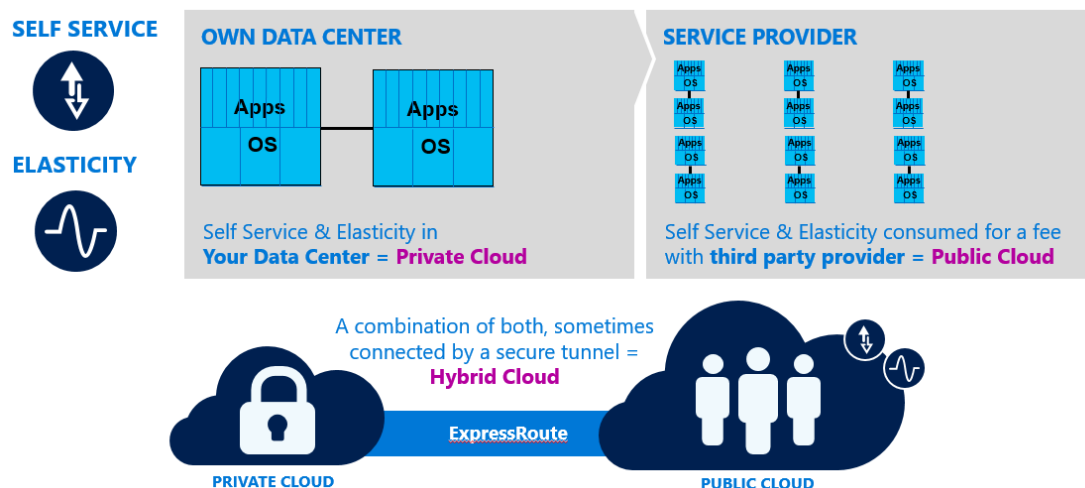


Figure 4: Private, Public and Hybrid Cloud

## Types of Cloud Service Offerings

Next few points that will be mentioned below are around types of Cloud service offerings. We all have probably heard of these terms before – so I will briefly reiterate and mention some examples.

- So, at the basic level we have - **Infrastructure as a Service (IAAS):**  
This is where the cloud service provider provides the Network, servers, and storage resources and you bring you own Operating System, your own Applications and data. In IaaS, you are basically you're out of the hardware business.
- Then we have **Platform as a Service (PAAS):**  
This is where in addition to providing the hardware, the vendor also provides the Operating System and you bring in your Application and data. Basically, you're out of the Operating System business, and you don't have to patch or upgrade, but you will need to develop, deploy, monitor and maintain your applications. One important thing to note is that your Applications will need to be re-architected to conform to the vendors OS – so there is some work involved.
- And finally, we have **Software as a Service (SAAS):**  
This is where the vendor manages the service end to end, for instance an email service. With on premise software it's the customer's job to deploy it and make it work; with SAAS it's the vendor's job to make it work.

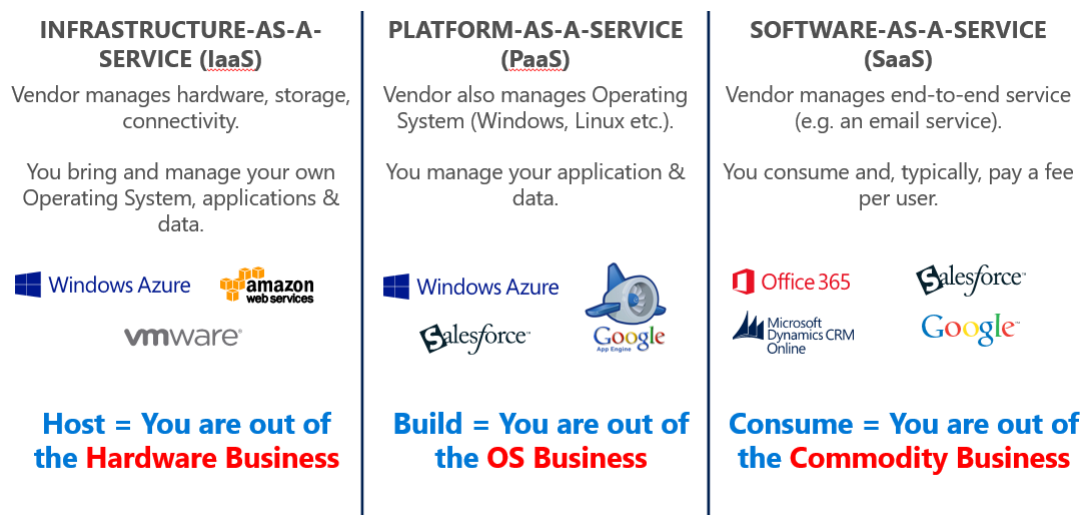


Figure 5: IaaS, PaaS, SaaS

## Cloud Services Offerings by Workload

In Traditional IT, you are managing all workloads. In a move to IaaS, you're out of the Hardware/Storage/Network workloads. In the move to PaaS, you're out of the O/S workloads and middleware. Then with a full transition to SaaS Cloud Solution, you're managing your applications and data in the Cloud, through a Self-Service provisioning and with rapid elasticity

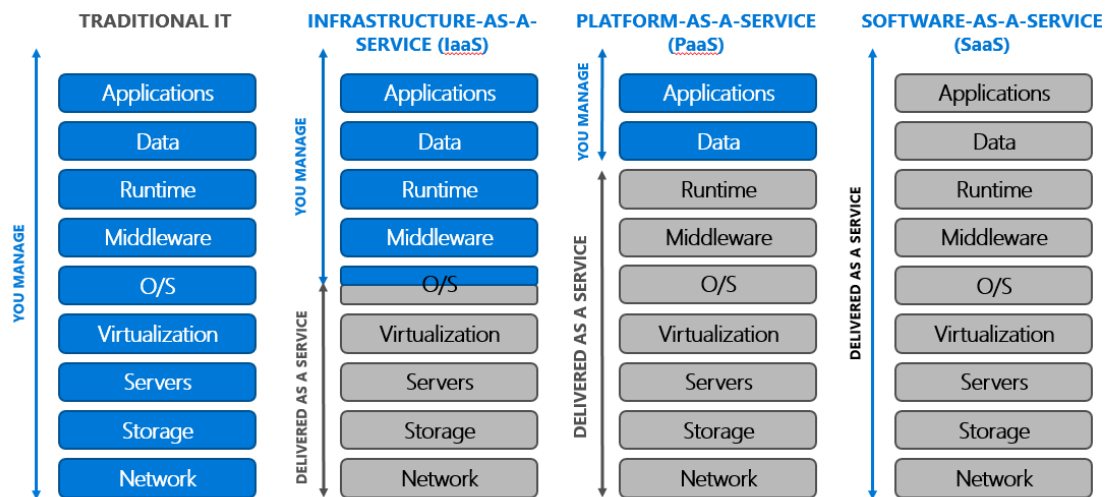


Figure 6: Cloud Services Offerings by Workload

## Digital Transformation

### Our Society and Technology

Technology is omnipresent and is playing an increasing role in everything we do. This access to digital services is shaping growth, disrupting industry landscapes and providing the catalyst for businesses to transform themselves e.g. through new business models, products, services and experiences.

Capitalizing on this phenomenon is the key to innovation and growth. From the rise of connected devices and other “things” within the Internet of Things (IoT), the growing mounds of data, and the emergence of advanced analytics, machine learning and artificial intelligence, to augmented reality and the next frontiers, the challenge and opportunity for business leaders is to harness the ubiquitous, disruptive force of technology to be more agile, fuel efficiency and ultimately shape their destiny. Naturally, this comes while navigating the expectations of a changing workforce, addressing evolving cybersecurity threats and managing a host of other challenges.

### Digital transformation is both inevitable and mandatory

Klaus Schwab, Founder and Executive Chairman of the World Economic Forum, defines the first three revolutions as: the transport and mechanical production revolution of the late 18th century; the mass production revolution of the late 19th century, and the computer revolution of the 1960s. He accepts that some people might consider the fourth revolution just an extension of the third but argues that the scale, speed and impact of the latest technologies mean they deserve a name of 4<sup>th</sup> revolution.

We are in the middle of another Industrial Revolution. After the revolution driven by steam power in the 18<sup>th</sup> Century, electricity in the 19<sup>th</sup> Century, IT and automated production in the 20<sup>th</sup> Century, this 4<sup>th</sup> industrial revolution is the Digital Era.

The first revolution helped humans mechanize production with steam power, followed by the second revolution which was enabled by electricity and brought on the era of mass production. The third revolution used electronics and information technology. The speed of current breakthroughs and the exponential pace of disruptive innovation now bring about a fourth industrial revolution - characterized by unprecedented processing power, storage, access to knowledge and the blurring of lines between physical, digital and biological space. It is a unique point in time, and it will fundamentally alter the way we live, work and relate to each other revolution of their own. “The changes are so profound that, from the perspective of

human history, there has never been a time of greater promise or potential peril”, Schwab asserts.

We can already see the impact:

- Number of employees working on teams has nearly doubled over the last five years. - *Microsoft: US Information Worker Survey, 2009 & 2014*
- 41% employees say mobile business apps are already changing the way they work - *CCS Insight's Employee Mobile Technology Survey, February 2015 (surveyed 1,200 employees in the US and five countries in Western Europe)*
- Information overload wastes 25% of workers' time costing the U.S. economy alone \$997 billion each year (as of 2010) – *published research by Basex, a member of The Information Overload Research Group; The Information Overload Research Group's Media Release Feb 3, 2011; Harvard Business Review 'Conquering Digital Distraction' June 2015*
- Over 160 million customer records have been compromised – *Identity Theft Resource Center (ITRC) Breach Report 2015*
- 229 days to detect security infiltration – *FireEye, Inc. 2014 Mandiant® M-Trends® report*

Every CEO and every company is resetting to make digital their top priority. Land that digital transformation is #1 priority for customers – top of mind for IT and business leaders alike.

With digital pervading everything, companies that quickly move beyond digital culture shock to create thriving digital cultures will have the advantage. True leaders will put people first, driving a cultural shift to exploratory "fail fast" risk-taking methods while looking at technology as the way to enable people to drive relentless change. To hasten the transformation and counteract potential destabilizing effects, companies are implementing digital strategies for their workforce to improve business outcomes and employee engagement.

This business disruption<sup>145</sup> is creating an opportunity for big IT vendors to be at the forefront of value creation for all the industries and companies around us. They have the opportunity to help customers create systems of intelligence around their customers, their employees, their operations and their core product and business model.

The results can be staggering:

- “Organizations mature in their journey with digital transformation generate an average of \$100 million more in additional operating income each year than those who lag behind.” ~Keystone Strategy interviews Oct 2015 – Mar 2016. (Based on interviews with 340+ leading enterprises comparing data platform maturity with business performance, controlling for company size and industry. Incremental operating income of \$100M is based on median company revenue of \$3.4B.)
- 25% of the world's economy will be digital by 2020. We are in the middle of a major technology revolution, specifically a digital revolution. *Digital is now dominating every sector of the economy (Accenture Technology Vision 2016. People First: The Primacy of People in the Digital Age. Gartner. January 1, 2016)*

## Digital Business

Digital business transformation has largely focused on operational efficiency. The potential is much greater. Gartner<sup>42</sup> defines digital business “*the creation of new business designs by blurring the digital and physical worlds.*” (<http://www.gartner.com/it-glossary/digital-business>). CIOs and other digital business leaders are now thinking about how they will reinvent their vision. Let's take a deeper look at some of the top CIO concerns and opportunities as they operationalize digital transformation.

Organizations need to ask and answer two key questions:

- How is your business being changed by digital technology?
- How is your core business model being changed by digital technology?

Answering these questions requires the mindset of a digital company, a way of operating like a digital company beyond procuring and deploying individual solutions – such as CRM, ERP or even office automation solutions – that is instead anchored on building systems of intelligence.

Digital business is evolving rapidly. The limit of what is possible continues to expand, changing economic models. Leading companies that embrace digital business could disrupt others and achieve unprecedented growth; however, CIOs are often unclear on the specific actions they must take to enable digital transformation and optimize digital business. The top three takeaways for IT Leaders are:

- **Organizations can't transform to digital unless people do:**  
Digitization and automation are outpacing the organization's skill level and the workforce's ability to become proficient with the new technologies. Eighty percent of organizations agree the difference between current workforce skills and future business requirements is very real. To ensure this trend doesn't disrupt an organization's health, IT leaders are introducing digital literacy strategies and increasing employee engagement in new technology rollouts. By 2018, 30 percent of organizations will formalize workforce digital literacy strategies to improve business outcomes and employee engagement.
- **Embrace digital-first to fast track transformation:**  
Moving at the speed of digital business means developing new skills, new processes, and whole new ways of working. CIOs are increasingly taking the lead in this digital shift by transforming IT from within with targeted investments. Agile and "secure by design" methodologies also come to the fore with DevOps models and practices, service-oriented architecture (SOA) and the cloud for scalability, software as a service (SaaS) for efficiency, architectures built for agility, and platforms for collaboration. The goal is to reengineer the business of IT, enabling delivery at the speed the business requires.
- **Harness information for break-through customer engagement and new business models:**  
Artificial intelligence (AI) can help organizations manage the explosion in data coming from smart machines, sensors, devices, and other sources. AI—in the form of automated features within popular applications—is already helping organizations combat information glut. These small steps are leading inevitably to a future where we rely on AI for daily assistance with mundane tasks. In the near future, AI will be used to identify and capitalize on new opportunities by innovating new products. Leading organizations will monetize their information assets and look for new business opportunities, fueling an information-driven economy<sup>31</sup> that is targeted at \$156 billion.

Digital transformation is relevant and can be pitched as a cost savings strategy to organizations in challenging economic situations, such as emerging markets, public sector, and countries struggling with economic recovery.

Many organizations are already behind the curve in terms of funding digital business. A looming economic slowdown further threatens organizations' abilities to make these investments. Here are some on the top things that every business leader should know about the cost of digital business:

- **Digitalization drives down costs:**  
Forward-thinking enterprises are using digital platforms, automation, and algorithms to drive down costs. Platforms are being used to reduce delivery timeframes, test new products and services at a fraction of the cost, and be more efficient in a wide range of areas, from human resources and supply chain to R&D, IT infrastructure, and

customer relations. McKinsey reports that digital labor platforms can increase output by 9 percent and reduce employee-related costs by 7 percent. Big data analytics in healthcare and government could produce some \$150 billion to \$300 billion in cost savings—and even bigger returns in the form of health, more effective public services, and improved quality of life.

- **Investments in innovation pay off in efficiency:**

Improvements in information technologies are outstripping the traditional focus on operational cost savings. Today, operations department dominates global IT budgets, accounting for 57 percent of overall spending. Interestingly, only 16 percent of spending targets business innovation. However, forward-thinking IT leaders are deploying technology solutions to save money in operations and other areas of their companies. Governments around the world are also beginning to realize tremendous cost savings of innovative technology solutions; the United Kingdom, for instance, estimated that Gov.uk saved £42 million (\$63 million) by reducing wait times and lowering costs. The next wave of major cost savings will come via automation. By 2020, artificial intelligence-enabled efficiencies are expected to total \$60 billion in savings for US enterprises.

- **Future-ready the workforce through digital literacy:**

As robotics and automation continue to make inroads in workplaces, leaders in the private and public sectors need to work together to ensure healthy business and labor environments. Technologies are moving faster than the expertise needed to exploit them can be disseminated to the workforce, and by 2025 digitization is expected to displace up to 12 million middle-skill workers. To accelerate development and promote efficiency, a broader view is needed promoting digital literacy, increasing awareness of digital tools, and encouraging their adoption by consumers and workers.

## The cloud platform for digital transformation

Both the challenge and opportunity for business leaders is to harness the disruptive force of technology to be more agile, fuel efficiency and ultimately shape their destiny. Businesses can use cloud as a mean to achieve digital transformation because it provides app innovation, data and intelligence, flexibility and security.

Whether an organization has been around for a few years or a few decades, the cloud is perceived as a strategic investment to help save technology costs, innovate quickly, grow at global scale, and test new business models.

However, cloud maturity and adoption amongst organizations varies wildly, and technical leaders need assurance that the solutions they choose to invest in have longevity, breadth, leadership status across different capabilities, and provide a simple experience to ramp up and use.

Cloud computing's as-a-service model has become a key enabler for successful digital transformations as IT departments/organizations are tasked with enabling a new range of services, millions of users and the skyrocketing amount of data.

We are witnessing the arrival of a new age, one in which the cloud serves as a key delivery model for IT and business innovation. Cloud computing is becoming the rule and not the exception. People now ask less about “why the cloud” and more about “why not the cloud?”. The cloud offers a lot for less with benefits including cost savings, simplicity<sup>68</sup>, scalability, availability, business continuity, disaster recovery, centralization, and improved privacy, compliance, and security.

Within this cloud megatrend, the IT focus has shifted from individual solutions to a full suite of services delivered through a single platform. Many CIOs view technology as a service (cloud) will have a profound impact on their roles and their organizations ability to meet

customers' needs. This business transformation will impact processes and IT infrastructure enabled by the cloud.

## **Current drivers, challenges and the opportunity presented by digital transformation**

Technology is shaping how businesses plan for innovation and growth within their markets. The importance of digital transformation is urgent; Since 2000, 52% of Fortune 500 companies are gone due to digital disruption.

We see companies responding by creating digital strategies across four core areas: engaging their customers, empowering their employees, optimizing their operations, and transforming their products.

Everyone is aware of how important this is. Let's take a look at a company like Uber for example. They've created a digital model for the taxi industry that has allowed them to surpass every other taxi company by at least double in valuation (most recently valued at \$62.5 Billion). They've created a significant shift in an industry that has been largely untouched for decades.

Previously businesses designed, built, produced and shipped a product, then customers bought it. That was the end of the cycle. Now organizations are building in continuous feedback loops – sensors in product, after-market services, customer feedback from a variety of channels.

Transformation requires a new way of thinking about and architecting rich systems of intelligence. And it isn't simply about technology, systems of intelligence represent the combination of technology, people and process that enable these feedback loops, and define an organization's competitiveness and ability to change the entire landscape of the industries in which it participates.

Systems of intelligence represent the digital feedback loops that help a company draw better insight out of data and convert it to intelligent action – engage with its customers, empower its employees, optimize its operations, and reinvent products and business models.

Every organization can achieve more through digital transformation:

- Organizations can build better and stronger engagements with their **customers** by harnessing data representing a complete view of their customers, then drawing actionable intelligence, predictive insights that can deliver personalization at scale. Business leaders are turning their focus to improving customer engagement by investing in the latest emerging technologies, such as Internet of Things (IoT), smart machines and sensors, computer vision, digital agents, bots, and language and speech recognition.

Organizations will need to balance the flood of new customer data available with securing and maintaining user trust in order to deliver a new wave of deeply contextual and personalized experiences.

- Organizations can also empower their **employees** with tools that fuel collaboration and productivity, while mitigating the risks that come with providing freedom and space to employees. After all, mobility is one tool that has shaped individual communications and productivity.

Business metrics have moved from static spreadsheets to living, dynamic dashboards with visualizations customized to users. And social conversations continue to grow inside a company, enabling the real-time analysis of employee sentiment and for feedback to be captured during presentations and other meetings. Moreover, the entire organizational effectiveness can be shaped through technology by reasoning over the data, the digital artifacts and the footprint of how people

communicate. This can inform things like how you should organize, how you should conduct meetings.

- It is also possible for organizations to optimize operations in order to reshape customer relationships and service models by gathering data across a wide, dispersed set of endpoints, and draw insights through advanced analytics that can be used to introduce improvements on a continuous, real time basis.

Arguably this is something software companies have done historically, but now organizations in manufacturing, retail and a host of other industries can have the same approach. They can even apply machine learning against the previously untapped potential of the data to anticipate and solve customer issues before they become issues.

- Organizations are given the opportunity to **transform or reinvent their products, services and business models** using digital content to capitalize on emerging revenue opportunities.

Analyst firm Gartner forecasts that by the end of 2016, 30 percent of businesses will have begun monetizing their information assets, which is fueling an information-driven economy targeted at \$156 billion<sup>12</sup>. This transformation by businesses is something we're seeing globally across industries and sectors. (Mike J. Walker, et al. Top 10 Strategic Technology Trends for 2016: Information of Everything. Gartner. February 26, 2016.)

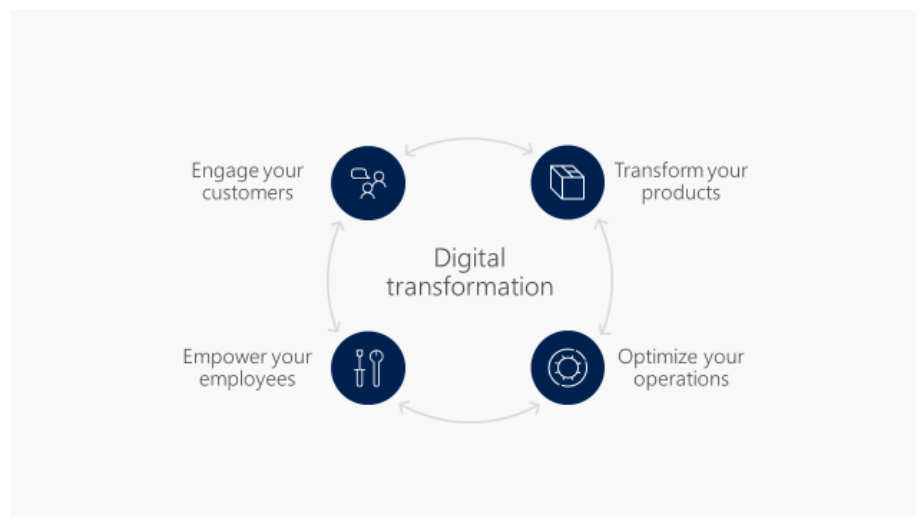


Figure 7: Technology drives digital transformation

## Implications of digital transformation

So, why is this transformation important? Let's take a look at the next few years.

In 2020, 1 million new devices are expected to come online every hour. The connectivity between people and data is creating billions of new relationships that are driven not only by data but by algorithms that keep customers engaged and buying. (<http://www.gartner.com/newsroom/id/3142917>)

In 2020, the average age of a Standard & Poor's 500 corporation is expected to be 12 years old. Compare that to the S&P 500 in 1960 when the average age was 60 years old<sup>44</sup>.

(<https://salespop.pipelinersales.com/crm-sales-software/interview-r-ray-wang-author-of-disrupting-digital-business/>)

By the year 2025<sup>40</sup>, at least 60 percent of computing will be cloud-based, due to "everything-as-a-service" shifting fundamental changes in the IT industry.



(<http://www.mesaaz.gov/Home/ShowDocument?id=11869>)

For digital transformation, mobility is the universal catalyst and cloud is the great enabler.

How are companies planning for digital transformation? Do they have the right people and the right technology in place to build their digital vision? How can they use technology to shape their future?

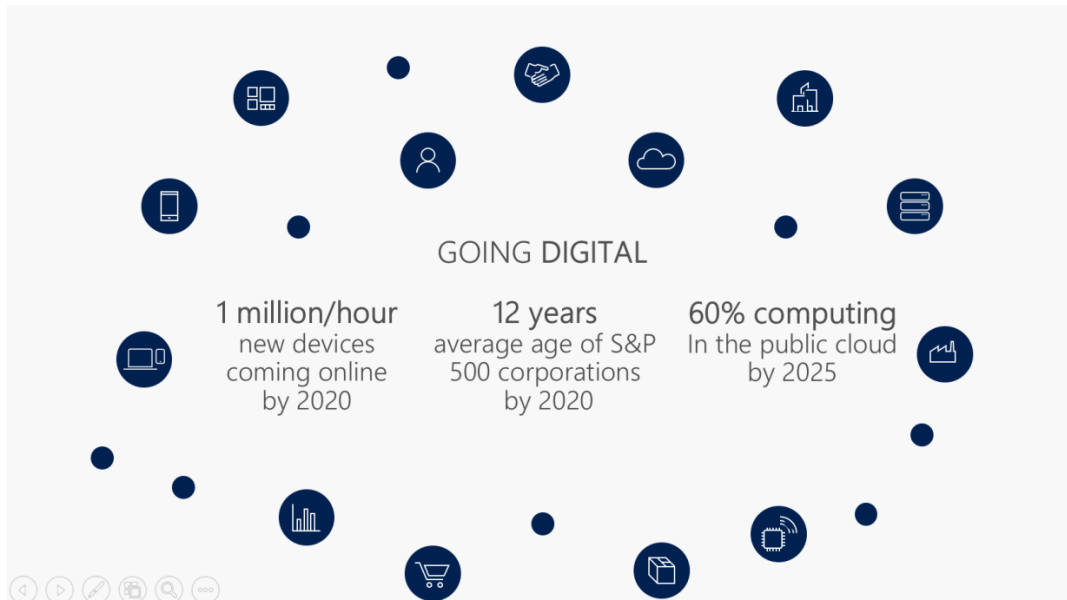


Figure 8: Importance of Digital Transformation

### Digital transformation competitive landscape

The Digital transformation conversation has many layers, and each layer can lead to a different competitive conversation. IT Vendors that want to compete each other, need to make sure they're having the right conversation depending on who they're talking to – business decision makers or IT decision makers. Digital transformation is a top priority for every CEO and it's a business conversation per definition, but CIOs are best-equipped for the digital world and will be the natural owners.

At the very top level, some companies will focus on “digital business” while others will focus on “Digital transformation,” depending on their area of expertise and how they want to land their value proposition.

Some companies will offer services around digital strategy and business transformation, while others will offer digital solutions or just technology platforms. Other companies will offer a more comprehensive service by their own or working with their partners.

The Digital transformation umbrella will be divided into smaller conversations around specific customer business themes. Most vendors have selected customer-centric themes but other competitors can group their offerings around different ones while other competitors will include non-digital business products and services under the Digital transformation umbrella by just adding the “digital” adjective.

Some of the technologies that will be used in a digital business are so disruptive that they could be the starting point of a Digital transformation conversation like Internet of Things, Big Data, Predictive Analytics, Cloud, Digital Marketing, etc...

Finally, as companies move their digital businesses to the cloud and transform their businesses by selling digital assets or services, some key underlying attributes like security, privacy, compliance, or even hybrid IT will be key differentiators, too.

To review the competitive landscape we will group these layers into 3 levels of service that will resonate with any company interested in digital transformation:

- A business level where they will expect services around digital business strategy and business model development and disruption.
- An industry level with industry-specific digital solutions.
- And a technology level with technology platforms and solutions for digital businesses.

A comprehensive Digital transformation offering should include these 3 levels - 1<sup>st</sup> party and/or 3<sup>rd</sup> party.

Let's have a look at the Digital transformation competitive landscape.

Amazon positions itself as “The biggest digital company” and will leverage its reputation reshaping the retail industry and ecommerce strength. But Amazon Web Services is a technology player that offers cloud platform technical solutions but lacks industry focus right now.

Salesforce focuses on key horizontal digital solutions: sales, services, and marketing. They are adapting them for specific industries through ISV solutions promoted in their AppExchange marketplace. They try to push their offering downward with App Cloud, Force.com, and Heroku and upward by adding some consulting companies and system integrators in their partner network.

Google is a technology platform player with no industry solutions.

SAP will leverage its industry strength, its next-generation business suite SAP S/4HANA, and SAP Digital Boardroom to help their customers manage their digital business. They have created a new digital business unit, SAP Digital, and hired a chief digital officer to manage it.

IBM has strong branding and storytelling across target industries and scenarios with IBM Watson. They have vertical expertise and large presence in key accounts. They will leverage the IBM Global Services arm to make the Digital transformation real for their customers. They will also leverage key alliances to extend their solution value like their alliance with Apple for devices and Cisco for IoT.

Oracle has a strong industry offering and presence and a strong sales, services and marketing offering. They were late transitioning to the cloud but they are catching up, although they can't compete with Amazon, Google, IBM<sup>128</sup>, or Microsoft.

Microsoft is rapidly adding vertical industry scenarios and ISV solutions to its leading technology platform and is working with top global system integrators to have a comprehensive offering.

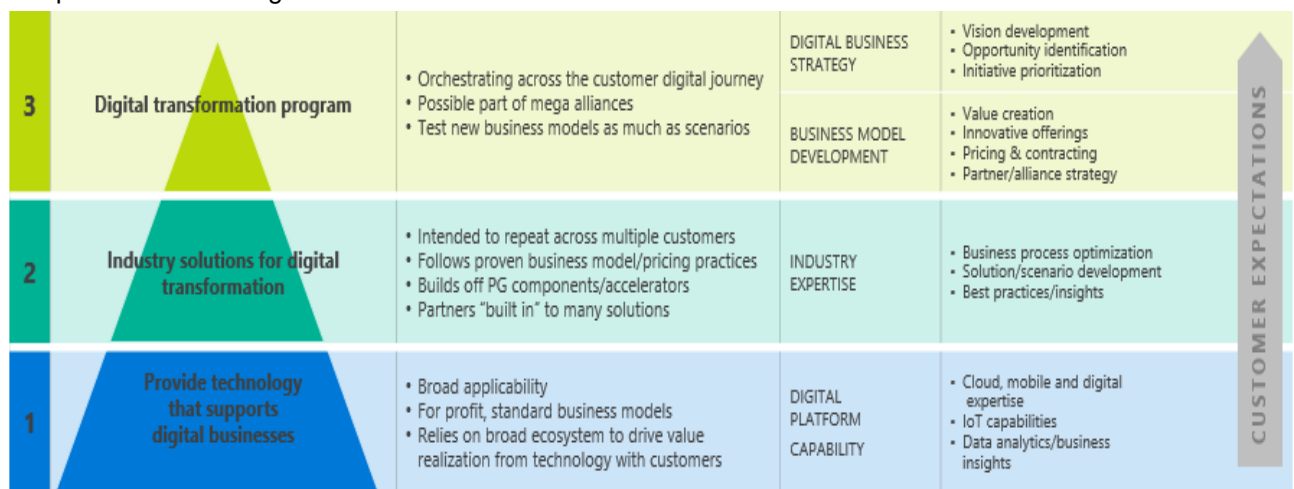


Figure 9: Customer Expectations for Digital Transformation

## Why Companies are making the transition to the Cloud?

So now that we've talked a little about What Cloud Computing really is, let's switch over and talk about Why Companies are making the transition to the Cloud.

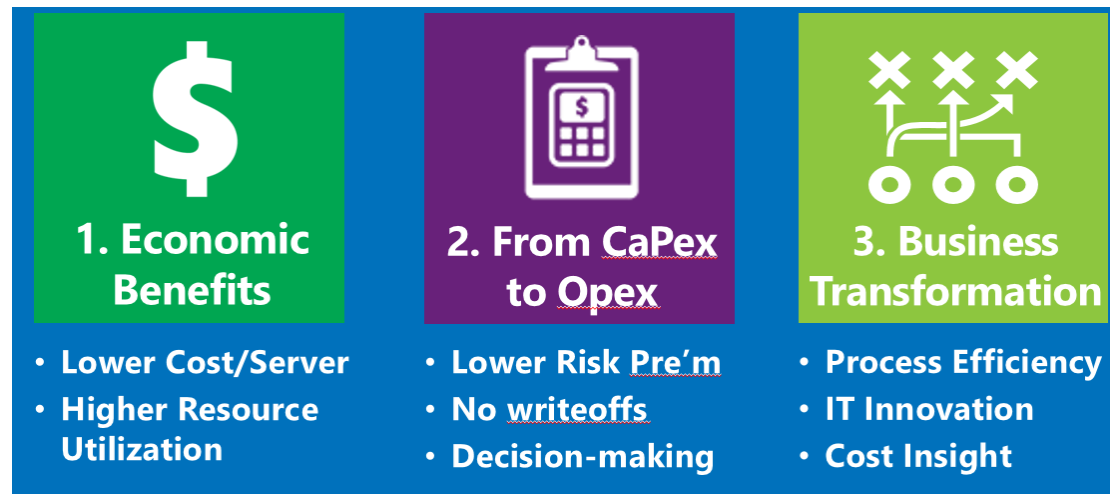
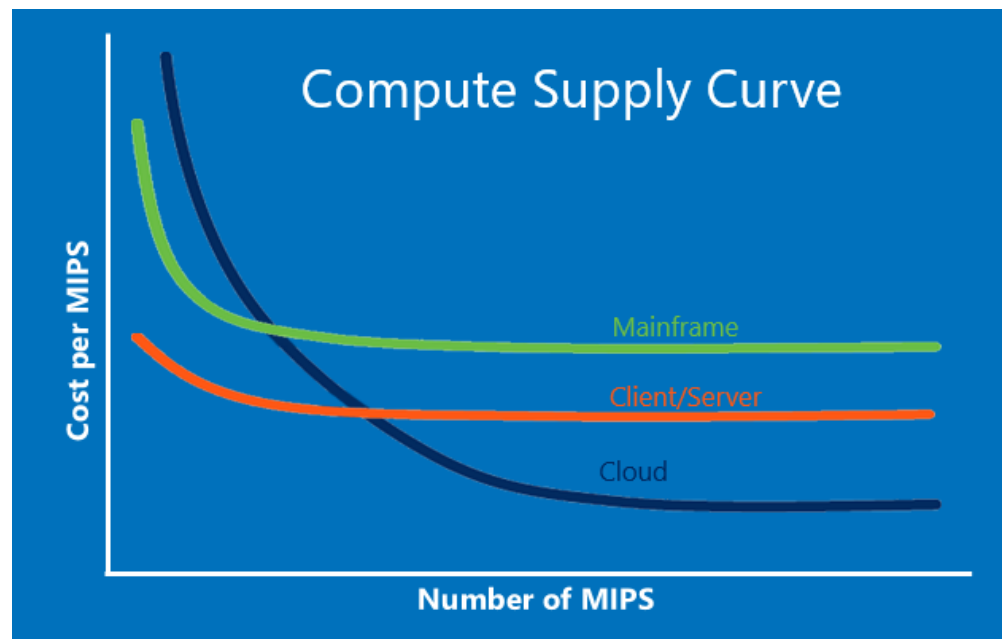


Figure 10: Why Cloud Computing?

- The **first**, and most obvious reason, is the **Economic Benefits** that Cloud Computing entails. There are two key pieces of Economics that we're going to cover:
  - **Supply-side Economies of Scale:**  
Lowering the total cost of IT through Economies of Scale of Cloud datacenters. Customers have the ability to drive to a lower cost per server or lower cost per unit of Compute the amount of money they are currently paying (how much am I paying?).  
Let's start by looking at the Cost per Server on the supply curve.  
On the chart below, the x axis represents the cost per MIPS, or Millions of Instructions per Second, which is one way of measuring compute in IT.  
On the y axis, we have the number of MIPS consumed.  
As we look back to the start of Traditional IT and think of the Mainframe era, we had these huge machines that were very expensive, and which only central IT could use. As computing power increased, cost declined rapidly at first, but would level out due to scale.  
Then along came the Client/Server model, where companies were setting up their own On-Premise datacenters with rows and rows of Servers. The initial investment wasn't nearly as high as mainframe, and the cost/MIP was lower than mainframe, but still hindered by 5-10% utilization.  
Then along came Cloud. Although the cost to startup a datacenter is extreme, given the sheer size and scale of Cloud datacenters, as the volume of compute increased, the cost/unit was able to drop much lower than the Client/Server model.



**Figure 11: Economies of Scale from sheer size of Cloud Data Centers. As scale increases, the cost per server – or cost per unit of Compute or Storage – goes down. Mainframe vs On-Premise (Client/Server) vs Cloud environments. MIPS = millions of instructions per sec**

But where did these cost savings come from?

The cost of running IT is made up of:

- Server hardware costs (~45%),
- Hardware labor costs (~15%),
- Facility & operations (~25%),
- Power costs (~15%).

*What are the cost savings associated with Cloud Data Center size?*

- **Cost of Real Estate**  
Cloud providers would build their massive DCs in locations that offered cheap real estate, away from the expensive real estate of their urban headquarters. They would work with state and local governments to arrange tax deals and tax incentives.
- **Cost of Power**  
Electricity is one of the largest single costs that make up IT Computing. Large providers can locate their DCs in locations that offer the cheaper power & electricity, and negotiate bulk purchase agreements. In some areas of the US, local electricity rates are at 30% of the US national average. Those savings add up to extremely lower costs over time.
- **Infrastructure Labor Costs**  
You need less physical people per server in larger DCs. A single administrator in a small datacenter may look after 200 machines, but that same administrator in a large DC can manage 2000 servers.
- **Security & reliability**  
Although sometimes talked about as a barrier to Public Cloud, large DC providers can spread the steep costs of security and reliability across more machines, lowering the cost.
- **Buying power for hardware**

Large DC operators can simply get better pricing for Hardware than smaller DC operators. For example, if you're going to Dell with an order for 40,000 servers, vs 4,000 servers, you're going to be able to solicit a much lower price per server, it is just basic economics. Adding up these different components of scale and size, large public Cloud datacenter operators can get Compute pricing down much lower than smaller operators or commercial enterprise.

○ **Demand-size economies of scale:**

By getting more efficient with the utilization rates of the resources we provision, we are able to remove unwanted overcapacity. Customers have the ability to drive higher resource utilization (how many am I buying?).

Overall cost of IT isn't just determined by the cost of capacity, but also by the degree to which that capacity is efficiently utilized. The economic impact of having elasticity is that essentially you are only paying for what you use.

Customers used to provision storage & compute power based on peak workloads, but how often do their applications actually run at peak? Based on several analyzes and metrics, the answer to that question is that it doesn't happen very often. This means that most of customers' compute & storage is wasted on over-provisioning. With Cloud, you only pay for what you use and when you use it.

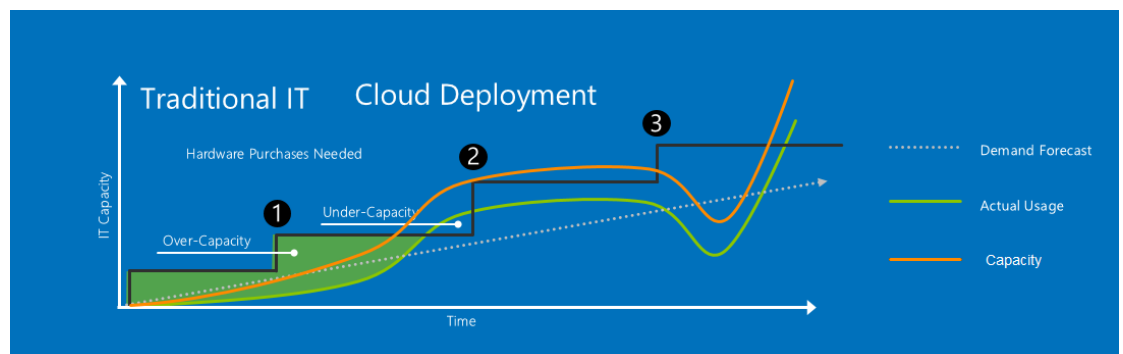


Figure 12: Cloud Services offer Elastic Scalability

- The **second** compelling factor behind Cloud Computing is the impact that Cloud has on the Balance Sheet of an organization, and the transition **from CapEx to Opex**. By switching to Opex, can potentially lower taxable income. Historically, both the physical cost of IT Hardware, and the License cost of owned Volume Licensing have been Assets on the Balance Sheet. This has required a huge out-front outlay of Capital Expenditure, which gets recorded on the B/S as an asset, and drawn down as depreciation over time.

These Hardware and Software assets have carried huge volume of depreciation from year to year. The transition to Cloud Services means these IT costs can be expensed vs capitalized. This means that costly assets don't have to be procured up front *through rigorous approvals*. The main financial impact is that companies can reprioritize that Capex to other projects or new strategic directions.

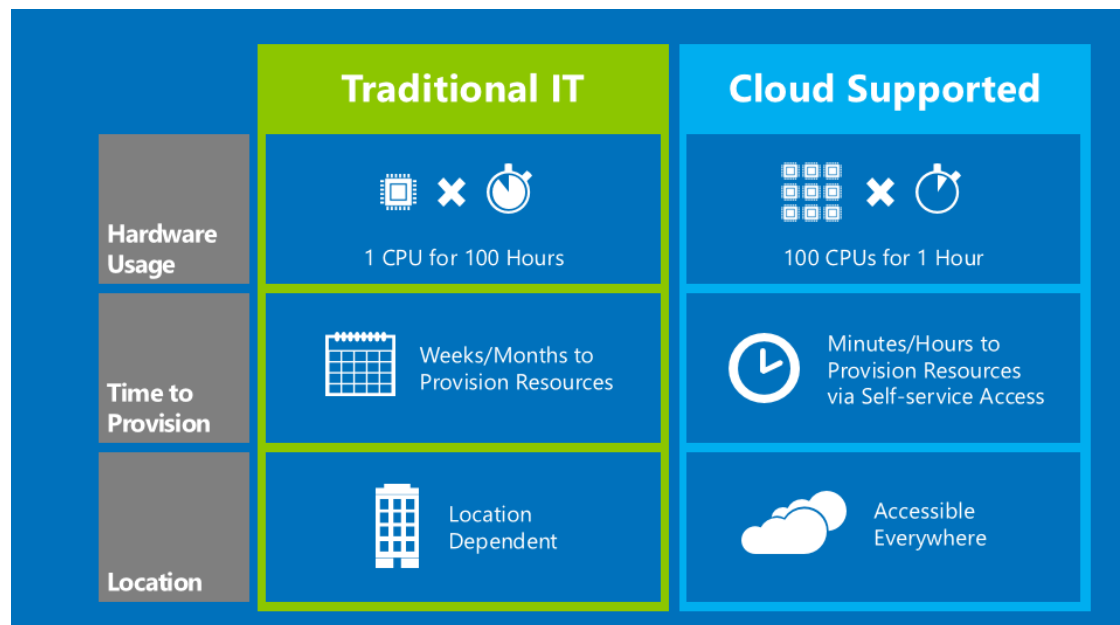
It also favors Capital Ratios. It lowers the risk premium for new IT projects or app development, which will lead to more experimentation. It means that companies can take on new strategic application and computing opportunities that were

previously cost prohibitive. In other words, it lowers the cost of starting a project and lowers the cost of failure or exit.

- The **last** influencer is how Cloud can transform each of our businesses through efficiencies, innovation, and business insight.

Often, transitioning to the Cloud is positioned as a Cost Savings opportunity, but in reality, it's much more than that. Below are mentioned the most common of its benefits:

- Process Efficiency:  
**Self-service nature** of Cloud technology means users can provision & integrate projects quicker.



**Figure 13: Process Efficiency**

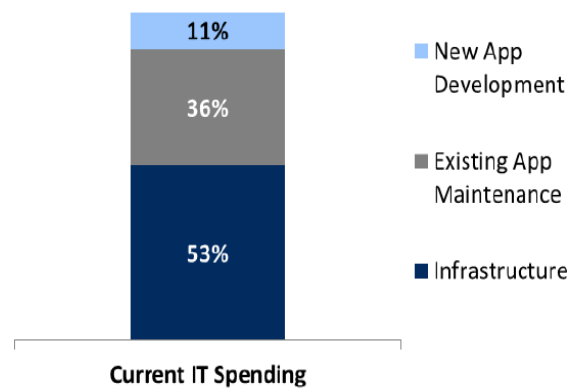
- IT Innovation:  
 What impact will Cloud Economics and Efficiency have on the IT Budget?  
 If we look at the chart below, we can see the traditional IT budget broken out between Infrastructure, existing application maintenance, and new application maintenance.

Cloud impacts all 3 of these areas. Just by looking at this chart, we can see that only slightly more than 10% of IT spend is spent on new app development, which is considered the heart of IT innovation.

Internal teams queue up for IT change requests, or feature/functionality enhancements, that can never be satisfied with the current capacity for app development within organizations.

Demand for general purpose technology like IT has historically proven to be very elastic. Thus, many projects that in the past were cost prohibitive will now become viable due to Cloud.

Economic benefits of Cloud computing allow for **redeployment of IT Budgets** to application development.



**Figure 14: Repurposing IT Spend to Innovation**

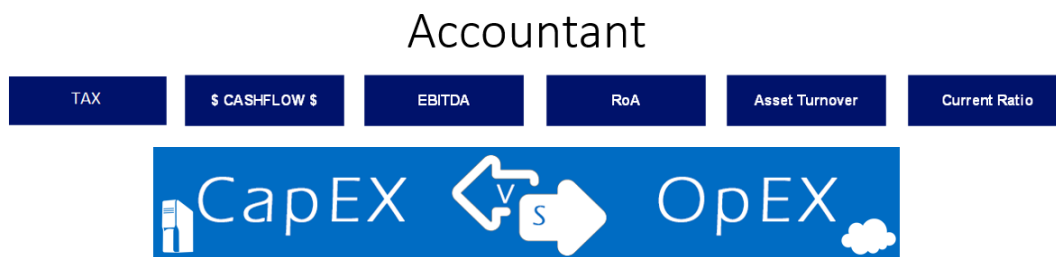
- Cost Insight:  
Costs are spread out across many different buckets making it tough to figure out the cost of IT and it is even tougher to break down all the disparate cost buckets (*IT Shared Services, Operations & Utilities, Capital Expenditures, Project Budgets, Software Licensing*) within IT. Trying to get the insight into how much a single IT project costs, or how much IT a product line or project costs is almost impossible. Cost is broken out into compute, storage and bandwidth charges per application and per location. Cloud Services enable usage monitoring and controlling and thus cost is easily measurable by project.

### Finance point of view on the Cloud

When we try to understand the Finance point of view on the Cloud, we should keep in mind that there are different roles in Finance:

- CFO who's in charge of all Finance
- Accountant who drives statutory and tax reporting (among many other tasks)
- Analyst whos primary job is managerial analysis (for instance, "whether this project is worth financing")

Let's start with **Accountant**.



**Figure 15: Accountant's point of view for Cloud**

Accountant is not just composing the financial statements, but also provides analytics on a few important indicators. For any accountant the choice between Cloud and on premise is all about the Opex vs CAPEX discussion.

**Tax:** Taxation is extremely dependent on specific situation – customer, country, etc. Yet, in general if we're talking Corporate Income Tax, normally it's in favor of OPEX (Cloud), because typically the company is not allowed to depreciate hardware/software as fast as it wants for taxation purposes.

**Cashflow:** Cashflow is definitely on the OPEX side. Especially if we're comparing purchasing Cloud service versus purchasing equipment and software altogether.

Let's move to some financial indicators analysis. One popular indicator is **EBITDA** (Earnings before Income Tax, Depreciation and Amortization). By design, as service purchase doesn't imply any depreciation or amortization, id est, decreasing the earnings directly in this case, EBITDA will vote in favor of CAPEX (on-premises).

We should remember that CAPEX means increasing the volume of Assets which in some cases (for instance, upcoming IPO) might seem more beneficial. At the same time an accountant should be critical on evaluating the quality of assets. The right approach here would be taking on balance only the assets related with primary company activity which is normally not the case if we're talking about hardware/software purchase.

Other indicators are typically grouped into Performance, Activity and Liquidity ratios.

Naturally, not all of the ratios are impacted by choosing between Services or on-premise model of IT.

Let's look at the most impacted ones.

**Return on Asset** is one of the key Performance indicators and shows the return on every dollar invested in Assets of the company. Obviously, as choosing the Service IT model versus on-premise lowers the company's assets (in perfect world limiting them to only the assets related to primary activity of the company), RoA says Cloud is better.

Same story with **Asset Turnover** – this Activity indicator shows the value of a company's revenue generated relative to the value of its assets. This indicator can often be used to define the efficiency with which a company is deploying its assets in generating revenue. By design, this ratio is in favor of the Cloud.

Liquidity ratios (**Current Ratio** for example) are definitely in favor of the Cloud IT model, for the reasons we discussed earlier when we talked about cashflow, less money outflow means better liquidity.

Now let's switch to the **Analyst** view.

Analyst normally compares Cloud vs On-premises as two IT infrastructure upgrade projects and selects the most beneficial one by comparing money inflows and outflows, using indicators like NPV (net present value) and others. While it's normally hard for the analyst to quantify and compare the inflows, for cost comparison he would normally use the TCO (total cost of ownership) models.

While Cloud solutions are typically less expensive than on-premise at direct comparison, let's be conservative and assume that the company already has a developed IT infrastructure and would have to spend some cash to switch to Cloud. Plus, normally Cloud solutions would require better Internet connection which might also cost.

Yet, at the same time the company would save a lot on Hardware – Datacenters.

We should also take into account savings on IT administration – when most of the company's IT is in the Cloud, there's much less need in support.

Electricity and other maintenance expenses, office space – both direct rent per square meter and the alternative expenses should also be considered.

And, of course, one of the biggest benefits here is improved collaboration and communication.

Now let's switch the gears and look at **CFO** point of view.

CFO has the privilege to look at the long-term picture.



We normally forecast the linear growth of our IT demand.

When we go with classical on-prem model, our IT capacity is stage-by-stage, as there's no way you can divide by half a server.

At the same time, the real demand is always a curve, and sometimes a subject to ups and downs (take the recent crisis, for instance).

Thus, with traditional approach the company tends to have some instances of under-capacity, and in many cases the capacity is excessive (meaning distraction of funds from profitable projects and activities).

With Cloud approach, the capacity is always slightly above demand due to extreme flexibility.

## Obstacles & Barriers

Some of the obstacles and barriers that are mostly met towards the cloud adoption journey are the following:

- **Performance:** Moving to the Cloud requires CIOs to trust Cloud provider services. Even small downtimes can have disastrous impacts.
- **Security & Privacy:** Cloud services raise privacy challenges for businesses. Company executives express concern about losing control of where their data is stored, who can access it, and how it gets used, particularly in light of high-profile data breaches as well as unauthorized access by governments in recent years. There are huge issues for the executive team. We've seen many public data breaches at Target, Blue Cross, eBay over the last years, and therefore companies are skeptical about Cloud security. Many CIOs believe the huge efforts they put in place for their On-Premise legacy apps will be tough to replicate in the Cloud.
- **Compliance:** There are also data sovereignty issues for countries and compliance protocols.
- **Deployment Cost:** Deploying cloud demands implementation, consulting, and training costs.
- **Others:** In many customer cases compatibility with legacy applications is needed.

## Market Overview

Cloud has been the biggest and most disruptive force in the tech market over the past 15 years and adoption is accelerating, according to Forrester, who sums up the current scenario by stating that "cloud is a given".

Models from major market research firms Gartner, IDC, and Forrester offer a market view comparison, albeit with different segmentation, definitions, and forecasts for the next few years. With this in mind, all three constantly forecast growth for the cloud market. Over the forecast period through 2020, Gartner has the lowest CAGR (compound annual growth rate) at 16.5% and IDC has the highest, 28.2%.

- Gartner's June 2016 quarterly public cloud services forecast predicts 2016 revenue of \$209 billion reaching \$382 billion by 2020. Over the 2015-2020 forecast period, the highest growth will come from cloud system infrastructure services (IaaS), which is projected to grow 42.8% in 2016 to \$25 billion and reach \$70 billion by 2020.
- Also published in June 2016, IDC forecasts the public cloud IaaS market to more than triple over the next five years, from \$12.6 billion in 2015 to \$43.6 billion in 2020. Worldwide spending on public cloud services will grow at a 19.4% CAGR – almost six times the rate of overall IT spending growth – from nearly \$70 billion in 2015 to more than \$141 billion in 2019. SaaS will remain the dominant cloud computing type, but worldwide spending on IaaS and PaaS will grow at a faster rate, with five-year CAGRs of 27.0% and 30.6%, respectively<sup>77</sup>.

- In a September 2016 report, Forrester predicts that the public cloud market will reach \$236 billion by 2020, growing from \$68 billion in 2014. The increased size of the 2020 public cloud market reflects faster-than-expected growth, especially for cloud platform revenues, whose 2020 total of \$64 billion will be 45% higher than projected two years ago.

Although each of these firms agree that cloud market growth will be robust, Gartner and IDC<sup>79</sup> both project a flattening of yearly growth through 2020. According to Gartner, annual growth will peak in 2017 at 18% and will plateau or slightly decrease through 2020 to 15.1%, although actual spend will continue to increase through 2020 with a 16.1% CAGR. IDC sees 2018 as the peak year, with 21.9% CAGR.

## Market Drivers

IDC marked 2015 as the beginning of large-scale enterprise interest in public cloud IaaS, and movement toward the cloud appears to be strong. IDC's CloudView Survey found that 58% of all organizations surveyed are embracing cloud, using public or private cloud for more than one or two small applications or workloads<sup>80</sup>. 38% of respondents to 451 Research's Voice of the Enterprise survey<sup>20</sup> have adopted a cloud-first approach, and enterprise IT executives expect 60% of workloads will run in the cloud by 2018. The top drivers of cloud adoption revolve around improving resource utilization and staff productivity.

According to Forrester analyst John Rymer, today's "second wave"<sup>55</sup> of cloud adoption is being powered by an expansion of analytics, such as real-time insights and the Internet of Things, and the main driving force behind this is customers. A Forrester survey revealed that enterprises are trying to pursue this second wave of adoption through applications built for customer management, customer analytics, customer-facing web apps, financial management, mobile apps, product management, BI, and data warehousing. 451 Research's survey<sup>20</sup> predicts strong growth in critical enterprise workload categories, such as data and analytics and business applications.

Barriers to cloud adoption remain, but they are shifting. Security is still top of mind for many, but perceptions are changing, and it is not always the primary issue anymore. RightScale's survey found that lack of resources/expertise is now the #1 cloud challenge (cited by 32%), supplanting security (29%). Cloud cost management was also named as a significant challenge by respondents. There are also challenges around integration<sup>53</sup> – many businesses find that the second wave of cloud adoption is just as rough as the first.

Confusion continues to be an obstacle, including "cloudwashing" (using the "cloud" term to obfuscate and make claims of cloud that are unsubstantiated), although it has evolved - enterprise IT departments are now doing as much, if not more, cloudwashing than vendors, according to Gartner. The firm states that cloud computing is still perplexing to many CIOs, even after 10 years; thus, it is not being exploited for its maximum benefit. While cloud computing is a foundation for digital business, Gartner estimates less than one-third of enterprises have a documented cloud strategy. IDC sees regulatory and organizational policy restrictions as cloud adoption inhibitors.

## Compete

Public Clouds are sets of infrastructure services provided by several vendors including Amazon, Microsoft, Google, Rackspace<sup>30</sup>, and others, that allow customers to purchase compute, storage, networking, and platform services on an as-needed basis. Increasingly, these services are being used to augment or replace on-premises systems, to augment capacity, and to handle high performance computing applications.

## Competitive Landscape

As the cloud computing market has developed and grown, the number of players has tightened and there is a jostling for position. AWS and Microsoft have been recognized by analysts as the two leading service providers in the cloud market and are expected to remain as the strongest in the cloud adoption race. According to Gartner, the future of other service providers is increasingly uncertain. The top vendors set a pace of services innovation, global scale, marketing muscle, and economics that is simply too fast for the other vendors and even for huge enterprise incumbents; both HP<sup>48</sup> and Verizon exited the public cloud platforms market in 2015 for this reason.

Forrester identifies six top “megacloud” vendors: AWS, Google, IBM, Microsoft, Salesforce, and Oracle; the first five collect most of the revenue. Like Forrester, Synergy<sup>22</sup> underscores that the top providers in the cloud infrastructure services market combined – the “Big Four” of AWS, Microsoft, IBM, and Google (they don’t publicly break out Salesforce and Oracle) – control well over half of the market and also continue to grow more rapidly than their smaller competitors. Forrester views each of the six megacloud vendors, which are discussed briefly below, as currently having a distinctive mix of cloud platform and app services at various levels of maturity that make direct comparisons difficult.

- **Amazon Web Services (AWS)**<sup>3</sup> IaaS cloud is considered so mature and feature-rich by Gartner that it’s defaulted to become the “safe choice”. AWS, which turned ten years old earlier this year, has a “multi-year” competitive advantage over other competitors and offers the widest variety of services.
- **Google** has been trying hard to win market share from AWS and Microsoft and to prove that it is serious about the public cloud market. The company is in the “rudimentary stage” of learning to engage with enterprise customers, Gartner says, despite Google bringing on former VMware co-founder Diane Greene as its cloud business chief.
- Although **IBM** is typically considered in the top tiers of the IaaS cloud market, Gartner pegs it as right in the middle of the pack of competitors. It has been said that it is largely IBM’s own fault that it doesn’t get the respect it expects in cloud, which has contributed to the impression that it is failing in the segment.
- **Salesforce**, considered a cloud computing “powerhouse”, continues to stand out for a hugely popular SaaS application that features a very powerful app ecosystem and is extended with a very broad range of development platforms.
- **Oracle** announced in July 2016 that it was acquiring cloud ERP vendor NetSuite for \$9.3B in cash, the largest-ever SaaS transaction. With current revenue from the cloud less than 10% of overall sales, the company continues its struggle of almost two decades to transition to the cloud.
- **Microsoft** Azure Platform was introduced at Professional Developers Conference (PDC) 2008 as an alternative for developers and in acknowledgement of AWS – then chief software architect Ray Ozzie said that he was “tipping his cap to Jeff Bezos for innovating the hosted computing model.” At the time, still known by its codename “Red Dog,” the company’s message was that Windows Azure was a cloud version of Windows Server. Microsoft combined its Server and Cloud teams into a single unit in late 2009, released Windows Azure Platform commercially in 2010, and renamed Windows Azure to Microsoft Azure<sup>105</sup> in April 2014. Today, the platform is central to Microsoft’s “mobile first, cloud first”<sup>54</sup> strategy and has benefitted as a strong strategic priority under Satya Nadella’s<sup>25</sup> leadership.

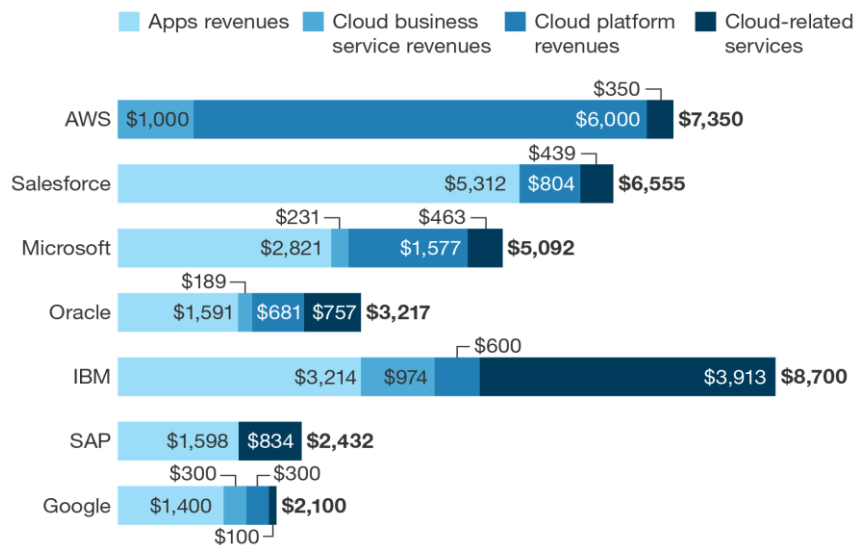
Microsoft is seen as having come a long way in the IaaS cloud market, and it is investing heavily in Azure and rapidly coming out with new features and functionality. At present, the company is second in terms of market share behind leader AWS, with a hefty growth rate of 124% YoY, according to Synergy. Gartner praises Microsoft for taking a unique approach to the market: Packaging IaaS/application development PaaS in both off-premise hosted environments and on-premises options for customers. Microsoft’s huge legacy install base gives it a ready-made platform for selling into enterprises, where it is seeing success – the company’s first-quarter 2017

sales and earnings topped analysts' estimates, buoyed by growing demand for cloud-based software and services.

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### Cloud Revenues Of Seven Enterprise Vendors

*Are The Biggest Enterprise Software Vendors Now The Best Cloud Platform Bets?*



Total 2015 revenues in bold.

Note: Vendor reports and Forrester estimates based on earnings releases and briefings from vendors.

119663

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**Figure 16: Cloud Revenues of Seven Enterprise Vendors**

Below we are going to present in depth the most popular cloud vendors in terms of strategy, mindset, corporate values, strategic products etc.

## Microsoft

### Core DNA – legacy, mindset, corporate values

Microsoft's core DNA is that it is a platform company and engineering-led.

### Microsoft's Trust Principles

Microsoft notes that security is a key component that enables privacy and compliance, and is foundational to building trust. Microsoft's trust principles<sup>91</sup> are the following:

- Transparency: Clarity on how Microsoft operates, how handles data and responds to access requests.
- Privacy: Customers own their data, Microsoft provides the tools to help them manage and govern access to their data.

- **Compliance<sup>69</sup>:** Microsoft complies with applicable laws and regulations to help customers achieve compliance.
- **Security:** Microsoft helps customers safeguard their infrastructure and data.
- **Reliability:** Ensuring customers have access to their data when they need it.

### Microsoft holistic security perspective

Microsoft's holistic security approach extends across the entire enterprise estate. Company not only owns its workloads and technology, but also helps secure the entire enterprise estate for customers. Microsoft does this in four ways:

- **Platform**  
Builds security from the ground up in all of its products (Windows, Office, Azure) and it is extended across all parts of customers' systems—devices, identity, apps and infrastructure, and even data.  
And because Microsoft owns those workloads it can effectively provide security built-in versus bolt-on, and extend from there.
- **Intelligence**
  - All the protection in the world can't stop hackers, so Microsoft needs to focus on detection after the fact. It uses machine learning to identify and detect issues early and accurately. Microsoft has more than 300B user authentications per month, 1B Windows devices updated, 200B emails analyzed for spam and malware. This gives visibility into risky behaviors and potential risks before they happen.
  - **Diversity of signal:** Microsoft's unique value is that it has both breadth and depth, it works across every technology in its portfolio and is getting data from the public cloud (Xbox, Hotmail, Outlook.com), as well as private cloud (Azure, O365, CRM, etc.).
  - **Complement that with human intelligence:** Digital Crimes Unit (DCU), Cyber Defense Operation Center (CDOC)—Microsoft's cybersecurity experts monitor all this information to identify real threats. This combination of machine learning and human vigilance equals holistic protection.
- **Digital transformation**  
One of your biggest challenges in digital transformation is ensuring security, privacy, and compliance. Microsoft enables customers to make this transition by building security into the fabric of its products and solutions.
  - **Shift from passive-defensive to active-defense**  
Microsoft has evolved beyond point solutions that address individual security concerns one product at a time.  
Microsoft's "built-in" approach to security now enables customers to be vigilant from a high level on all fronts. For example, when a new SaaS app is being used by a company's employees, company can detect it immediately and get data about what risks and threats it may pose to it.  
When you approach security as if your environment has already been compromised, you start thinking about how to detect compromises early and recover quickly. Shifting from passive-defense to active-defense changes your security posture—you're aware, you're prepared, you're ready to take action.
  - **Response time**  
The time between breach and detection is huge. On average, an attacker exists on a company's network for 140+ days before they are found.

Microsoft has to get smarter about detection and how they respond to them. Microsoft's target is to get that 140 days down to minutes between infiltration and detection.

- **Microsoft's Intelligent Security Graph**

Microsoft has a vast cyber footprint. They receive **telemetry** from billions of logins, devices, and services, both private and public cloud. Combining that with **machine learning, behavioral inspection**, and expert **human analysis**, they can detect and respond to what looks like anomalous behaviors and incorporate that to prevent a potential threat. This intelligence is built into the products and solutions to give customers visibility and insights into potential compromises.

### **Frequent questions about security and corresponding Microsoft answers**

- **How can I prevent data loss in the cloud?**

Data Loss Prevention (DLP) in Office 365 provides tools and resources to apply policies and generate alerts in order to help mitigate potential data loss. DLP covers sensitive content detection, including fingerprinting and manual classification, and contextual policy application and management across the Office 365 Suite.

- **What defenses do I have against intruders attacking my cloud services?**

Threat mitigation and protection of customer environments is similar to that used in many on-premises datacenters.

To protect Azure platform services, Microsoft provides intrusion detection and distributed denial-of-service (DDoS) defense system that is part of Azure's continuous monitoring and penetration-testing processes. Azure's defense system is not only designed to withstand attacks from the outside, but also from other Azure tenants.

- **What data encryption capabilities are available?**

The Microsoft Cloud uses encryption to safeguard customer data and help you maintain control over it. When customer data moves over a network—between user devices and Microsoft datacenters or within the datacenters themselves—the Microsoft Cloud uses industry-standard secure transport protocols. For customer data at rest, the Microsoft Cloud offers a range of encryption capabilities, giving you the flexibility to choose the solution that best meets your needs<sup>126</sup>.

- **How can I provide secure access to cloud resources?**

Azure and Office 365 multi-factor authentication<sup>125</sup> helps safeguard access to data and applications while meeting user demand for a simple sign-in process. It delivers strong authentication with a range of easy verification options—phone call, text message, or mobile app notification—allowing users to choose the method they prefer.

- **How do I know what's actually happening in my cloud?**

Customers can access many log reports that tell if and when a non-owner of data may have accessed end user data. Customers may use these logs as an audit mechanism. Customer administrators may enable audit logging for the tenant after which reports can be generated and exported by the customer.

### **Security with Office 365**

Office 365, at its core, is extremely secure. With the advanced security features Microsoft gives Chief Information Security Officers (CISO) and IT more visibility and control into Office 365 environments to leverage behavioral analytics and machine learning for threat detection<sup>110</sup>.

- **Advanced Threat Protection** is a cloud-based email filtering service that helps protect against unknown malware and viruses by providing robust zero-day protection and includes features to safeguard your organization from harmful links in real-time. ATP has rich reporting and URL trace capabilities that give admins insight into the kind of attacks happening in your organization.
- **Advanced Security Management** provides enhanced visibility and control.
- **Customer Lockbox** gives enhanced customer data access controls.
- **Advanced eDiscovery** identifies the relevant data quickly.

### **Security with Azure**

Customers can gain visibility and control across hybrid cloud with simplified operations management and security.

- **Azure Active Directory** (Azure AD) is used to sign into devices and the Windows Store, no Microsoft Account needed; it is a comprehensive identity and access management solution for the cloud; it supports the use of Microsoft Passport and Windows Hello to access 1000's of SaaS apps.
- **Azure Security Center**<sup>16</sup> provides a central view of the security state of all of a customer's Azure resources. At a glance, a customer can verify that the appropriate security controls are in place and configured correctly, and quickly identify any resources that require attention.
- **Windows Server** is a key ingredient of the Cloud OS. With Windows Server, in conjunction with the developer technologies within the Cloud OS, a customer can build modern business applications. Modern business applications often span on-premises and the public cloud.

### **Microsoft Infrastructure Investments**

In order to help organizations meet data residency, sovereignty and compliance requirements, Microsoft has a worldwide network of more than 30 announced Microsoft-managed datacenter regions, and continues to make significant investments in geo-expansion through local and sovereign offerings in more than 10 unique geographic regions worldwide.



Figure 17: Microsoft's Datacenter Locations Worldwide

## Microsoft Azure

### Product Descriptor

**Microsoft Azure** is a cloud platform<sup>2</sup> comprised of infrastructure and application services, with integrated data services and advanced analytics, and developer tools and services, hosted within Microsoft's public cloud data centers. Customers use Azure for many different capabilities and scenarios, from basic compute, networking, and storage, to mobile and web app services, to full cloud scenarios like Internet of Things, and can be used with open source technologies, and deployed as hybrid cloud or hosted within a customer's datacenter. Azure provides cloud technology as building blocks to help companies save costs, innovate quickly, and manage systems proactively.

Microsoft Azure<sup>81</sup> is an open and flexible cloud platform that enables customers to rapidly build, deploy and manage secure applications to scale, on premises, in the cloud or both. Customers can leverage the skills they already have and the world's most popular languages, tools, and frameworks and finally they can deploy their applications on the same secure and reliable global datacenter network powering Xbox, Office365, Skype, and Bing—or their own on-premise datacenter.

### Brand Affiliation

**Microsoft Azure**<sup>17</sup> is the umbrella product group for the cloud platform which includes hundreds of services, categorized informally as Compute (Virtual Machines, Service Fabric, Azure Container Service etc), Web & Mobile Apps (App Service, API Management, Functions etc.), Data & Storage (Azure SQL DB, Document DB, StorSimple etc.), Intelligence (Cortana Intelligence, Cognitive Services etc.), Analytics (Data Lake, HDInsight, Machine Learning etc.), Internet of Things (IoT Suite, IoT Hub), Networking (Virtual Network, ExpressRoute, etc), Media & CDN, Hybrid Integration, Identity & Access Management (Azure Active Directory)<sup>131</sup>, Developer Services (Visual Studio Team Services, DevTest Labs, HockeyApp, Application Insights), Management & Security (Log Analytics, Security Center).

### Positioning Statement

Microsoft claims that Azure is the only cloud computing provider that offers a secure, consistent application platform and infrastructure-as-a-service for teams to work within their different cloud skillsets and levels of project complexity, with integrated data services and



analytics that uncover intelligence from data wherever it exists, across both Microsoft and non-Microsoft platforms, open frameworks and tools, providing choice for integrating cloud with on-premises as well as deploying Azure cloud services within on-premises datacenters. As part of the Microsoft Trusted Cloud, customers rely on Azure for industry-leading security, reliability, compliance, privacy, and the vast network of people, partners, and processes to support organizations in the cloud.

With Microsoft Azure, Technical Decision Makers (TDMs) can:

- Accelerate innovation with the cloud
- Power business decisions & apps with insights
- Build freely and deploy anywhere
- Protect their businesses

Microsoft Azure helps customers accelerate innovation across teams and skillsets, with deeply integrated cloud platform services enabling a range of scenarios from simple mobile apps to internet-scale solutions, providing data-driven intelligence through advanced analytics, and the flexibility of hybrid cloud and open source support to add value to customers' existing technology assets. Azure customers are protected by industry-leading security, compliance, privacy, and transparency, with a large network of partners, people, and processes committed to their business.

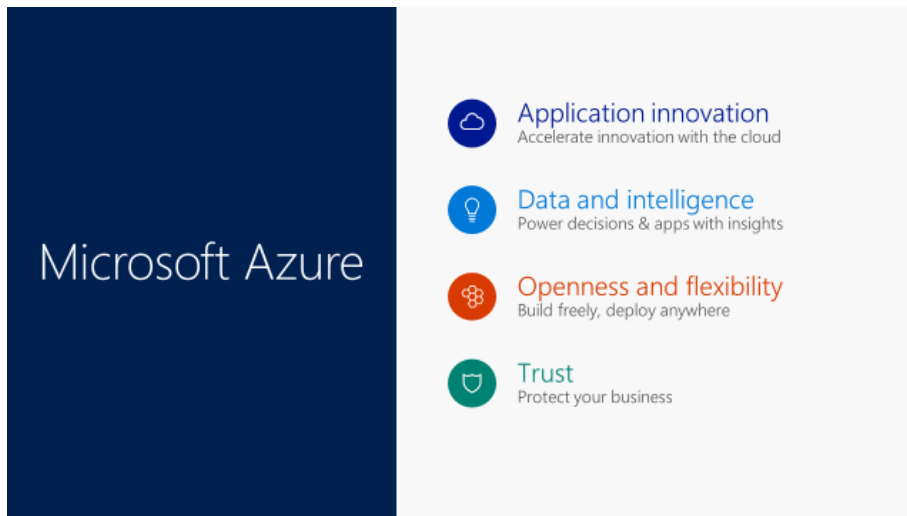
### **Azure strategy**

Depending on your perspective and familiarity with infrastructure-as-a-service (IaaS), platform-as-a-service (PaaS), or software-as-a-service (SaaS), Azure can mean many different things to different people. For Microsoft, Azure represents a product family for its cloud platform that spans IaaS and PaaS, and also includes data services and advanced analytics, tight integration with developer tools and services, and hybrid cloud capabilities for adding value to on-premises with the cloud.

Microsoft Azure is an open and flexible cloud platform that enables you to quickly build, deploy and manage applications across a global network of Microsoft-managed datacenters. You can build applications using any language, tool or framework. And you can integrate your public cloud applications with your existing IT environment.

Microsoft Azure is a cloud platform for digital transformation across businesses. Its strategy is to provide a platform of technologies that:

1. Accelerate **application innovation** through rapid app development and agility in the cloud.
2. Deliver integrated **data and intelligence**—data for rich insights to intelligence embedded within apps.
3. Is **open and flexible**, meaning that you can use the tools and technologies you already have and want to use.
4. Is **trusted** to protect customers' business assets. As more customers expect digital experiences, they expect the data they share with an organization to be protected.



**Figure 18: Azure Strategy**

### **Application Innovation**

Platform as a service (PaaS) is a complete development and deployment environment in the cloud, with resources that enable you to deliver everything from simple cloud-based apps to sophisticated, cloud-enabled enterprise applications.

Like IaaS, PaaS includes infrastructure—servers, storage, and networking—but also middleware, development tools, business intelligence (BI) services, database management systems, and more.

PaaS is designed to support the complete web application lifecycle: building, testing, deploying, managing, and updating.

You manage the applications and services you develop, and the cloud service provider typically manages everything else.

PaaS lets developers create applications using pre-built software components and services.

Cloud features such as scalability, high-availability, and multi-tenant capability are included, reducing the amount of coding that developers must do.

Azure is providing the building blocks to help you take full advantage of the cloud, across existing teams and skillsets. It provides the platform services for rapid application development, deployment, and management.

Azure empowers organizations to accelerate innovation with the cloud through the application platform for building simple to complex projects, within a consistent portal experience, and deeply integrated with data and analytics services, so that organizations can build and deploy rapidly, and proactively manage and improve systems.

### **Top Level Summary Points**

With Azure, customers benefit from deeply integrated infrastructure, application platform, data services and advanced analytics, and developer tools and services provided within a consistent portal for choosing the right building blocks to support cloud projects, whether you're hosting VMs on Azure, to building simple employee mobile apps, to creating internet-of-things solutions.

DevOps practices and management tools help organizations continue to improve agility in the cloud, with log analytics and application insights to provide feedback on how systems are performing, so IT can focus more on improving systems than maintaining them.

Microsoft is committed to empowering organizations to improve computing with Azure, to give more resources back to the organization to focus on their core work. For professional developers, the cloud offers unparalleled power and agility. Resources that were once cost and logistics-prohibitive are now accessible at a developer's fingertips. Across several hyper-scale computing providers, core OS infrastructure is easily accessible for networking, storage, and compute power.

However, with core OS developers still need to manage and control resources intensely. This approach may be preferable for some applications, but to rapidly develop across an entire business's strategy, developers need flexibility and choice for how they best build each scenario.

With Azure, customers benefit from choice of development paradigm and level of abstraction they need for each project, and also across technical skillsets with the Azure application platform services. Azure provides deeply integrated web and mobile services, data platform and advanced analytics, and developer tools and services, delivered through a single portal with federated identity through Active Directory.

Azure also provides an integrated DevOps experience with a development and operation teams' existing tools and frameworks, with log analytics and application insights to provide feedback on to quickly iterate, improve, and innovate.

#### **Key features and functionalities**

- Azure application platform services including Service Fabric, Cloud Services, App Service, and Functions, built on Azure infrastructure-as-a-service, provides 466% greater ROI than infrastructure-as-a-service alone.
- Balance consistency between design and production with agility using Azure Resource Manager<sup>142</sup> export templates, to meet speed and compliance requirements.
- Manage and maintain applications proactively with Azure dashboards including diagnostics, log analytics, and application monitoring, integrated with Application Insights for DevOps processes, and connected to Operations Management Suite to manage hybrid deployments.
- Seamlessly connect packaged applications across the cloud with Azure Active Directory, offering simple connection, self-service, and single sign-on, and B2C identity.
- Xamarin, HockeyApp, and Mobile App Service provide a complete rapid mobile development practice.
- Customers can choose the development paradigm and level of abstraction they need based on their skillset and project, from large-scale industrial workloads to lightweight apps, using Azure's application platform services built on top of infrastructure as a service.
- Customers are able to build apps that connect with their customers through SMS and chat, learning from interactions and conversing to achieve core tasks, using the Bot Framework.
- Easily integrate the tools, languages, and frameworks that customers use today for a collaborative DevOps experience, improving agility, monitoring, and resiliency of their apps.
- Customers are able to monitor, detect, and resolve issues within their applications, and track user and application behavior to quickly iterate on their apps.
- Automatically adapt and tune database performance and improve reliability and data protection with Azure SQL Database.
- Easily manage end-user self-service, and single-sign-on across cloud and on-premises services with granular role-based security with Azure Active Directory.

#### **Technologies<sup>88</sup>**

- Azure App Service (Web, Mobile, Logic, API)
- Azure Service Fabric
- Azure Container Service
- Azure IoT Suite
- Azure Marketplace

- Azure Active Directory
- Azure SQL Database
- The Azure portal
- Azure Resource Manager (export template feature built-in)
- Operations Management Suite
- Visual Studio Team Services
- Visual Studio Application Insights
- Mobile App Service
- Xamarin
- HockeyApp

#### **Building apps faster and easier**

Building apps faster and easier means using the right building blocks for the job. Azure's core building blocks are storage, computing, and networking, or Infrastructure-as-a-Service, which provides customers with agility and cost savings.

When you add Microsoft's integrated platform services, which run IaaS on the back-end, customers accelerate that agility. A recent study showed that customers that are using Microsoft's platform as a service for app development estimate 466% ROI than on just IaaS alone. This includes services across apps both small and internet-scale, data, integration, and so on.

Microsoft is packaging up services and capabilities to deliver preconfigured solutions such as with Azure IoT Suite. IoT is not a new concept in the IT industry, but it is extraordinarily difficult to deliver and maintain. In the past several years, the technology required to facilitate IoT solutions has improved dramatically, making it more accessible across industries and scenarios. Microsoft's IoT preconfigured solutions aim to further amplify that momentum, allowing companies to get to a working proof of concept in a fraction of the time than if they were building with individual components from scratch.

Finally, customers can leverage full templates for web, mobile, containers, etc.--both first and third party--to get started in minutes rather than hours and days, through the Azure Marketplace.

#### **Managing Applications proactively**

Coupled with cloud speed and agility, customers need insights and actions to quickly monitor, iterate, and manage their systems. Azure services, dev tools, and hybrid capabilities provide them the ability to track 360-degree health of their systems.

Customers can use Azure Portal to build dashboards that include monitoring, metrics for individual resources, topology views, and more—this is something each user can personally configure.

When building applications, many groups leverage Application Insights for monitoring within the DevOps process. Application Insights integrates with the Azure portal to view metrics directly from applications, as well as application dependencies.

Finally, Operations Management Suite pulls together cloud, on-premises, and multi-cloud into one view for management as well as security across Azure, but also AWS, Windows Server, Linux, VMWare, OpenStack<sup>33</sup>, etc.

#### **Delivering Native Mobile Apps Seamlessly**

In the sense of the prediction that by 2020 the number of mobile devices coming online will reach 1 million per hour, Mobile development couldn't be a more important response for Microsoft to targeting customers and providing connected experiences across different interaction points.

That's why Microsoft is investing in mobile capabilities to help customers build mobile apps fast across platforms, with continuous integration and continuous deliver.

On the front-end of development, Xamarin helps developer productivity for building mobile apps with C# compiling code across platforms: iOS, Android, Microsoft. Xamarin Test Cloud, provides automated testing to find bugs quickly before you deploy.

With HockeyApp Microsoft can manage beta distribution, get real-time crash reports, and engage with customer feedback for continuous integration.

Azure Mobile App Service provides the back-end services that customers require, including offline data sync, user authentication, and push notifications. Mobile App Service is also tool agnostic, so whether you're using Xamarin/HockeyApp or another tool, you can leverage the mobile back-end services all the same.

### Customer Examples

#### Heineken

- **Customer profile:** HEINEKEN<sup>96</sup>, which sells its flagship premium beer in 178 countries, has long run innovative marketing campaigns around the world with the use of Azure. Along with great beer, it's part of what makes Heineken one of the world's best-known brands.
- **Challenge:** HEINEKEN based a global campaign on UEFA Champions League (UCL) soccer games. The campaign would launch simultaneously in more than 70 markets and 30 languages, and would require real-time computing on a global scale. That's because the centerpiece of the UCL campaign was a pinball game for consumers to play live against players anywhere in the world. The solution would also have to support multiple leaderboards for each player, based on the number of friends and family that an individual played with. It would require real-time updating of the leaderboards as play was underway. HEINEKEN wanted the technology to support 1 million simultaneous users.
- **Strategy:** To meet these requirements, HEINEKEN expanded its use of Azure from one datacenter to four—one each in Europe and Asia, and two in the US—gaining geo-redundancy and low latency. Data was stored in Azure Table Storage for asynchronous updates. The storage was structured with 10,000 partitions—up from 10 initially—for the requisite scalability. HEINEKEN developed the solution using Microsoft Visual Studio 2013. The architecture was tested with a Visual Studio load-testing cluster to generate the load and test the application without testing the Internet. Microsoft Services consultants helped develop and load-test the solution, and resolve performance issues.
- **Results:** HEINEKEN used Microsoft Azure to achieve 100 percent reliability on a massive scale. The platform exceeded its service-level agreement with perfect performance in the UCL campaign, supporting 2 million gameplays per hour and with capacity for more than 40 million players in all.

#### 3M

- **Customer profile:** 3M<sup>92</sup> Company produces more than 55,000 products for industries including healthcare, retail, consumer electronics, and construction. Based in St. Paul, Minnesota, 3M has customers in more than 200 countries and reported sales of US\$38 billion in 2013.
- **Challenge:** The company had recently purchased the assets of parking, tolling, and automatic license plate reader businesses, and required better insight into these acquisitions. Chad Reed, Global Business Manager for 3M Parking Systems, says, "With

thousands of installations across the world, we couldn't keep track of our software and hardware deployments, which made it difficult to understand our market penetration.”

3M wanted a tracking application that sales staff could use to get real-time information about the type and location of 3M products in parking lots and garages. So that it could be used on-site with potential customers, the solution would have to provide access to data anytime, anywhere, and from an array of mobile devices.

- **Strategy:** They chose Microsoft Azure Mobile Services for a secure, scalable platform that would easily integrate and store data from 3M equipment and other sources. They also used Xamarin, a development platform with a C# shared code base, to write native apps for iOS and Android devices. Xamarin includes Xamarin Studio, an integrated development environment that integrates with the Microsoft Visual Studio 2013 development system for streamlined creation of Android, iOS, and Windows software including mobile apps.
- **Results:** In two days, 3M created a tracking solution that connects multiple types of mobile devices, potentially thousands of machines and data sources, and a cloud platform. Aligning with the 3M reputation for technological innovation, the solution can easily be extended to support growth across the company.

#### Willis Towers Watson

- **Customer profile:** Now in its second century, Willis Towers Watson<sup>100</sup> (10,000 employees) is a trusted advisor to insurance companies that have come to depend upon its consulting and software solutions. They've used its software and guidance to implement a string of innovations over the decades, such as new ways to analyze risk, price auto insurance, and evaluate capital requirements.
- **Challenge:** The opportunity for Willis Towers Watson was to help its customers adopt usage-based insurance (UBI) despite the inherent obstacles that implementation seems to pose. Processing and analyzing highly granular data feeds from automobiles, and integrating that information with third-party feeds that provide contextual information supporting the analytics, make for a massive computational workload. For many smaller insurers, the capital, operating expenses, and technical expertise needed to build and support a technology infrastructure for UBI are daunting if not prohibitive. And then there's the risk of either overbuilding, and sitting on unused and unprofitable capacity, or underbuilding, and being unable to meet unexpected demand.  
Willis Towers Watson wanted to provide the UBI technology infrastructure for its customers, so they could adopt the service without having to build and maintain it themselves. But that merely transferred the challenge of UBI onto Willis Towers Watson itself—and multiplied that challenge by the number of insurers the company would ultimately want to support.
- **Strategy:** Willis Towers Watson had faced a similar need to provide its customers with highly scalable computing resources for another service, its Risk Agility FM service (formerly known as “MoSes”). Customers use Risk Agility FM to model all sorts of financial risk.  
The company's solution to support both Risk Agility FM and UBI is Microsoft Azure. “There has been a major evolution over the past few years in how we support big computing at Willis Towers Watson, and Microsoft plays a growing role in that support,” says Wayne Bullock, Global Leader of Life Insurance Software Development at Willis Towers Watson.

- **Results:** Lingard says that the power, reliability, and elastic scalability of Azure are crucial contributors to the competitive advantage that Willis Towers Watson gains from its implementation of UBI.

Azure is also crucial to the company's ability to conduct those analytics cost-effectively. Willis Towers Watson estimates that using Azure saved it 20 percent in initial capital costs compared to building an entirely on-premises solution. Further, it forecasts saving between 30 and 40 percent in capital and operating costs as the number of vehicles scored by the solution develops into the millions.

Coca-Cola Bottling Co.

- **Customer profile:** Coca-Cola Bottling Co. Consolidated (CCBCC) is America's largest independent Coca-Cola bottler. The Company operates primarily in the Southeast, with corporate offices located in Charlotte, North Carolina. CCBCC stock is traded on the NASDAQ exchange under the symbol COKE.
- **Challenge:** With demanding users and high stakes delivery timelines, Coca-Cola Bottling Co. Consolidated's (CCBCC) requires collaborative DevOps<sup>107</sup> practices to help its developers create apps that users love for their ease of use and business stakeholders love for their impact on sales, with short turnaround times for deployment and updates, and leverage their existing skillsets with C#.
- **Strategy:** To better serve sales teams and customers, CCBCC used Xamarin, Visual Studio, Visual Studio Team Services, and Azure to get the Marketplace iPad app into users' hands in just four months, made possible by managing the entire DevOps cycle in C#.
- **Results:** Rapid time to deployment—4 months—due to leveraging in-house C# skills and .Net talent. Xamarin allowed them to code in C# and deliver across native mobile app platforms, while incorporating native APIs as well, like Maps.

### Data and Intelligence

Digital transformation can't happen without data. Customers need the right data to derive new insights as well as to inform whether or not their digital vision is paying back on its investment. Intelligent services on Azure provide the processes and connections to create experiences that meet the demand of mobile customers.

Customers who've invested in the cloud recognize its benefits for cost savings, speed, and agility. With Azure, they can architect solutions that leverage the cloud to uncover insights within both traditional and new data, predict behaviors in their business, and proactively engage through the use of artificial intelligence.

#### Top Level Summary Points

Customers who have invested in the cloud recognize its benefits for providing speed and agility. They also understand that architecting solutions leveraging the cloud can uncover opportunities within their business that they wouldn't have been able to facilitate with available on-premises computing and data.

Three examples of data-driven intelligence architected within solutions include big data, machine learning, and artificial intelligence.

Big data capabilities within Azure provide an organization to take traditional sources of data and combine them with new dynamic sources, like user logins, social data, or large sets of public data. Azure provides the capabilities to analyze these data sources and gain insights into customers like never before.

Azure also provides machine learning capabilities that allow companies to apply learning models to data that previously would have required a heavy on-premises investment.

Visual modeling within Azure helps customers quickly spin up models, measure data, and take action.

Artificial intelligence with cognitive services and the bot framework embed human aspects into your applications so your end-users can interact with applications in new ways. From seeing, hearing, and interpreting behaviors, organizations can provide their customers new and different styles of engagement.

For developers and organizations that have already optimized cloud computing within their practices, applying digital innovation to other areas of their business and products is the next logical step toward full digital transformation.

Data is the grey matter that connects digital solutions, and optimizing for both new and traditional data sources is key to any new project.

In the past, intelligent services such as big data processing, Internet of Things (IoT), machine learning, and artificial intelligence have been available but largely inaccessible due to hardware, software, or length of time to develop capabilities in-house.

Azure unlocks digital innovation by offering integrated and packaged data platform and analytics solutions to rapidly build and integrate intelligent solutions and products. A few examples of these are big data, IoT, machine learning, and artificial intelligence.

Intelligent services paired with open technologies and hybrid capabilities allow developers to build solutions that are transportable based on the business's needs.

#### **Key features and functionalities**

- Customers can process traditional data with new dynamic data sources to create and analyze new information to support business strategy with Azure Data Warehouse, Azure Data Lake, HDInsight.
- You can predict business outcomes using Azure Machine Learning capabilities within your apps to visually model, build, deploy, and share predictive insights so you can anticipate key events and proactively respond.
- Administrators can embed business intelligence dashboard controls directly within applications with Power BI for visual feedback for their end users.
- Customers are able to connect existing things or build new products embedded with Internet of Things capabilities using Azure IoT Suite preconfigured solutions to connect real-time data from devices, sensors, and infrastructure, to applications for monitoring and predictive maintenance.
- Organizations can build next-generation mobile consumer applications that learn from the interactions of their customers and engage in conversation with customers through SMS and instant message, with artificial intelligence provided by Cognitive Services and Bot Framework.
- Customers can connect device sensors with real-time data to Azure services with the IoT Suite (Internet of Things) so that they can benchmark against historical values, transform incoming data, and detect anomalies to predict maintenance and automate activities.
- By implementing machine learning it is feasible to build, deploy, and share predictive analytics solutions so you can anticipate key events and proactively respond.
- Customers can build applications that can see, hear, interpret, and understand the world around them with APIs from Cortana Intelligence Suite.
- Organizations can dynamically deploy, grow, and shrink storage and compute in minutes, and pay for query and performance rather than hardware.
- Processing structured data from traditional sources with unstructured data from dynamic sources enables customers to analyze new sets of data to uncover insights.

#### **Technologies**

- Azure IoT Suite
- Azure Machine Learning
- Azure Stream Analytics
- Azure Redis Cache
- Cortana Intelligence Suite



- Cognitive Services
- Bot Framework
- Azure HDInsight
- Azure SQL Database
- Azure SQL Data Warehouse
- Azure SQL Server Stretch Database
- Power BI
- Power BI Embedded

#### **Supporting Business Strategy with any Data**

Data is exploding. Customers have traditional data sources like ERP and CRM. They also have web data – web logs, mobility, targeted advertising, search data. And finally, they have big data – data from devices, sensors, social media, content, marketplaces. How do they use this to their advantage?

For example, Real Madrid takes their customer data in legacy systems, combines it with social data and mobile app usage data to better understand customers and target for specific marketing incentives, using Azure Data Factory which extracts, loads, and transforms the data, then uses HDInsight for querying. The data is then pushed to Azure SQL Database and consumed by Excel and Power BI.

This is true back-end power—supporting any data, with any query--to front-end insights—using natural language Q&A to query. That is directly impacting revenue for Real Madrid.

#### **Predict and Respond Proactively**

Once you understand the data you have, data you need, and potential outcomes you may drive, you can apply intelligence with machine learning.

Machine learning refers to computing systems that become smarter with experience. Experience in this case is past data and human input. Demand forecasting for example can apply to predicting how much inventory is needed when a person is likely to go to the hospital.

Three key benefits are supported with Azure Machine Learning.

One problem that many enterprises face is data ingestion. With the cloud, you can bring in data sources with the ease of a drop down or drop your on-premises data set into the built-in storage space. Users can then model in Microsoft's development environment – Machine Learning Studio – which offers Python, SQLite and also other well-known Microsoft algorithms.

The second issue is putting finished work into production in a way others can use. Many data scientists model in R on a Linux stack but then have to hand over their work to developers who need to translate that into another language to actually make it work. This time consuming and unnecessary process can be eliminated with Azure, as the model is with a click transformed into a web service end-point that can run over any data, anywhere and connect to any solution or client.

Moreover, not only can this model be put into production for the interested company, but also it can be made available for the world on Azure's Machine Learning Marketplace. Microsoft hosts the solution and markets it, while customers have the freedom to brand and monetize as they see fit. This marketplace also offers several Microsoft created solutions.

#### **Learning and Engaging with Artificial Intelligence**

Lastly, Azure supports a number of artificial intelligence capabilities. Artificial Intelligence is no longer an exotic concept. Rather, it's embedded into experiences we have every day. Siri and Cortana for example help us complete tasks faster and on the go.

Another example is Dominos. They recently went through a massive digital transformation to improve their brand perception and engage customers in new ways, and they launched a series of “app-less apps” or rather social/chat/text apps where you can order pizza through natural language interaction through channels like Twitter and SMS. Not only are they reaching people in channels unexplored by any other pizza company, they’re building a positive brand Figure as a company that’s truly centered on customers.

With Cognitive Services and the Bot Framework, Microsoft is providing the APIs and SDKs to help you embed these experiences within your Azure applications. Cognitive Services includes APIs for vision, speech, language, knowledge, and search. Bot Framework includes a connector, to text/sms, O365, Slack, etc., an open source SDK, and a directory of public bots.

#### Customer Examples

##### Dartmouth Hitchcock Medical Center

- **Customer profile:** Dartmouth–Hitchcock Medical Center<sup>93</sup> (10,000 employees) is New Hampshire's only academic medical center and is headquartered on a 225-acre campus in the heart of the Upper Connecticut River Valley, in Lebanon, New Hampshire. DHMC is New Hampshire's only Level I Trauma Center, one of only three in northern New England, and it includes New Hampshire's only air ambulance service.
- **Challenge:** At Dartmouth-Hitchcock Health System, an unlikely team of experts from a broad of industries — from medicine to retail, entertainment, publishing and hospitality — is fearlessly and persistently challenging the status quo of modern healthcare. They’re piloting a highly coordinated, intensely personalized solution that encompasses physical, mental and emotional health, called ImagineCare.
- **Strategy:** Using the perceptual intelligence capabilities of the Cortana Intelligence, the system can detect a person’s emotional state which is an extraordinarily valuable index. By monitoring Twitter feeds and other social media, the system performs a sentiment analysis, looking for troublesome trends. It can also perform speech and tone analysis during interactions with ImagineCare nurses — a boon for early intervention. A mobile app that invites timely mood check-ins completes the picture, vastly increasing the chances of catching and treating depression before it becomes a life-changing issue.
- **Results:** “With this system, we can proactively reach out and prevent emergency room visits, unnecessary primary care visits, hospital admissions and readmissions,” says Dr. Ethan Berke, Medical Director for Clinical Design & Innovation. “If you have congestive heart failure and your weight starts to trend up, rather than letting that get worse — potentially landing you in the emergency room — your practitioner can start to monitor and help you change some lifestyle issues to prevent that trip to the ER.” This not only benefits patients but also payers such as employers and insurance companies, because better outcomes translate to lower costs of care. Larson says that could eventually result in lower patient premiums, a “double win.” And physicians stand to gain, too. “Many of the solutions currently on the market give physicians access to raw data; that’s not as useful as actionable intelligence to help them make a diagnosis,” says Berke. “When you start looking at tools such as ImagineCare that have intelligence built in, I think that’s a big deal for providers.”

##### Rolls Royce

- **Customer profile:** Rolls Royce<sup>98</sup> has more than 13,000 engines for commercial aircraft in service around the world, and for the past 20 years, it has offered customers

comprehensive engine maintenance services that help keep aircraft available and efficient.

- **Challenge:** Worldwide, flight delays and disruptions cost the airline industry millions of dollars every year. Even a small reduction in “aircraft on ground” (AOG) time can translate into significant amount of money, so airlines are always looking for ways to improve the efficiency of maintenance activities.  
The same applies to fuel costs. Fuel generally accounts for a whopping 40 percent of airlines’ operating expenses. Even a 1 percent optimization of fuel consumption can save an airline millions of dollars annually.
- **Strategy:** Starting with Azure IoT Suite, Rolls Royce will be able to collect and aggregate data from disparate and geographically distributed sources at an unprecedented scale. Using Microsoft Cortana Intelligence Suite, Rolls Royce will be able to analyze a rich set of data and perform data modeling at scale to accurately detect operational anomalies and help customers plan relevant actions.
- **Results:** Rolls Royce foresees that by gaining access to wider sets of operational data, it will be able to offer more valuable services to customers. Another important benefit is that the company will gain a better understanding of how it should structure its support contracts, how it can better manage risk, and what its product development needs are.

Jabil

- **Customer profile:** Established in 1966, Jabil<sup>97</sup> is one of the world’s largest and most innovative providers of manufacturing, design engineering, and supply chain management technologies and services. With global operations spanning 102 locations and 28 countries, Jabil helps leading companies in a diverse range of industries become more competitive.
- **Challenge:** In recent years, staying competitive requires more than just offering newer, better products. Rather, the modern consumer’s expectation of faster, more personalized services has permeated the industrial world, bringing a whole new level of complexity to organizations.  
The challenges are more complex than just getting products to market faster. Now, companies might make a product only once, with even very large global corporations behaving much like boutique manufacturers with one-off production lines. As a result, traditional inspection techniques for ensuring quality are quickly becoming outdated. For example, in a process called first-article inspection, an initial model is manufactured, checked, and verified at multiple steps, and then reworked as needed before the production line kicks off. For decades, wasted time and material were just part of the manufacturing process.
- **Strategy:** For Jabil, an Internet of Things (IoT) approach based on the Microsoft Azure Cortana Intelligence Suite was the solution that made sense. With the Cortana Intelligence Suite, Jabil gained the predictive analytics and integration capabilities it needed for its new roadmap.
- **Results:** In the next step along the road of digital manufacturing, Jabil and Microsoft collaborated on a pilot project that connected an electronics manufacturing production line to the cloud. Collecting more than 1 million data points from each assembly across a 32-step, four-hour manufacturing process, Jabil was able to anticipate and avert more than half of circuit board failures at the second step in the process, and the remaining 45 percent at step 6. This effectively means that by using machine learning, board errors can be detected early in the production line. As a result, the errors can be corrected prior to adding expensive electronic components and creating costly errors that end up on shop

shelves. The end results are a reduction in scrapped materials and warranty costs, and an increase in customer satisfaction.

**Openness and Flexibility**

Azure provides the openness and flexibility to build freely and deploy anywhere. With Azure, Microsoft strives to meet customers where they are with what they have today. This is done in two ways: With their approach to open source, and with hybrid solutions.

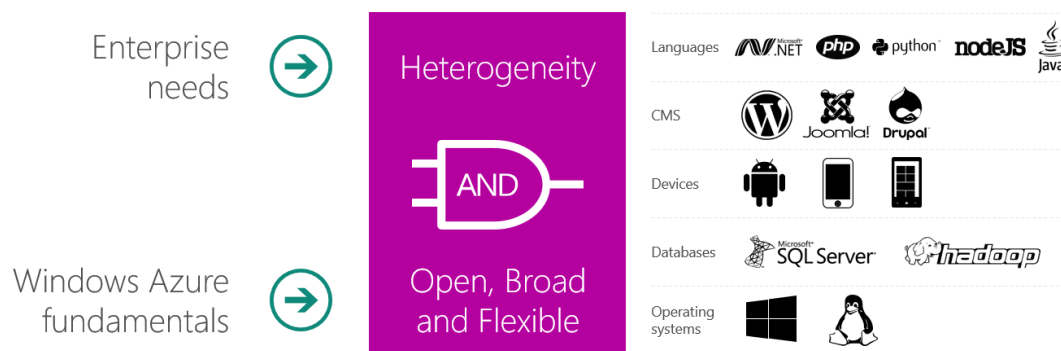
Customers want to run a variety of workloads in the cloud. Microsoft Azure provides best experience and support for Microsoft workloads, but at the same time embraces other open technologies so customers get a cloud experience that satisfies their heterogeneous needs.

In enterprises, Java and .NET are still mostly used, but developers are also using PHP, Python and other languages in addition. Microsoft Azure supports all these languages and more.

Microsoft Azure provides out-of-the box experience for open frameworks like Hadoop, web frameworks like Wordpress, Joomla and Drupal. It also provides first party SDKs for developing apps using Android, IOS or Windows phones. Microsoft not only supports, but has embraced open technologies.

Microsoft also provides a broad set of services that give customers a good choice. In addition to the breadth of the platform, it's important to note that using Microsoft Azure is not an all or nothing proposition. Customers can use most services independently of each other. For example, you can just use storage without compute or use DB without using storage. What you want to use and how you want to use is really your choice.

Customers want choice, and with Azure they have the ability to use the technologies they want and need, deployed where they require. With nearly one in three VMs on Azure running Linux, customers can build freely. Microsoft also combines customers' cloud and on-premises needs, offering a truly comprehensive hybrid cloud.



**Figure 19: Azure is Open Up & Down the Stack**

**Top Level Summary Points**

Technology “lock-in” isn’t a new concept and can apply to all kinds of scenarios. Customers need options and they need to know that the tech they build not only has staying power but is also portable.

Azure addresses this problem by striving to meet customers where they are currently with their investments in on-premises and cloud technologies, and open source platforms, tools, and frameworks.

Azure’s hybrid cloud capabilities are comprehensive and established, ranging from solutions that extend existing applications, such as adding bottomless capacity or continuous availability, private network connections between Azure and on-premises infrastructure, to security and control across applications, managing and protecting resources wherever they are.

## Azure Stack<sup>90</sup>

Azure also extends the cloud to a customer's on-premises data center with Azure Stack, which provides cloud-inspired infrastructure, locally hosted. Azure Stack allows customers to develop for the cloud and deploy where they need to.

Microsoft Azure Stack<sup>18</sup> is a new hybrid cloud platform product that enables organizations to deliver Azure services from their own datacenter.

With Azure Stack, IT service operations can maximize agility and efficiency by transforming on-premises datacenter resources into Azure-consistent IaaS and PaaS services. They can enable application developers to quickly provision and scale services using the same self-service experience as Azure. IT service operations can customize the service delivery experience using the same administrative tools and experiences as Azure.

With Azure Stack integrated systems, IT infrastructure operations can quickly deliver an end-to-end solution that “just works”, not just at deployment time, but also as new updates are introduced. This enables customers to rapidly consume Azure innovation in a predictable, non-disruptive manner.

### Core Pillars of Azure Stack

- **Azure services in customer's datacenter**

Customers can transform on-premises datacenter resources into cloud services for maximum agility. They may run Azure infrastructure services - including Virtual Machines, Virtual Network, and Blob/Table/Queue storage - for applications like SQL Server or SharePoint.

Azure Stack empowers developers to write cloud-first applications using on-premises deployments of Azure App Service and Docker-integrated containers.

IT gets to control on-premises service delivery experience to boost efficiency and meet business requirements.

#### Key capabilities

- Next-generation Azure Compute services – Virtual Machines, Virtual Machine Extensions (incl. containers)
- Next-generation Azure Networking services – Virtual Network, Load Balancer, VPN Gateway
- Next-generation Azure Storage services – Blobs, Tables, and Queues
- Azure App Service
- Azure portal (end-user experience)
- Azure service admin portal experience for managing subscriptions, quotas, Figure gallery, and metering

- **Unified application development**

Customers can build and deploy their application the same way whether it runs on Azure or Azure Stack. With Azure Resource Manager they can author reusable and customizable application templates for traditional and cloud-native applications. They can use role-based access control in Azure Resource Manager and Azure Active Directory to enable fine-grained access to application resources. Key Vault gives them the power to protect their applications digital secrets from unauthorized access. Customers write to the same Azure APIs and use the same Azure SDK. Or they use PowerShell to deploy and Visual Studio as their development tool. Just like Azure, customers get a broad choice of open source application platforms, languages, and frameworks, including Linux, Java, node.js, and PHP.

#### Key capabilities

- Identical APIs and application model with Azure Resource Manager
- Reusable and customizable Azure Resource Manager templates (improved Azure Resource Manager template compatibility between Azure and Azure Stack)
- Role-based access control with Azure Active Directory and Azure Resource Manager
- Key Vault to protect application secrets

- Unified Azure SDK
- Native Visual Studio integration
- Support for Linux, Java, node.js, and PHP.

- **One Azure ecosystem**

Customers can select a defined set of applications and components from the Azure Marketplace and publish them to Azure Stack. This can include Azure Resource Manager templates, Windows Server/Linux OS Figures, or even open-source application frameworks and platforms such as LAMP. They may also use GitHub to store and share templates in the Azure Stack gallery.

**Key capabilities**

- Curated Azure Resource Manager templates for SharePoint, SQL Server, Active Directory
- Curated gallery Figures for Windows Server and Linux
- GitHub-based gallery
- Syndication of Azure Marketplace Figures for Azure Stack (syndicate-able Figures include: LAMP stack, CoreOS Linux, SLES 12, Windows Server 2016 TP5 with Containers, SaltStack Enterprise)

- **Cloud-inspired infrastructure**

Is possible for companies to go from concept to operations much faster with Azure Stack integrated systems that are purpose-built for Azure Stack and include hardware, software, and services that just work together from the start. This means that your developers get to be productive as quickly and consistently as possible. They can take advantage of the great quality and infrastructure reliability across the full lifecycle with management and automation designed for the whole stack. This means that customers' systems will work as smoothly on day 100 as they were on day 1.

As a result of continuous testing and curated, orchestrated updates across the full stack it is feasible to deliver continuous cloud innovation – new services and updates - without impacting the tenant experience and availability. This means customers can focus on the services that they will offer with Azure Stack in their datacenter.

**Key capabilities**

- Same hypervisor – Hyper-V – is used in Azure as well as Azure Stack
- Azure-inspired software-defined networking stack (incl. network controller, software load balancer, distributed firewall)
- Storage Spaces Direct technologies in Windows Server (distributed design, industry-standard disks)
- Infrastructure lifecycle management for Azure Stack regions, including deployment, adding new capacity or services, updates, business continuity, and availability
- APIs to integrate monitoring and usage functionality into your existing datacenter toolsets
- Curated, orchestrated updates across the full stack (BIOS, firmware, drives, OS, infrastructure management software, Azure services)
- Azure-inspired management and automation tools for service delivery and management

**Competitive positioning vs. OpenStack**

OpenStack is an open-source cloud platform that has gained a lot of mind-share recently. OpenStack is a collection of independent open source software projects that provide an IaaS cloud on-premises.

Being a loosely coupled collection of projects, OpenStack needs significant integration investment with specialized skills. Unlike OpenStack, Azure Stack is a single integrated product, thereby promising deployment and operations simplicity.

OpenStack has multiple fragmented and proprietary distributions – HPE, VMware for example - who are primarily interested in selling hardware and services. Unlike OpenStack, Azure and Azure Stack deliver one consistent enterprise-proven platform that supports a broad choice of open source application platforms, languages, and frameworks such as Linux, Java, node.js, and PHP. Unlike OpenStack that is essentially limited to IaaS, Microsoft is also bringing higher-level PaaS (such as Azure App Services and Azure Service Fabric) to on-premises environments, thereby enabling rich application innovation.

Differentiators	Advantages	Disadvantages
<ul style="list-style-type: none"> <li>It is an open source project</li> </ul>	<ul style="list-style-type: none"> <li>Some firms offer public IaaS based on OpenStack, so it gets a lot of press.</li> </ul>	<ul style="list-style-type: none"> <li>Users love standards, so vendors claim to follow them, but they also add proprietary extensions which results in it often not being truly standardized.</li> <li>Only a few vendors will most likely dominate OpenStack and it's unclear who they'll be.                         <ul style="list-style-type: none"> <li>Hp's Helion public cloud hasn't gotten much traction.</li> <li>Rackspace has left the pure IaaS market.</li> </ul> </li> </ul>

**Table 1: OpenStack Assessment**

**Competitive positioning vs. AWS**

AWS is the leader in public cloud computing (mainly their infrastructure as a service offering). AWS fundamentally dismisses the notion of private clouds and by inference, hybrid cloud computing. However, many customers prefer a hybrid cloud computing approach, due to requirements such as data sovereignty, regulation, compliance, latency, business process customization.

Unlike AWS which is essentially public-cloud only, Microsoft offers one consistent enterprise-proven platform – i.e. Azure and Azure Stack - that enable public-cloud agility and innovation across private, hosted, and public cloud contexts.

**Competitive positioning vs. VMware**

VMware is the leader in the virtualization category.

They tend to have the market look at cloud using a virtualization lens. By itself, virtualization falls far short of the essential NIST-defined characteristics of the cloud model, such as on-demand self-service and rapid elasticity.

VMware can help incrementally optimize traditional infrastructure, but their solutions aren't designed for application innovation. Modern application patterns necessitate looking beyond traditional virtualization that were primarily meant to solve for application compatibility and hardware consolidation. Unlike VMware, Microsoft's offerings are designed for cloud-first application innovation; platform consistency across Azure and Azure Stack combined with a rich set of application platform assets (such as Azure App Services, Azure Service Fabric, and Windows Server Containers) make this possible.

VMware claims that vCloudAir<sup>34</sup> enables the same VMware infrastructure in hosted environments, but the reality is that they have a very small hybrid footprint that's limited to IaaS scenarios, primarily VMs and networking.

#### **Building and Running Open Source Solutions**

Microsoft has heavily invested in open-source technologies and partnerships.

Why is this important to Microsoft? Because it's in the best interest of its customers. In fact, over 40% of CIOs were using open source as their primary strategy heading into 2017. Microsoft supports customers' computing, whatever it is and wherever it is.

Finally, Microsoft contributes to the open source community as well as builds some of its services on open source technology, like HDInsight and Azure Container Service. This helps Microsoft scale to customers' needs as it rapidly releases cloud solutions.

#### **Extending On-premises Data and Apps**

With Azure, customers can take the investments they've made in open source IP, or data, or apps, and extend from on-premises to the cloud, or vice versa, with hybrid cloud capabilities.

Companies fall into two main buckets with regards to hybrid: those who are using hybrid solutions as a temporary bridge to the cloud, and companies who are architecting hybrid solutions for use in perpetuity.

Amongst each of these types of customers, there are common use cases such as:

- Application Availability
- Bottomless Storage
- Identity Management
- Full hybrid applications

Microsoft provides seamless, secure hybrid cloud capabilities across infrastructure, data, users, apps, and management.

#### **Deploying the Cloud On-premises**

Azure Stack provides the capabilities of Azure for customers who want to host it on their own premises. The Azure portal acts as a hub for managing between cloud and on-premises.

Hybrid cloud is an ideal solution for many organizations, bringing together the agility of public cloud and the control of on-premises systems.

Microsoft builds and runs its own hyper-scale datacenters and delivers that same technology back to customers' and partners' datacenters.

Microsoft Azure Stack - extends the agile Azure model of application development and deployment to customers' datacenters. Azure Stack delivers IaaS and PaaS services into customers' datacenters so that they can easily blend their enterprise applications such as SQL Server, SharePoint, and Exchange with modern distributed applications and services while maintaining centralized oversight. Using Azure Resource Manager, customers get consistent application deployments every time, whether provisioned to Azure in the public cloud or Azure Stack in a datacenter environment. This approach is unique in the industry and gives developers the flexibility to create applications once and then decide where to deploy them later - all with role-based access control to meet their compliance needs.

Built on the same core technology as Azure, Azure Stack packages Microsoft's investments in automated and software-defined infrastructure from Microsoft's public cloud datacenters and delivers them to customers for a more flexible and secure datacenter



environment<sup>78</sup>. For example, Azure Stack includes a scalable and flexible software-defined Network Controller and Storage Spaces Direct with automated sync and failover.

Shielded VMs and Guarded Hosts bring “zero-trust” software-defined security to customers’ private clouds so that they can securely segment departments and workloads and centrally control and monitor access and administration rights. Furthermore, Azure Stack will simplify the complex process of deploying private/hosted clouds based on Microsoft’s experience building the Microsoft Cloud Platform System, a converged infrastructure solution.

#### Customer Examples

##### Siemens | Enel

- **Customer profile:** Siemens<sup>99</sup> is a global powerhouse focusing on the areas of electrification, automation and digitalization. One of the world’s largest producers of energy-efficient, resource-saving technologies, Siemens is a leading supplier of systems for power generation and transmission as well as medical diagnosis. In infrastructure and industry solutions the company plays a pioneering role. As of September 30, 2015, Siemens had around 348,000 employees in more than 200 countries and generated revenues of €75.6 billion in 2015.

As a truly global business, Enel is perfectly placed to open power around the world. Enel’s global reach extends from Europe, to North America, Latin America, Africa and Asia. They connect more than 61 million customers to more reliable and increasingly sustainable power, drawing from a net installed capacity of more than 89 GW, and they run 1.9 million kilometers of grid network, supplying the largest customer base of any European energy company.

- **Challenge:** When global technology powerhouse Siemens and multi-national power company Enel (Official Global Partner of Expo Milan 2015) joined forces to create an Energy Management System (EMS) they could showcase at Expo Milano 2015, they had the “Internet-of-Things” paradigm in mind. The solution would have meters and sensor devices sending energy, environmental and other data from the power utility Enel Supervisory Control & Data Acquisition (SCADA) smart grid to a control system in the cloud that could then report key information to energy decision-makers using mobile devices as well as desktop and laptop PCs.
- **Strategy:** One of the key decisions the Siemens team made at the start of the project was to provide only a web application. The decision was made to build these web applications using HTML5 to provide the application not only for the external environment, but also for the mobile application. The two companies chose to work with these open source technologies because it enabled them to use a common JavaScript stack end-to-end. Plus, they could also use the same microservice architecture technology for mobile as well as cloud applications.
- **Results:** They chose Azure because, according to Maurizio Bigoloni, Smart Grid Solutions Head of Operations, “The decision was made due to the fact that Microsoft Azure is quite open, so not only was Microsoft technology supported by Azure, but also non-Microsoft and Open Source technologies could be used. This was, for us, an important point. We needed support for JavaScript, HTML5, MongoDB on Linux, and Node.js. Microsoft Azure provided it.”  
The decision, however, didn’t end there. “The most important point,” emphasizes Bigoloni, “was the support that Microsoft was able to provide. The fact that they were able to support our solution architecture and the solution design on Azure was the most crucial thing.”

Using the Microsoft Azure platform, development of the entire solution took less than a year and a half. This gave the companies plenty of time to prepare for their successful debut at Expo Milano 2015.

#### Generali

- **Customer profile:** Generali<sup>95</sup> US Branch is the US representative office of Assicurazioni Generali, S.p.A., a global leader in insurance and financial services headquartered in Trieste, Italy, with offices in 68 countries and 65 million customers. Based in NYC, Generali US Branch provides a wide range of insurance products and services and works closely with other Assicurazioni Generali companies and their multinational customers.
- **Challenge:** Generali's disaster recovery plan relied on creating nightly backups of all servers, storing the backup tapes offsite, and when necessary sending the most recent backup tapes to a sister company in Missouri for restoration, which could take up to a week. When the Missouri company was sold, Generali needed to implement a new disaster recovery plan quickly to meet industry regulations. This was also an opportunity to find a better option for business continuity.
- **Strategy:** Generali adopted Microsoft Azure Site Recovery, a cloud-based disaster recovery orchestration service that coordinates the replication and recovery of virtual machines across sites. They created a disaster recovery infrastructure in Azure, which is being continuously synchronized with the production workloads running in the Generali US Branch datacenter. Using a management console in Azure, they are able to monitor the company's production workloads around the clock and, in the event of a looming disaster, switches the production workloads to Azure, where they can run indefinitely.
- **Results:** In a disaster situation, instead of being disabled for three to five days, Generali can be running again in minutes with less than 30 seconds of data loss. By using inexpensive cloud storage and only paying for computing capacity during the time workloads are running in Azure, Generali reduced its disaster recovery costs by 65 percent. The solution also allows Generali to easily and frequently test the full disaster recovery environment, meeting regulatory needs and providing peace of mind.

#### Dunnhumby

- **Customer profile:** Dunnhumby<sup>94</sup> employs over 2,000 people in offices across Europe, Asia, Africa, and the Americas. They analyze data from nearly one billion customers worldwide, uncover valuable insights: what customers want, where they want it, and how much they're willing to pay for it. They turn those insights into action, personalizing consumer experience in and out of store, online and off, before, during and after, earning a lifetime of loyalty. Additionally, they use these insights to transform their clients into customer-first organizations.
- **Challenge:** Dunnhumby needed to take customer science and activate it through digital channels, targeting millions of people at time, and personalize experience in digital shopping. The challenge was in scale and speed as quantity of calls could be 10,000 transactions per session. They also needed a platform to support their open source technology with the help they need when they need it.
- **Strategy:** Using Azure, they can concentrate on the delivery of the solution while Microsoft takes care of the rest. Building their solution on Azure provides the millisecond response times they need, with the scale they need. They also chose Azure for advanced analytics that they could build into the platform to deliver insights to customers.

- **Results:** Response times under 30 milliseconds help customers shop quicker, have personal experiences, through to the checkout process, that in turn helps increase client revenues. Azure additionally helps to serve analytics back to their customers, with support through HDInsight and Linux.

## **Trust**

Cloud computing has changed the role of enterprise IT. While still concerned with cost reduction, scalability, and service availability, today's IT manager is innovating and driving business agility more than ever before. Yet in order to realize these benefits, businesses must trust their cloud service provider.

Without this trust, security concerns threaten to stall innovation and stifle business growth. IT and business leaders need a trusted partner to bridge the gap between innovation and security. With the right technologies and processes, even the most complex enterprise can move to the cloud with confidence.

Microsoft Azure provides cloud services to enterprises and government agencies all over the world. With its unique experience and scale, Microsoft services achieve higher levels of security, privacy, and compliance than most customers could achieve on their own.

Secure cloud solutions are the result of comprehensive planning, innovative design, and efficient operations. Microsoft makes security a priority at every step, from design and operations, to threat detection and mitigation, network isolation, data encryption, identity and access control.

Key security features of Azure include Azure Active Directory, Azure Multi-Factor Authentication, Microsoft Antimalware for Cloud Services and Virtual Machines, Key Vault, and Azure Virtual Network. In addition to the robust security capabilities built into Azure, the Azure Marketplace offers a rich array of additional security products built by Microsoft Azure partners.

Azure delivers a trusted foundation on which customers can design, build and manage their own secure cloud applications and infrastructure, while reducing the cost, complexity and risk associated with security in the cloud.

Cloud services raise unique privacy challenges for businesses. That is why Microsoft implements strong privacy protections in Azure services and makes commitments to safeguard the privacy of customer data.

Privacy is built into Azure through Privacy by Design, a program which describes how Microsoft builds and operates products and services. Microsoft backs those protections with strong contractual commitments to safeguard customer data, including offering EU Model Clauses (which provides terms covering the processing of personal information), and complying with international standards. One measure of Microsoft's commitment to the privacy of customer data is the adoption of ISO/IEC 27018 related to cloud privacy. Azure does not use customer data for advertising or similar commercial purposes.

When customers entrust their data to Microsoft, they are not giving up control. Microsoft makes a clear commitment, to provide customers with control over their data.

Microsoft provides a choice of global data centers, and enables customers to determine where their data is stored, how it is used, and who has access to it. When a customer leaves Azure, or when requested, Microsoft has their data deleted entirely from its servers, backed up by contractual commitment.

For customers to effectively exercise their right to control their data, they must have access and visibility into how Microsoft handles that data. They must know where it is stored,

how it is secured, who can access it, and under what circumstances. Microsoft provides transparent policies about data use and data transfer and will fully disclose law enforcement requests for customer data. They also make available third-party auditor reports on compliance certifications and they publish their own audited security reports. Customers are notified of any security breaches and have access to clear data maps and boundary information for all Azure data centers.

Microsoft invests heavily in the development of robust and innovative compliance processes. The Microsoft compliance framework for online services maps controls to multiple regulatory standards<sup>144</sup>. This enables Microsoft to design and build services using a common set of controls, streamlining compliance across a range of regulations today and as they evolve in the future.

Microsoft compliance processes also make it easier for customers to achieve compliance across multiple services and meet their changing needs efficiently. Together, security-enhanced technology and effective compliance processes enable Microsoft to maintain and expand a rich set of third-party certifications. These help customers demonstrate compliance readiness to their customers, auditors, and regulators.

Azure holds many key certifications, attestations and authorizations as applicable to available services, including: ISO 27001, SOC 1 and SOC 2, Cloud Security Alliance Cloud Controls Matrix, EU Model Clauses, HIPAA BAA and FedRAMP P-ATO, PCI DSS, and country specific standards such as Australia IRAP, UK G-Cloud and Singapore MTCS. Over 85% of Fortune 500 customers trust the Microsoft Cloud for their business. Azure protects an organization's assets through a trust framework across security, privacy, compliance, and transparency, so that customers can focus on their core competencies.

### **Top Level Summary Points**

Security has always been a common blocker for cloud adoption, but as the technology has improved and weathered the test of business, and the value of the cloud become more apparent, individuals and organizations have developed trust in the cloud. But, that doesn't mean the work is finished, and as new cloud technologies are introduced, there are more potential vulnerabilities.

Microsoft's approach with Azure is to implement strict processes and practices to secure the platform, and also empower its customers to protect themselves and make choices about where they put their data and applications.

Security practices such as "red team/blue team" where Microsoft sets up hackers to breach the systems (red team) and defenders to defend the systems (blue team) are one innovative approach to protecting its customers. It also provides services that customers can configure to proactively detect and mitigate threats. It also provides choice in where the customer wants to put their data and apps: the public cloud, a local cloud, or sovereign clouds such as in China, that are heavily regulated yet important for its customers to be able to take advantage of the cloud.

Trust in Microsoft's commitment to business is proven to developers in several ways: security, compliance, privacy and transparency.

### **Key features and functionalities**

- Microsoft proactively detects security vulnerabilities, automatically restricts access, and provides notifications and recommendations across cloud services and identity with Azure Security Center.
- Customers can protect their technology investments with Azure's global datacenter reach, with 32 announced regions worldwide in over 100 countries, ranking Azure as one of the top three networks in the world, with financially backed SLAs across all GA services.
- Within Azure's customer agreement, both customer and provider have full rights to protect their own intellectual property, unlike Amazon Web Services' customer agreement which states you may not assert patent or intellectual property infringement on them.

- Azure has one of the largest compliance portfolios in the industry, from HIPAA to ISO 27018.

### Technologies

- Azure datacenter coverage (32 announced, 24 launched, [full list](#))
- Azure Sovereign clouds (8 announced—US DoD East, US DoD West, Germany Central, Germany Northeast, 4 launched—US Gov Iowa, US Gov Virginia, China North, China South)
- Azure security processes and operations (e.g. “Assume breach”)
- Azure customer agreement intellectual property terms in [Microsoft Online Subscription Agreement](#)<sup>104</sup>
- Azure service level agreements<sup>134</sup> across all generally available services ([full list](#))<sup>135</sup>
- Azure compliance across services ([full list](#))

### Detecting and Mitigating Treats

Security is built into the services Microsoft provides to its customers, and embedded within its development processes, infrastructure, operations, and compliance.

Assume Breach is an example of operational innovation for securing customers’ business.

Identifying and ejecting attackers, limiting what access an attacker would have if various layers were breached – Microsoft does this through techniques like segregation of duties. By constantly challenging the security capabilities of the service, Microsoft can stay ahead of emerging threats and be prepared to act quickly to threats.

Microsoft provides customers services to empower them to protect their assets, for example, Azure Security Center helps them prevent, detect and respond to threats with increased visibility and control over the security of all your Azure resources. It provides a central view of security across customers’ subscriptions, and enables them to set policies and monitor security configurations. Policy-driven recommendations guide resource owners through the process of implementing security controls and enable rapid deployment of Microsoft security solutions. Security-related events from across a customer’s Azure deployments are automatically collected and analyzed using Microsoft global threat intelligence and expertise to identify actual threats and reduce false alarms. The resulting real-time alerts offer insights into the attack campaign and suggest ways to remediate and recover quickly.

### Achieve Global Scale, in Local Regions

Customers can explicitly choose which regions to deploy and store their data according to local privacy, security, or compliance requirements. Microsoft operates on 34 regions including:

- Public cloud regional datacenters with geographic diversity. Customers can deploy two identical workloads in different regions with an Active/Active failover model. This can ensure business continuity in the event of a local disaster.
- Local and sovereign cloud. In-country Microsoft datacenters address data residency requirements, and Microsoft is using a combination of technology as well as a legal framework to legally isolate certain regions of the world according to local sovereignty, governance, and rule of law, all the while providing the same exact up to date set of services in those regions.

There are four sovereign clouds today and four more planned, including Germany for example, as well as: US Gov, China North Beijing, China South Shanghai, Germany Central, Germany Northeast, US DoD East, US DoD West.

**Relentless Business Commitment**

Finally, Azure is designed with an aggressive compliance strategy that helps customers address business objectives and industry standards & regulations. Microsoft’s security compliance framework includes test and audit phases, security analytics, risk management best practices, and security benchmark analysis to achieve certificates and attestations.

In summary, Microsoft Azure is the cloud platform for digital transformation, from app innovation to data and intelligence, with the openness and flexibility to deploy what customers want, where they want it, with industry-leading security and compliance.

Finally, Azure is just one component of the Microsoft Cloud. Customers also benefit from integrated solutions across productivity<sup>26</sup> with Office 365, and business apps with Dynamics.



Figure 20: Microsoft Cloud Alignment

**Introducing the new Office**

- Devices:** Fast and fluid experience with touch, pen, mouse & keyboard; Immersive touch-optimized Windows 8 store apps; Support for Windows Phone, iOS & Android phones.
- Social:** Newsfeeds, microblogging & Yammer; Pervasive social capabilities across Office; Multiparty HD video & Skype federation.
- Cloud:** Office - on demand, roaming & up-to-date; New cloud app development model; Enterprise-grade reliability and standards.
- Control:** Spreadsheet governance and controls; DLP, data retention & unified eDiscovery; Consistent management experience across Office 365.

Figure 21: Office 365 capabilities





Office 365: Technical differentiators		
	Microsoft	Google
 Standards & Certifications	Accessibility HIPAA compliance	Not addressing accessibility issues No HIPAA compliance
 Manageability	Simple online administration Single management console	DIY approach to administration No desktop deployment tools
 Identity Federation	Seamless integration via native tools (Active DirSync, ADFS)	Requires connectors, adapters, new servers, and custom code
 Change & Innovation	12 months' notice SLA covers all services	1 week notice (if at all) SLA only covers core services

Figure 22: Office 365 vs Google Apps Technical differentiations

#### Always Up & Always On

In addition, Microsoft Azure is always up and always on, open and provides unlimited servers and storage.

Delivers a 99,95% monthly SLA (99.95% SLA provided on compute, 99.9% on other services), enabling customers to build and run highly available applications without focusing on the infrastructure.

#### Open

Azure enables developers to use any language, framework or tool to build applications. Supports open protocols, licensing and solutions.

#### Unlimited Servers and Storage

Azure enables customers to easily scale their applications to any size. It is a fully automated self-service platform that allows them to provision resources within minutes.

### Products and Services

#### Microsoft Azure Compute

**Virtual Machines** deliver on-demand, scalable compute infrastructure when customers need to quickly provision resources to meet their growing business needs. With Virtual Machines, customers get a choice of Windows Server and Linux operating systems in multiple configurations on top of the trustworthy Azure foundation.

#### Understanding Azure Virtual Machines

Azure virtual machines (VMs) allow customers to use Microsoft Infrastructure as a Service (IaaS) by letting them rent time on a Microsoft server. Common use cases include development and test, running production applications in the cloud, extending their datacenter into the public cloud, and disaster recovery. Customers can deploy a virtual machine nearly

instantly, with any workload and any language on nearly any operating system, and pay by the minute.

**Mobile Services** allows for the creation of a scalable and secure backend for customers' Windows, Android, and iOS apps. Mobile Services allows customers to accelerate their mobile app development by providing a turnkey way to structure storage, authenticate users, and send push notifications. With SDKs for Windows, Android, iOS, and HTML as well as a powerful and flexible REST API, Mobile Services lets customers to build connected applications for any platform and deliver a consistent experience across devices.

**Websites** offers secure and flexible development, deployment and scaling options for any sized web application. Customers can leverage their existing tools to create and deploy applications without the hassle of managing infrastructure.

**Cloud Services** offers highly-available, infinitely scalable applications and API's. It is easy to quickly deploy and manage powerful applications and services with Azure Cloud Services. Customers can simply upload their application and Azure handles the deployment details - from provisioning and load balancing to health monitoring for continuous availability. Applications are backed by an industry leading 99.95% monthly SLA. Customers just focus on the application and not the infrastructure.

Infrastructure building blocks	Platform building blocks	Cross-service offers	Other tools
<b>Compute</b> VM's, Web/Worker roles, Cloud Services,	<b>Database</b> SQL Database, Tables, DocumentDB	<b>Deployment</b> Automation, Scheduler	<b>Management</b> Azure Portal, Diagnostics & Service Management, APIs, Systems Center, SCOM pack
<b>Storage</b> Blob Storage, Azure Drive, Backup, StorSimple, Site Recovery	<b>Messaging</b> Service Bus, Azure Queues, Notification hubs, Event Hub	<b>Analytics</b> HDInsight, Machine Learning, Stream Analytics	<b>Development</b> Command line interface, Eclipse tools, Visual Studio
<b>Networking</b> Azure DNS, Virtual network, Traffic Manager, ExpressRoute	<b>Delivery</b> CDN	<b>Apps</b> Azure Search	<b>Industry-specific</b> Media services, Mobile services
	<b>Caching</b> Shared/dedicated caching	<b>Identity</b> Azure Active Directory	
		<b>Integration</b> BizTalk Services	

Microsoft Global Infrastructure  
 North America: US North Central (Illinois), US Central (Iowa), US South Central (Texas), US East (Virginia), US West (California)  
 Europe: Europe North (Ireland), Europe West (Netherlands), APAC: Asia Pacific East (Hong Kong), Asia Pacific Southeast (Singapore), China (Beijing) China (Shanghai), Japan East (Saitama Prefecture), Japan West (Osaka Prefecture), Brazil South (Sao Paulo)  
 Future Locations: Australia (East), Australia (Southeast)

**Figure 23: Microsoft Azure Computing Platform (Microsoft Azure Stack)**

**Data Services**

**Storage** provides anywhere and anytime access via a cloud storage system. It is highly durable, available and massively scalable.

**SQL Database** makes tier-1 capabilities easily accessible for cloud architects and developers by delivering predictable performance, scalability, business continuity, data protection, and near-zero administration—all backed by the power and reach of the Microsoft Azure platform.

**HDInsight** brings an Apache Hadoop-based solution to the cloud. It provides the ability to gain the full value of Big Data with a modern, cloud-based data platform that manages data of any type, whether structured or unstructured, and of any size.

**Cache** creates the ability to build highly scalable and responsive applications by providing super-fast access to data through a family of distributed, in-memory, scalable solutions.

**Backup Recovery** offers familiar tools in Windows Server, Windows Server Essentials, or System Center Data Protection Manager to provide a cloud backup service.

**Azure Site Recovery** helps protect important services by coordinating the automated replication and recovery of System Center 2012 private clouds at a secondary location.



## App Services

**Media Services** offer cloud-based media solutions from many existing technologies from the Microsoft Media Platform, including ingest, encoding, format conversion, content protection and both on-demand and live streaming capabilities.

**Service Bus** serves as a messaging infrastructure that sits between applications allowing them to exchange messages for improved scale and resiliency.

**Notification Hubs** provide a highly scalable, cross-platform push notification infrastructure that enables either broadcast push notifications to millions of users at once or tailor notifications to individual users.

**Scheduler** allows actions - such as calling HTTP/S endpoints or posting a message to a storage queue - on any schedule. With Scheduler, customers can create jobs in the cloud that reliably call services both inside and outside of Azure and run those jobs on demand, on a regularly recurring schedule.

**Automation** allows for the automation, creation, deployment, monitoring, and maintenance of resources in the Azure environment using a highly scalable and reliable workflow execution engine, allowing for a decrease in operational expense for cloud operations.

**BizTalk Services** provides Business-to-Business (B2B) and Enterprise Application Integration (EAI) capabilities for delivering cloud and hybrid integration solutions through a simple, powerful, and extensible cloud-based integration service.

**Visual Studio Online** allows the ability to host code, plan and track projects, and collaborate with team members to ship better software. Visual Studio Online provides an end-to-end, cloud-based ALM solution that handles everything from hosted code repos and issue tracking to load testing and automated builds.

**Active Directory** is a comprehensive and highly available identity and access management cloud solution. It combines core directory services, advanced identity governance and application access management. Azure Active Directory interoperates with on-premises Active Directory deployments and third-party identity providers. It is a powerful identity and access management solution that connects users and cloud applications to provide a seamless sign-in experience that can be secured by using multifactor authentication. Azure AD also provides rich standards-based platform for developers.

Active Directory Federation Services, Microsoft Identity Management, Rights Management Services are more examples of the commitment of Microsoft in the access and information protection space. Azure Active Directory continues the legacy in the Public Cloud era and provides a secure and comprehensive solution for those enterprises that want to extend their reach to cloud-based applications and resources.

**Multi-Factor Authentication** helps secure access to on-premises and cloud applications by providing an additional layer of authentication. It supports authentication through mobile app, phone call or text message.

**CDN** improves performance of applications by caching content at locations closest to end customers.

**API Management** allows organizations to publish APIs more securely, reliably, and at scale. Customers can use API Management to drive API consumption among internal teams, partners and developers while benefiting from business and operational insights available in the admin portal.

**RemoteApp** delivers Windows Server-based applications from Azure. Users can access their applications remotely from virtually anywhere, at any time, and on a variety of devices. Applications are centralized on Azure but they appear as if they are running on end users' devices.

## Network Services

**ExpressRoute**<sup>51</sup> enables private connections to be created between Azure datacenters and infrastructure that's on-premises or in a co-location environment. ExpressRoute connections do not go over the public Internet, and offer more reliability, faster speeds, lower latencies and

higher security than typical connections over the Internet. ExpressRoute via an Exchange Provider is charged based on a monthly dual-port fee, and is separated into SKUs by port speed. All inbound data transfer is free of charge, and some outbound data transfer is provided free of charge. ExpressRoute via a Network Service Provider is charged based on a monthly dual-port fee, and all inbound and outbound data transfer are included free of charge. Network Service Providers are priced with unique SKUs according to port speed.

**Azure Virtual Network (VNET)**<sup>146</sup> enables the creation of a Virtual Private Networks (VPN) within Azure and securely link with on-premises IT infrastructure. Setting up a VNET is free of charge. However, there is a charge for the VPN gateway that connects to on-premises. This charge is based on the amount of time that gateway is provisioned and available.

**Azure Traffic Manager**<sup>143</sup> allows for the ability to load balance incoming traffic across multiple hosted Azure services whether they're running in the same datacenter or across different datacenters around the world. Traffic Manager is priced according to queries and endpoint, each with a unique SKU<sup>118</sup>.

**Data Transfers** refer to data moving in and out of Azure data centers other than those explicitly covered by the Content Delivery Network or ExpressRoute pricing. Inbound data transfers to Azure are free. Outbound data transfers (i.e. data going out of Azure data centers) is based on volume.

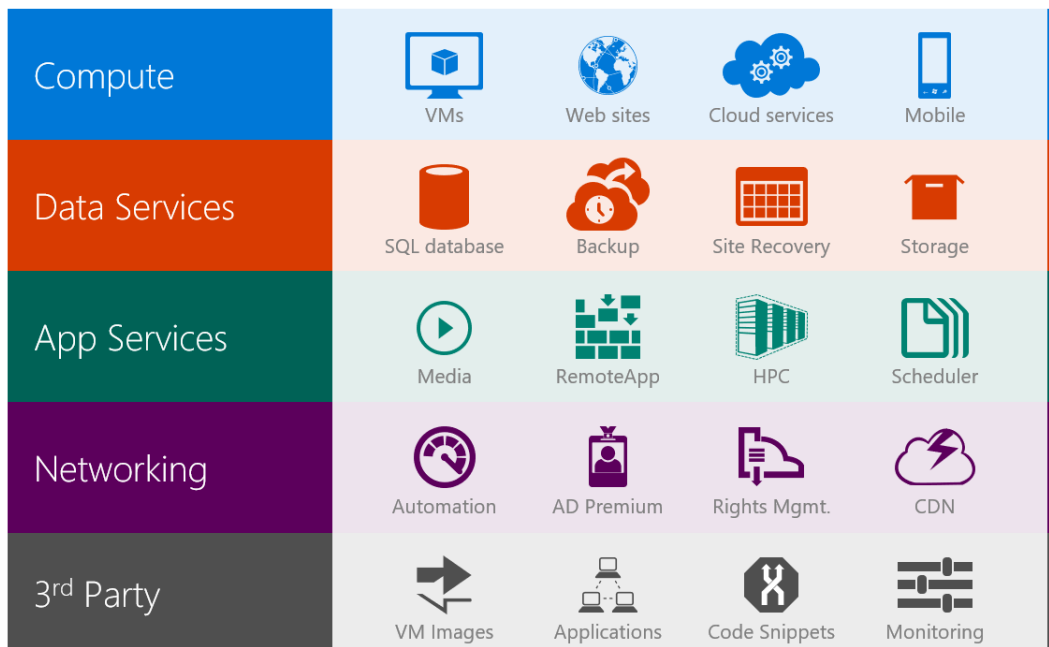


Figure 24: Azure Products

## Azure Consumption Models



### Azure Plans and Services

#### Plans

- Pre-defined resource, for use over a pre-defined period of time, includes:
  - Non-consumption offer e.g. Azure support
  - Pre-configured Service e.g. Azure Active Directory
  - Suite of Services e.g. OMS
- Pre-pay for annual coverage
- Pay for additional usage via Monetary Commitment or Pay-As-You-Go

#### Services

- Flexible resources, for use with variable deployment needs – a.k.a. Virtual Machine, HD Insights
- Pay via Monetary Commitment or Pay-As-You-Go
- Pay for what you use

Azure Services 	Azure Plans 
<ul style="list-style-type: none"> <li>• Metered products</li> <li>• Pay for what you use</li> <li>• For variable deployment needs</li> </ul> <p style="text-align: center;"><b>Example</b> Virtual machines Storage Content delivery (CDN)</p>	<ul style="list-style-type: none"> <li>• Pre-configured grouping of products</li> <li>• Pre-pay for annual coverage</li> <li>• For predictable deployments</li> </ul> <p style="text-align: center;"><b>Examples</b> Insight and Analytics IoT Suite Azure Support</p>

**Figure 25: Azure Consumption models**

**Azure Services** are billed as:

- Metered usage products (each consumption meter has a price):  
Pay for the exact resources consumed.  
For Example:
  - Azure Virtual Machines consumption is metered and billed on a per-minute basis, based on an hourly price tag (price per hour). This price tag is defined by configuration parameters such as virtual machine instance type, operating system and datacenter.
  - Azure Storage is metered and billed based on average daily amount of data stored, in gigabytes (GB), over a monthly period (price per gigabyte per month).

A customer's final bill on their consumption of the service may be defined by multiple meters. For example, in addition to the price per gigabyte per month, we charge a price for a certain number of Storage transactions (read / write operations) per month.

- Monthly entitlement products metered by unit or user
  - Pay for a month's access to a service based on:
    - Per Unit (e.g. Site Recovery)
    - Per User (e.g. Azure Active Directory)

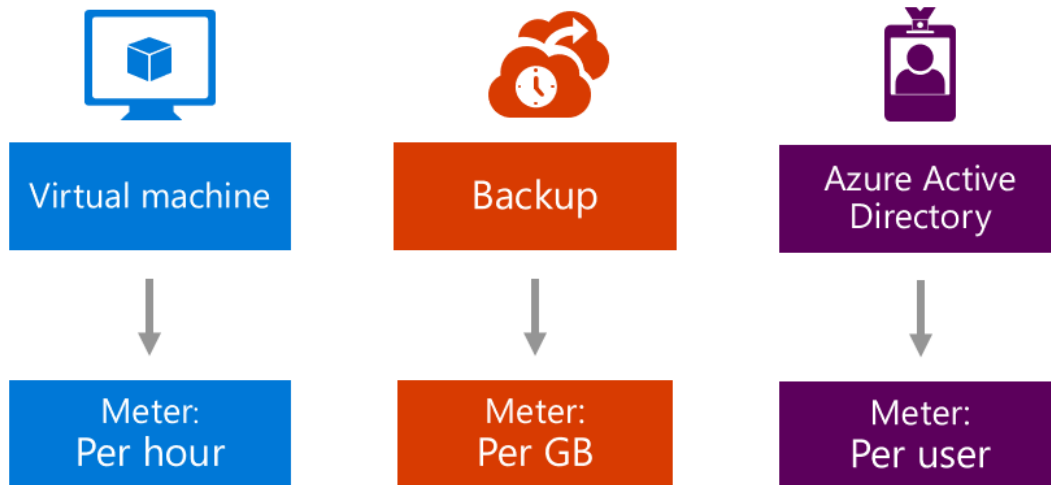


Figure 26: Azure Consumption models - Azure Services

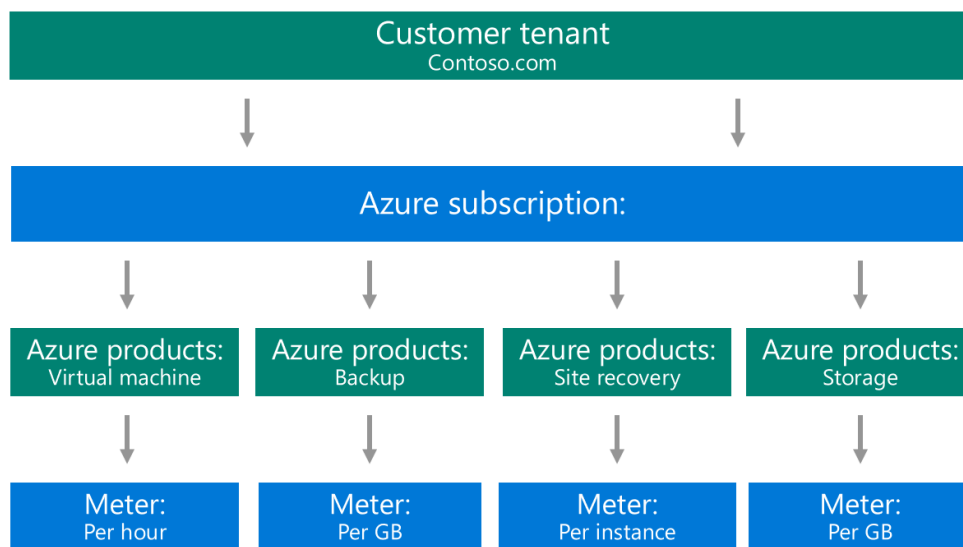
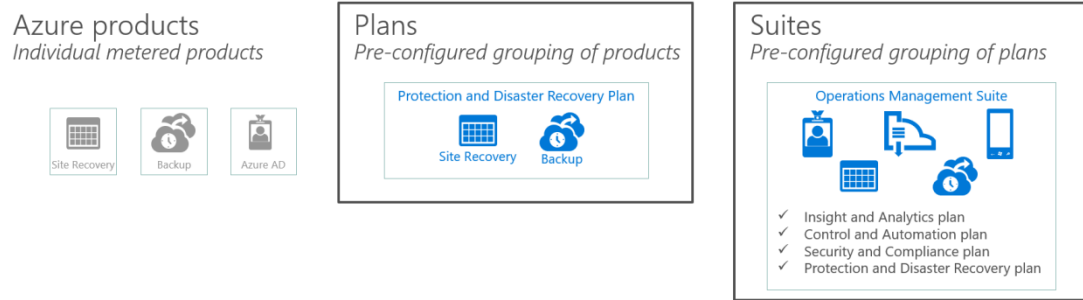


Figure 27: Azure Services - Account structure example

**Benefits of Azure Plans:**

- Some products are more easily consumed as a plan
- Plans can offer deeper value when licensed annually
- Targeted at specific solutions (e.g. Protection and Disaster Recovery Plan)



**Figure 28: Azure Consumption Models - Azure Plans**

Microsoft Azure Services Plans have different program availability, as summarized below. Service Plans are not available in CSP and MOSP.

Online Services	Open	EA/EAS	EES
Azure Active Directory Basic (User SL)			
Azure Active Directory Premium Plan 1 and Plan 2 (User SL)			
Azure Active Standard Support			
Azure Active Professional Direct Support			
Azure App Service Plan <sup>8</sup>			
Azure Information Protection Premium Plan 1 and Plan 2 (User SL)			
Azure Information Protection Premium Plan 1 and Plan 2 Add-on (User SL)			
IoT Suite Predictive Maintenance Plan 1 and Plan 2			
IoT Suite Remote Monitoring Plan 1 and Plan 2			
Azure Site Recovery (to Customer Owned Site)			
Microsoft Azure StorSimple Monetary Commitment-1 (8100 device) and Commitment-2 (8600 device)			
Microsoft Azure StorSimple Standard Support			
Microsoft Azure StorSimple Standard Support to Premium Support			
Microsoft Azure StorSimple Premium Support			
Microsoft Cloud App Security (User SL)			
Microsoft Cloud App Security K (User SL)			
Microsoft MultiFactor Authentication			
Operations Management Suite E1 and E2			
Operations Management Suite E1 and Suite E2 Add-on			
Operations Management Suite E1 and E2 From SA			
Operations Management Suite: Insights and Analytics			
Operations Management Suite: Automation and Control			
Operations Management Suite: Security and Compliance			
Operations Management Suite: Backup and Disaster Recovery			

**Figure 29: Ways to purchase Azure service plans**

## Sales Tactics

Microsoft's mainstream sellers are focused on selling on-premises solutions and incubation sellers sell Windows Azure. Microsoft pitches to enterprise IT and focuses on telling its platform story. In the past, Microsoft struggled to sell Windows Azure because sellers didn't engage enterprise developers and architects, the key target for Windows Azure PaaS scenarios.

## Azure Purchase Options

The first consideration when purchasing Azure is what is being purchased and how it will be billed. There are three main offerings for Azure:

- **Microsoft Azure Services** are a rapidly growing number of metered services providing immediate access to Microsoft's Cloud and the flexibility to increase or decrease usage according to business needs. With Azure services, customers pay for what they use in arrears, with no minimum quantity or upfront cost.
- **Microsoft Azure Plans** are logical groupings of services packaged together as a solution. Plans allow Microsoft to provide predictable pricing in return for an upfront commitment and/or to sell a package of services that logically make up a solution. Plans include entitled amounts of Azure services.
- **Microsoft Azure Marketplace** provides access to thousands of third-party products, all of which customers can provision in the Azure portal and which can be billed via most Microsoft Volume Licensing agreements.

Once a customer decides what services or plans they want to purchase, there are several purchasing options that apply to the offerings above:

Microsoft offers commitment-based and transactional options for commercial and government institutions that want to purchase Microsoft Azure through Microsoft-assisted, partner-led, or self-service web options.

- **Web - Online (Pay as You Go (PAYG)):**  
Customers pay only for what they use, in arrears. No minimum quantity or upfront costs. Features flexibility to start or terminate in the Azure Portal. Customers can use PAYG<sup>114</sup> for Azure Services and Azure Marketplace.

There are two options for pay as you go customers:

- **Month to month**  
Customers can purchase Azure online, directly through **MOSP** (Microsoft Online Subscription Program). Microsoft Online Subscription Program (MOSP)<sup>112</sup> is available to any customer that wants to purchase through the web. Customers can easily subscribe, manage and deploy Azure services online by going to <https://azure.microsoft.com/>. MOSP is available via a month-to-month purchasing option. Customers pay monthly based on their usage using a credit card or being invoiced. They can do so with no upfront commitment and can end their service at any time.

Use Scenario:

- Online Storage.
- Media Streaming.
- **6 or 12-month commitments (Prepay for committed services (Azure Plans))**
  - Customers pay up front for longer term commitments to specific services or groupings of services. Azure Plans may be right for

customers who can estimate their usage and who do not have surplus MC balance to use.

- Commitments start at \$500/month.
- Customers pre-determine their approximate usage and commit to a monthly payment.
- Customers can pay monthly or pre-pay in advance.
- Any unused commitment balance will be credited forward.
- Discount offered according to commitment level.
- Monthly billing.

Use Scenario:

- Startup with Compute, Storage and DB needs.
- Midsized business initial app migration.

- **Enterprise Agreement (EA)**<sup>74</sup>

Customers receive the best pricing option under an Enterprise Agreement. The EA purchase process is the following:

- Customers will make an upfront 1-3 years commitment, based on their expected use.
- Usage is charged against the commitment, much like a cell phone bill.
- If a customer exceeds their commitment usage by no more than 50%, they will continue to pay yearly, at the EA rates.
- If the customer exceeds their commitment usage by more than 50%, they will pay quarterly.
- If the customer's usage does not match their commitment, there is no roll-over of funds, but the customer will be eligible for a subscription reduction at anniversary.

Payment methods: An initial upfront payment is required to enroll under an EA, overages beyond the initial commitment are billed by invoice.

There are two methods to make the monetary commitment:

- Up front commitment in which the customer commits to a consistent dollar amount each year for three years.
- Incremental growth in which the customer makes an initial commitment, with a greater commitment for each successive year based on projected increase in Azure use.

Two forms of enrollments are available under an Enterprise Agreement:

- **Enterprise Enrollment** for customers' end user services and device needs, which covers popular products and services such as Office, Windows, and CAL Suites, allowing Azure to be added to an existing Enterprise Agreement.
- **Server and Cloud Enrollment** for licensing customers' datacenters and infrastructure products and services, both on-premises and cloud hosted. Server and Cloud Enrollment replaces the Enrollment for Application Platform (EAP) and Enrollment for Core Infrastructure (ECI).

	<b>Core Infrastructure</b>	<b>Application Platform</b>	<b>Developer Platform</b>	<b>Azure</b>
--	----------------------------	-----------------------------	---------------------------	--------------

<b>Products</b>	CIS (Windows Server + System Center)	SQL Server and/or BizTalk	Visual Studio	All Azure Services
<b>Requirements</b>	All Windows Server deployments covered with CIS SKUs	Full SA coverage of all SQL licenses in use	Full SA coverage	Automatically available
<b>Minimums</b>	50 processors of CIS SKUs	50 SQL Server cores or 5 servers + 250 CALs 24 BizTalk cores	20 licenses	No minimum with purchase of another component; Standalone for MC minimum of \$12000/yr.

Enrollment is an enrollment within the EA construct, designed specifically for customers making commitments to Cloud + Enterprise products. Customers can sign an SCE by committing to one or more of the following components in the table below:

The SCE allows customers to carve out commitments to C+E products and get all the benefits of the Enterprise Agreement. In return for customers committing to Software Assurance coverage of their installed base of the products in the table above, they receive discounts and other benefits. One of the benefits is how the SCE provides access to Azure.

In a SCE, customers have two options for purchasing Azure. First, if they have a commitment to another product component, such as SQL Server, CIS or DevTools, they can just start using Azure without committing anything up front and be billed quarterly in arrears. Secondly, customers can also sign an SCE with only Azure. This means they can get all the benefits of EA without having an EA or SCE for any other product at Microsoft. This is commonly referred to as having an “Azure only SCE.” There is one main difference between an Azure only SCE and having an SCE for another product when it comes to purchasing Azure. For SCE, the minimum MC requirement has changed to be 10 units i.e. 10 units \* \$100/unit \* 12 months = \$12000 per year.

SKU’s can be used to add funds to a customer’s Azure Monetary Commitment balance. All SKUs are sold in service specific blocks, dependent upon the product.

Customer discounts are based off the future pricing table with the standard EA A-D scale.

EA Customers with eligible application server licenses that are covered by active Software Assurance can elect to use License Mobility through Software Assurance to move their licenses to Azure with no mobility fees.





Figure 30: Understanding the EA Payment Process

**Monetary Commitment within Enterprise Agreement**

- Customers allocate funds and pay in advance for Azure Services on their Microsoft Enterprise enrollment. Customers can use MC for Azure Services only. Can't be used on Azure Plans, Support, Store, or other Enterprise Agreement products/services.
- Upfront payment valid until enrollment anniversary (maximum of 12 months).
- Azure-only Server and Cloud Enrollment (SCE) requires a minimum of 10 monetary commitment units per month.
- Indirect EA pricing comes from the partner.

**Additional usage beyond Monetary Commitment**

- **Direct Enterprise Agreement:**
  - Pay at the end of the year for unplanned growth
  - If a customer goes 150% beyond their commitment, the full additional usage starts to bill at the end of each quarter.
- **Indirect Enterprise Agreement:**
  - All additional usage is billed quarterly

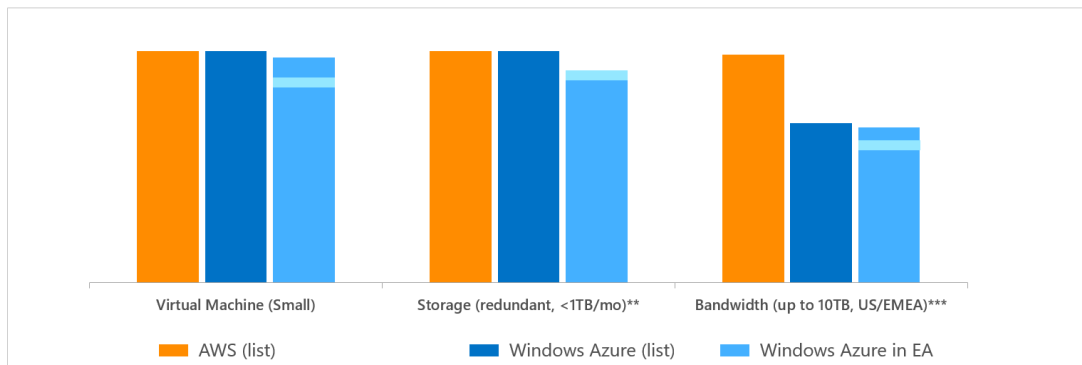


Figure 31: Better per-meter pricing than AWS on key cloud services\*

\* Microsoft has publicly promised to match AWS' prices on compute, storage and bandwidth. EA pricing is better than AWS's prices based on being a discount over that promise.

\*\*If customers exceed 500TB/mo, WindowsAzure.com, users get better pricing. The same 500TB/mo threshold exists for AWS, but only the incremental storage above 500TB gets the better pricing.

\*\*\* If customers transfer more than 51TB/mo, WindowsAzure.com<sup>119</sup> users get better pricing. The same 500TB threshold exists for AWS, but only the incremental transfers above 51TB/mo gets the better pricing<sup>120</sup>.

**Microsoft Azure Pricing Calculator**

1 Select Region & Currency

2 Select Instance Size & type, OS, # of instances, hourly usage/month

3 Quickly see hourly and month costs

4 Track monthly total cost by service

SKUs visible through separate export page

Select A, D, or G Series General Purpose Instances	Select instance size	Select OS	Instances	vCPUs	RAM	Hourly Price	Monthly Price
A0 Extra Small (1 core, 0.75GB RAM)	Standard	Windows	0	744	Hours	\$0.00	\$0.00
A1 Small (1 core, 1.75GB RAM)	Standard	Windows	0	744	Hours	\$0.33	\$244.40
A2 Medium (2 cores, 3.5GB RAM)	Standard	Windows	0	744	Hours	\$0.00	\$0.00
D0 (2 cores, 7GB RAM)	Standard	Windows	7	30	Hours	\$2.16	\$64.68
A4 Extra Large (8 cores, 14GB RAM)	Standard	Windows	0	744	Hours	\$0.00	\$0.00
Select A, D, or G Series Memory Intensive Instances							
D11 (2 cores, 14GB RAM)	Standard	Linux	10	744	Hours	\$2.08	\$1,547.52
A6 (4 cores, 28GB RAM)	Standard	Windows	0	744	Hours	\$0.00	\$0.00
A7 (8 cores, 56GB RAM)	Standard	Windows	0	744	Hours	\$0.00	\$0.00
Select A or G Series Compute Intensive Instances							
A8 (8 cores, 56GB RAM)	Standard	Windows	0	744	Hours	\$0.00	\$0.00
A9 (16 cores, 112GB RAM)	Standard	Windows	0	744	Hours	\$0.00	\$0.00

Total Virtual Machine Price: \$1,856.68  
Combined Hourly Price for all Instances: \$4.56

Figure 32: Azure EA pricing calculator

1 Name: Calc Demo

2 Select a price level: None, EA Level A, EA Level B, EA Level C, EA Level D

3 Virtual Machines

4

5

1 Name and save calculation online

2 Easily switch between MOSP and EA pricing levels

3 Add only the services of interest and quickly configure service details.

4 SKU details immediately visible

5 Save and share calculation with internal and external teams

Figure 33: Azure EA pricing calculator example

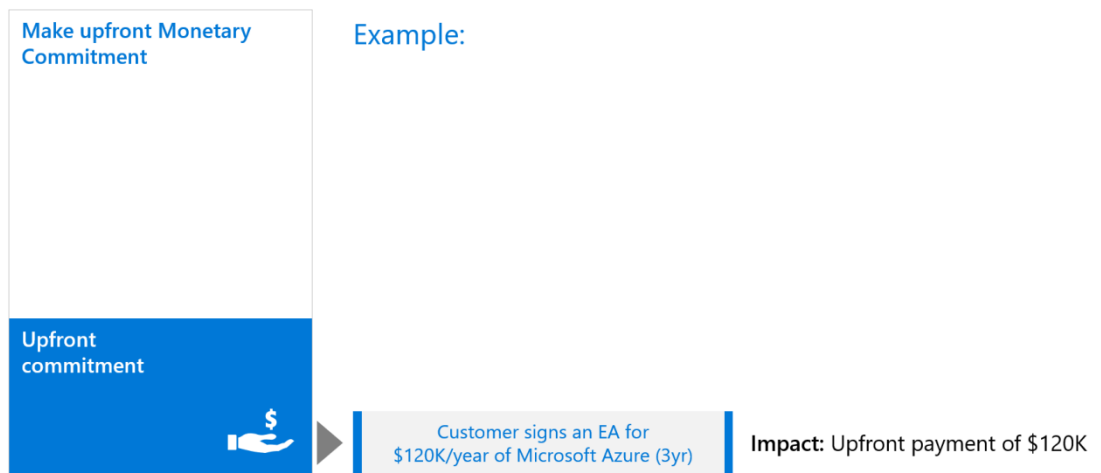
Usage Summary   Download Usage   **Price Sheet**

2 Download   
 1 Search   
 Data Transfer X

Service	Unit of Measure	Included Quantity	Commitment Part Number	Commitment Unit Price	Overage Part Number	Overage Unit Price
Data Transfer In - Zone 1	10 GB	0	QSH-00016	\$0.00 <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">3</span>	QSH-00017	\$0.00 <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">1</span>
Data Transfer In - Zone 2	10 GB	0	QSH-00018	\$0.00 <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">1</span>	QSH-00019	\$0.00 <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">1</span>
Data Transfer In - Zone 3	10 GB	0	QSH-00020	\$0.00 <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">1</span>	QSH-00021	\$0.00 <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">1</span>
Data Transfer Out - Zone 1	10 GB	0	QSH-00010	\$0.77 <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">1</span>	QSH-00003	\$0.77 <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">1</span>
Data Transfer Out - Zone 2	10 GB	0	QSH-00009	\$1.21 <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">1</span>	QSH-00002	\$1.21 <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">1</span>
Data Transfer Out - Zone 3	10 GB	0	QSH-00014	\$1.59 <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">1</span>	QSH-00015	\$1.59 <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">1</span>
ExpressRoute (Carrier) Data Transfer In (GB)	1 GB	0	J2Q-00053	\$0.00 <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">1</span>	J2Q-00054	\$0.00 <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">1</span>
ExpressRoute (Carrier) Data Transfer Out (GB)	1 GB	0	J2Q-00051	\$0.00 <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">1</span>	J2Q-00052	\$0.00 <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">1</span>
ExpressRoute (IXP) Data Transfer In at 1 Gbps (GB) - Zone 1	100 GB	0	J2Q-00009	\$0.00 <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">1</span>	J2Q-00010	\$0.00 <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">1</span>
ExpressRoute (IXP) Data Transfer In at 1 Gbps (GB) - Zone 2	100 GB	0	J2Q-00012	\$0.00 <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">1</span>	J2Q-00011	\$0.00 <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">1</span>

- 1 Search for individual Azure Services to view service measurement, SKU and price details
- 2 Download full price sheet
- 3 View customer's current and baseline price points

**Figure 34: Azure EA Enterprise Portal - Price Sheet**  
**Buying Azure Services: Monetary Commitment example**



**Figure 35: Make upfront Monetary Commitment**

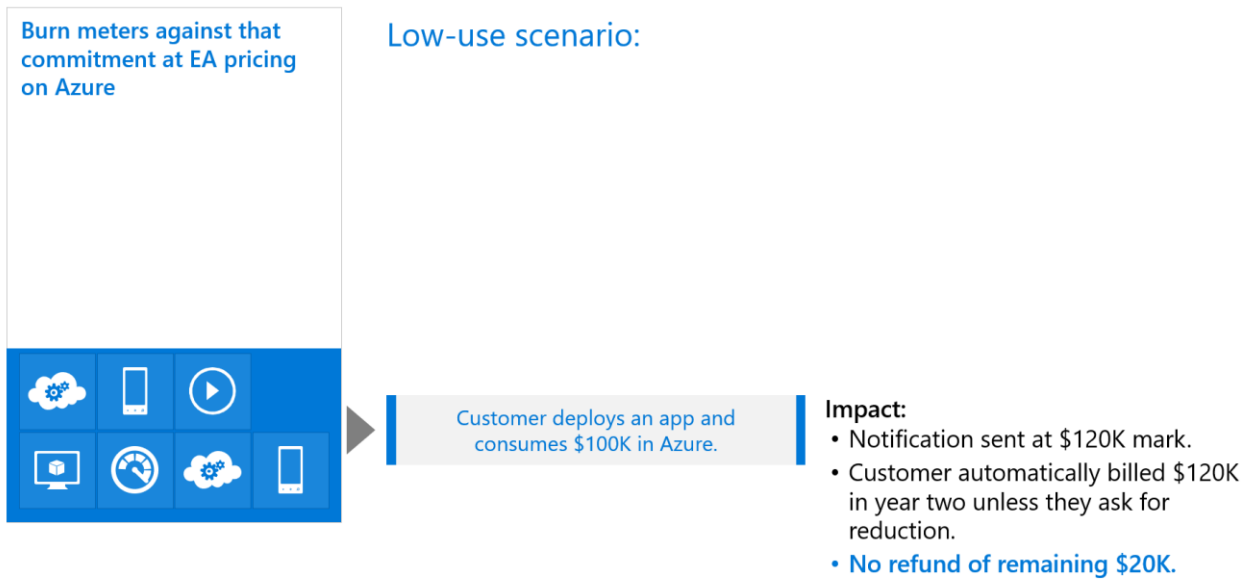


Figure 36: Buying Azure Services: Monetary Commitment - Low-Use Scenario

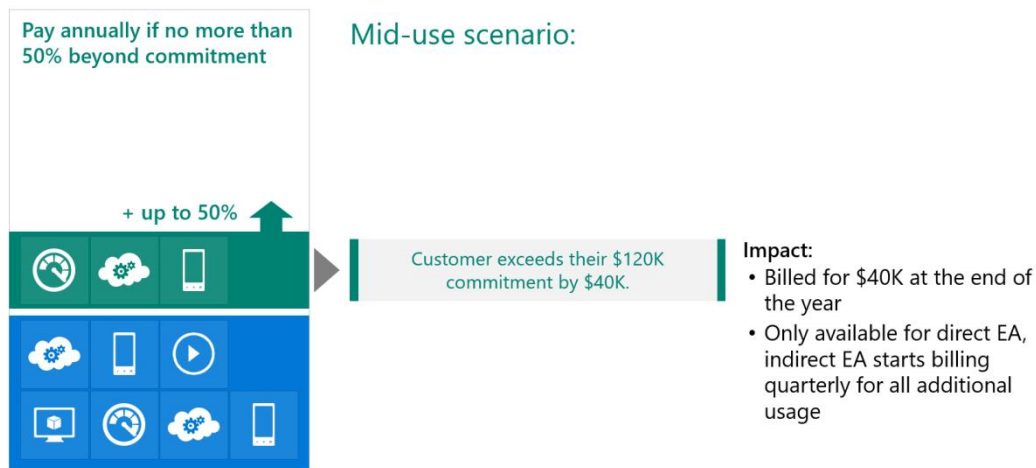


Figure 37: Buying Azure Services: Monetary Commitment - Mid-Use Scenario

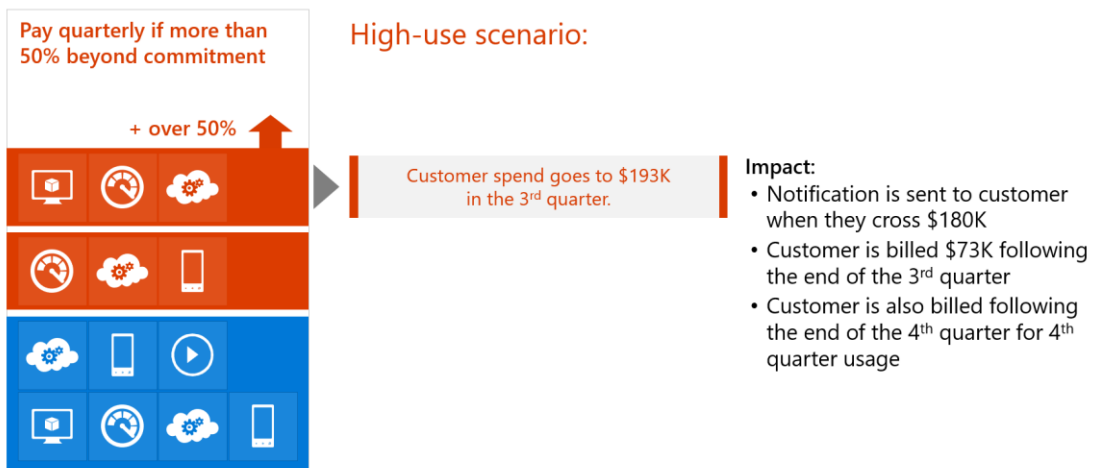


Figure 38: Buying Azure Services: Monetary Commitment - High-Use Scenario

- **Azure in Open<sup>14</sup>:**

The Microsoft Open License agreement (Open), Open Value agreement (OV), and Open Value Subscription (OVS) option are the group of commercial licensing agreements for small and mid-sized customers and are sold through a two-tier format via distributors and resellers. Together, they are commonly known as Open Agreements.

Microsoft Azure is sold in the Open License and Open Value as a monetary commitment that is valid for 12 months. These monetary commitments can be applied toward any consumption-based Azure service. You purchase Azure Monetary Commitment credits from your reseller in the form of an Online Service Activation (OSA) Key. Azure pricing is specific to the services consumed.

Azure is available as an Additional Product in Open License, Open Value, and Open Value Subscription for all customer types (Commercial, Academic, and Government), and leverages similar ordering and provisioning processes as other Online Services in the Open Programs.

- **Azure through CSP<sup>13</sup>:**

Customers can also purchase Azure through a solution partner. The Microsoft Cloud Solution Provider (CSP) program is ideal for customers looking to use a partner to help with buying, managing and supporting their Azure needs. CSP is built with the partner at the center of the customer relationship and customers who want to outsource the procurement, provisioning, management and support of Microsoft cloud services to a trusted partner who can oversee their solution from end-to-end. Microsoft is less central here (compared to EA or MOSP) since the partner manages the customer end-to-end.

CSP is a unique resale program because it requires partners to not only resell Azure to customers, but also to provide support as the first point of contact for all the customer's needs. This ensures that customers purchasing through CSP have a healthy level of help managing their Azure infrastructure. Partners can directly provision customer subscriptions and utilize tools to manage and modify subscriptions and bill customers for their usage. Partners own the complete customer lifecycle through direct billing, provisioning, management, and support.

CSP supports a PAYG model and currently there is no monetary commitment offer or volume discount waterfall in the program. Microsoft bills the CSP partner monthly and partner then bills the end customer while having full control over price or payment terms.

The Cloud Solution Provider (CSP) program allows partners to sell Microsoft Cloud Services along with their own offerings and services.

The CSP program enables partners to:

- Create a customer offer, set the price, and own the billing terms.
- Integrate service offerings with the Microsoft cloud services.
- Stay at the center of the Microsoft cloud customer lifecycle.
- Build a business by providing value-added assistance and IP to help customers consume and create the digital technology they need to transform.

Key Takeaways:

- Pay-As-You-Go within CSP is invoiced monthly in arrears based on the customer's usage across services.
- Usage may vary between months.

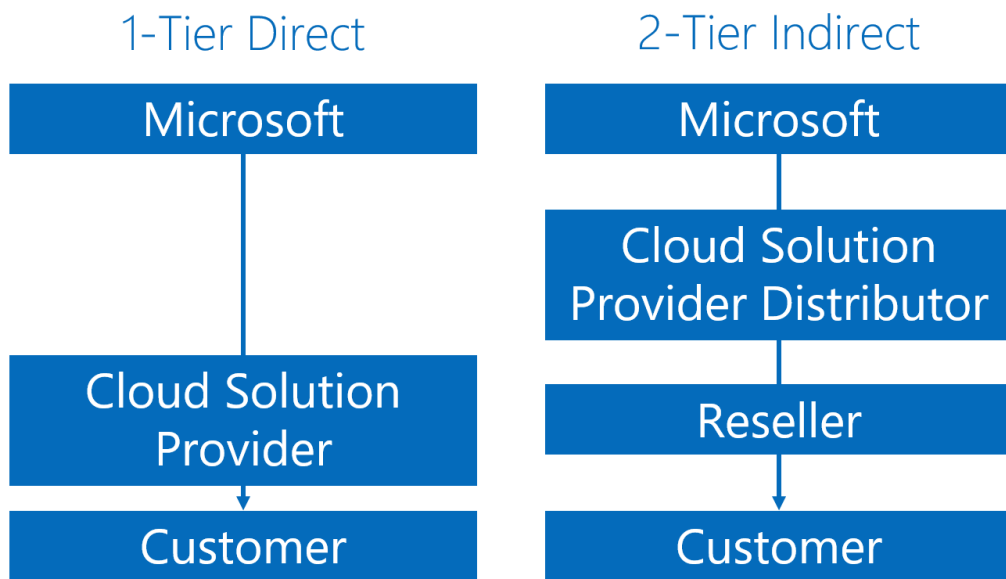


Figure 39: Cloud Solution Provider business models

Partner capability	Advisor	Open	Hosting	Cloud Solution Provider	Cloud Distributors
Value Added Services	Recommended	Recommended	Recommended	Recommended	●
Support	Recommended	Recommended	●	●	●
Manage	Recommended	Recommended	●	●	●
Provision	Recommended	Recommended	●	●	●
Bill	N/A	●	●	●	●
Sell	●	●	●	●	●


 Cloud Distributor determines reseller offers

Figure 40: Partner Capabilities Comparison

- **Azure through Microsoft Products and Services Agreement (MPSA):**

The Microsoft Products and Services Agreement (MPSA) is another way for customers to purchase Azure through a partner. MPSA is a resale model through partners in which customers can purchase both software and online services. However, unlike CSP, partners are not required to provide support for Azure.

The easiest way to think of MPSA is an indirect EA with different and easier entry requirements. There are no purchase minimums to get started with Azure in an MPSA. Customers simply review and sign the agreement online, and then start buying. Because MPSA does not expire, there is no agreement renewal process.

Azure in MPSA is also sold in a PAYG model only, however billing occurs on a quarterly basis in arrears. And just like CSP, the partner controls the end customer price.

	Online Pay As You Go (PAYG)	Online Monetary Commitment	Enterprise Agreement Monetary Commitment
Service Needs	<ul style="list-style-type: none"> <li>Customers getting started with Azure</li> <li>Handle on-demand, short term computing requirements</li> </ul>	<ul style="list-style-type: none"> <li>Broad needs across the Azure platform</li> <li>Steady monthly usage/growth</li> </ul>	<ul style="list-style-type: none"> <li>Broad needs across the Azure platform</li> <li>YoY Cloud usage growth</li> <li>Through Azure SCE, commitment to Azure can drive deeper discount</li> </ul>
Customer Scenarios	<ul style="list-style-type: none"> <li>Seasonal Computing requirements (Virtual Machines, Websites etc.)</li> </ul>	<ul style="list-style-type: none"> <li>Startup with regular compute, storage and DB needs</li> <li>Mid sized business initial app migration</li> </ul>	<ul style="list-style-type: none"> <li>Enterprise migrating to the cloud</li> <li>Med/Large customer projecting YoY cloud usage growth</li> </ul>
Customer Requirements	<ul style="list-style-type: none"> <li>Zero Upfront, cancel anytime</li> <li>Credit Card/Invoicing</li> </ul>	<ul style="list-style-type: none"> <li>Monthly billing</li> <li>Willing to commit to 6 or 12 months of service usage with Options to pre-pay</li> <li>Credit Card/Invoice</li> <li>Discounts starting at \$500/month</li> </ul>	<ul style="list-style-type: none"> <li>Upfront payments (SCE \$0 commit)</li> <li>Co-Terminus ONLY</li> <li>Invoice only payment</li> </ul>

Figure 41: Popular Azure Purchase Options

	Microsoft-assisted	Partner-led	Self-service web
	Enterprise Agreement	Microsoft Cloud Agreement (through CSPs)	Open agreements
	Enterprise Agreement	Microsoft Cloud Agreement (through CSPs)	Open agreements
Minimum purchase	Azure- only SCE: 10 monetary commitment units per month SCE, EA, or EAS: no minimum purchase required if customer commits to a server and tools product	No minimum	One unit (equivalent to \$100 USD)
Payment options	Upfront monetary commitment Overage billed quarterly in arrears	Monthly in arrears	Upfront monetary commitment – Azure product key/token Monthly in arrears
Azure Services	✓	✓	✓
Azure Infrastructure plans	✓		✓
Azure User plans	✓	✓	✓
Support services	✓	✓ (partner support)	✓
Compute Pre-Purchase	✓		
Marketplace available	✓		✓
Azure management portal	Azure Enterprise Portal	Azure Management Portal	Azure Management Portal
Government Community Cloud (where available)	✓	✓	

Figure 42: Azure in Microsoft commercial and government licensing agreements

The table below shows the programs in which Azure is available and what purchasing options exist in each.

Pay As You Go	Monetary Commitment	Azure Infrastructure Plans (e.g. OMS, Cortana)	Azure User Plans (e.g. EMS)

Microsoft Online Services Program (MOSP) <sup>103</sup>	✓			✓
Enterprise Agreement (EA / EAS / SCE)	✓	✓	✓	✓
Enrollment for Education Solutions (EES) <sup>101</sup>	✓	✓	Most plans available, but not all	✓
Cloud Solution Provider (CSP)	✓			✓
Open Programs		Token / Product key		✓

**Table 3: Programs in which Azure is available and what purchasing options exist in each**

Program	Benefits	Limitations
<b>CSP</b>	<ul style="list-style-type: none"> <li>• Simple contract which renews automatically</li> <li>• Pure PAYG option with no upfront commitments</li> <li>• Cancel at any time</li> <li>• Usage rolled up by customer simply since subscriptions are nested under a customer tenant</li> <li>• Most Azure services are available at Azure Portal</li> <li>• CSP or end customer can be admin for Azure - partner has permissions to admin &amp; manages for customer. Customer can manage services through Azure Portal, if provided for by partner</li> <li>• Puts the partner at the center of customer relationship, through billing, provisioning, managing, support, and best positioned to provided differentiated services</li> <li>• Partner gets one monthly invoice for all customers they are managing; they also get detailed view by customer</li> <li>• Partner can put spending limits on each subscription and add alerts to provide visibility for consumption rates</li> <li>• End-customer visibility</li> <li>• Deploy &amp; manage resources through Azure Resource Manager</li> <li>• Azure marketplace available to customers with Azure accounts – partners must set up the customer account in the marketplace</li> </ul>	<ul style="list-style-type: none"> <li>• Highly limited contract negotiation</li> <li>• Partner must sign agreement per region in which they do business and have a presence (partners expected to pass product terms &amp; conditions to customers within those regions)</li> <li>• Separate subscription required per customer</li> <li>• One-year term only (i.e. annual contract renewal)</li> <li>• Partner requires admin access to customer’s tenant (under review)</li> <li>• Customer cannot see consumption real time</li> <li>• Some Azure Services not available in all management interfaces (PowerShell ARM mode, X-Plat CLIs ARM mode, Resource Management REST APIs)</li> <li>• Lacks Service Management deployment, also known as classic deployment</li> <li>• Azure plans, reserved instances, and some workloads delayed</li> <li>• Geo restrictions (CSPs only able to sell in authorized markets)</li> <li>• No internal use allowed for partners</li> <li>• Azure marketplace not integrated into Partner Center</li> </ul>



<p><b>EA<sup>75</sup></b></p>	<ul style="list-style-type: none"> <li>• Highly customizable contract, using single global enrollment or split between affiliates as desired, including payment terms</li> <li>• Customers in regulated industries benefit from negotiated terms and conditions, based on regulatory requirements</li> <li>• Discounting supported</li> <li>• Price protection for customer</li> <li>• Access for customers to Enterprise Portal – end customer manages their own Azure services, and can assign partners access to this on the customer’s behalf</li> <li>• Azure marketplace available to customers and integrated to Enterprise Portal</li> <li>• Real-time consumption reporting for customer via Enterprise Portal</li> <li>• Single subscription or multiple subscriptions available</li> <li>• Monetary commitment option available, with overages paid quarterly or annually</li> <li>• Monetary commitment option supports Public Sector customer budget setting and procurement requirements</li> <li>• Lead program for new offers</li> <li>• No limits to Azure consumption, avoiding potential disruption of service due to spending limits</li> <li>• Deploy &amp; manage resources through Azure Resource Manager – Service Management deployment also available</li> <li>• Compute Pre-Purchase is available</li> <li>• Microsoft Financing available</li> <li>• No penalty for reduction of Azure services at anniversary on Enterprise Enrollment</li> </ul>	<ul style="list-style-type: none"> <li>• Longer contract cycle</li> <li>• No end-customer visibility for Microsoft if Managed Service Provider exception or Hosting exception used</li> <li>• Monetary commitment required - \$12,000 minimum – for Azure-only SCE (Server &amp; Cloud Enrollment)</li> <li>• No ability to reduce Azure services commitments mid-year (allowed at anniversary only)</li> <li>• Multiple invoicing streams – marketplace invoices separately</li> </ul>
<p>Web – online</p>	<ul style="list-style-type: none"> <li>• Simplest contract - click to accept</li> <li>• Pure PAYG option with no upfront commitments</li> <li>• Try before you buy</li> <li>• Credit card or invoice options</li> <li>• Easy access and fast setup – self serve</li> <li>• 1-year price protection</li> <li>• Single subscription or multiple subscriptions available</li> <li>• All Azure workloads available</li> <li>• Deploy &amp; manage resources through Azure Resource Manager – Service Management deployment also available</li> <li>• Access to Azure marketplace</li> </ul>	<ul style="list-style-type: none"> <li>• No customization of contracts</li> <li>• No discounting</li> <li>• Separate billing if purchasing other Microsoft online services</li> <li>• No Enterprise portal</li> </ul>

Open Programs	<ul style="list-style-type: none"> <li>• Click through contract in Open; simple contract for Open Value, Open Value Subscription</li> <li>• Available in all Open programs</li> <li>• Monetary commitment sold as a single SKU in \$100 increments</li> <li>• No credit risk for partners</li> <li>• Leverages existing online services processes in Open programs (e.g. ordering process, Volume Licensing Service Center for customer orders)</li> </ul>	<ul style="list-style-type: none"> <li>• Not all Azure plans are available through Open</li> <li>• No new Azure plans will be added to Open</li> <li>• No Enterprise portal</li> <li>• To activate, customer must go through multiple steps; obtaining key activation involves copy-pasting</li> <li>• No overage option – customer must make payment to ensure continuation of services, requiring close monitoring by customer</li> <li>• No PAYG option</li> <li>• Must use VLSC and Azure Portal to order, activate, and manage</li> </ul>
---------------	--	--

**Table 4: Azure Purchase Programs Considerations**

	CSP <sup>1</sup>	EA <sup>2</sup>
<b>Azure Plans</b>		
<b>User Plans</b>	<b>All Plans, full User Subscription Licenses (USLs) only</b> <ul style="list-style-type: none"> <li>• Azure Active Directory Basic Full USL</li> <li>• Azure Active Directory Premium Plan 1 + Plan 2 Full USL</li> <li>• Azure Information Protection Premium Plan 1 + Plan 2 Full USL</li> <li>• MultiFactor Authentication Full USL</li> </ul>	<b>All Plans, all types of USLs</b> <ul style="list-style-type: none"> <li>• Azure Active Directory Basic Full USL</li> <li>• Azure Active Directory Premium Plan 1 + Plan 2 Full USL</li> <li>• Azure Information Protection Premium Plan 1 + Plan 2 Full USL + Add-on USL</li> <li>• MultiFactor Authentication Full USL</li> </ul>
<b>Infrastructure Plans</b>	<b>No Plans</b>	<b>All Plans</b> <ul style="list-style-type: none"> <li>• StorSimple Plan with Device</li> <li>• OMS E1/E2 Full, From SA and Add-on SLs</li> <li>• OMS components</li> <li>• Azure Site Recovery to Customer Owned Site</li> <li>• Compute Pre-Purchase Plan</li> <li>• Azure Stack Plan</li> </ul>
<b>Support Plans</b>	<b>No Plans</b>	<b>All Plans</b> <ul style="list-style-type: none"> <li>• Azure Standard + Professional Direct Support</li> <li>• Azure StorSimple Standard + Premium Support</li> </ul>
<b>Billing</b>	<b>Upfront Monthly</b>	<b>Upfront Annually</b>

<b>Azure Consumption Services</b>		
<b>Availability</b>	<b>Most Services</b>	<b>All Services</b>
<b>Billing</b>	<b>Monthly in areas for services used</b>	<b>Annual Monetary Commitment</b> <ul style="list-style-type: none"> <li>• Overage is paid either quarterly or annually</li> </ul>
<b>Price Protection</b>	<b>1 month</b> <ul style="list-style-type: none"> <li>• Fixed price protection for the term of the Azure subscription</li> </ul>	<b>3 years</b> <ul style="list-style-type: none"> <li>• Best price protection for the term of the Enrollment</li> </ul>
<b>Portals</b>		
<b>Provisioning Resources</b>	<b>Azure Management Portal</b> <ul style="list-style-type: none"> <li>• Either used by partners on behalf of customers, or access is granted to customers and they use it directly</li> </ul>	<b>Azure Management Portal</b> <ul style="list-style-type: none"> <li>• Used directly by customers</li> </ul>
<b>Viewing Consumption and Spend</b>	<b>Via partner</b> <ul style="list-style-type: none"> <li>• Partners can view consumption and spend through Partner Center or a partner-developed portal</li> <li>• By default, customers cannot see consumption and spend; partners are responsible for sharing this information either manually or via a partner-developed portal</li> </ul>	<b>Azure Enterprise Portal</b> <ul style="list-style-type: none"> <li>• Used by customers and partners</li> </ul>
<b>Deployment and Test</b>		
<b>Visual Studio subscribers can use subscriber software on VMs</b>	<b>Yes</b>	<b>Yes</b>
<b>Dev/Test Subscription giving special rates for some services</b>	<b>No</b>	<b>Yes</b>
<b>Visual Studio subscriptions available</b>	<b>No</b>	<b>Yes</b>
<b>Additional Information</b>		
<b>Azure Hybrid Use Benefit</b>	<b>Available with full deployment options</b> <ul style="list-style-type: none"> <li>• Deploy via PowerShell/ Resource</li> </ul>	<b>Available with full deployment options</b> <ul style="list-style-type: none"> <li>• Deploy via PowerShell/ Resource</li> </ul>

	Manager <ul style="list-style-type: none"> <li>Use Marketplace images</li> </ul>	Manager <ul style="list-style-type: none"> <li>Use Marketplace images</li> </ul>
<b>StorSimple</b>	<b>Limited Availability</b> <ul style="list-style-type: none"> <li>Virtual Array only</li> </ul>	<b>Full Availability</b> <ul style="list-style-type: none"> <li>Device or Virtual Array</li> </ul>
<b>Azure Marketplace</b>	<b>Limited solutions available</b> <ul style="list-style-type: none"> <li>Some BYOL solutions</li> </ul>	<b>All solutions available</b>

**Table 5: Azure through CSP vs EA**

<sup>1</sup> The CSP column shows what is programmatically available to the partner

<sup>2</sup> The EA column shows what is programmatically available to the customer

	Cloud Solution Provider (CSP)	Microsoft Online Services Program (MOSP)	Enterprise Agreement (EA) / (EAS) / (SCE)	Enrollment for Education Solutions (EES)	MPSA	Open Programs
Azure Services – Pay As You Go	✓	✓	SCE*		✗	
Azure Services - Monetary Commitment			✓	✓		✓**
Azure Infrastructure Plans			✓	✓***		
Azure User Plans	✓	✓	✓	✓	✓***	✓***

\*Only available to SCE customers with an installed base-wide commitment on one of the three non-Azure SCE components

\*\*Token/Product Key

\*\*\*Select plans available

**Figure 43: Azure availability by program**

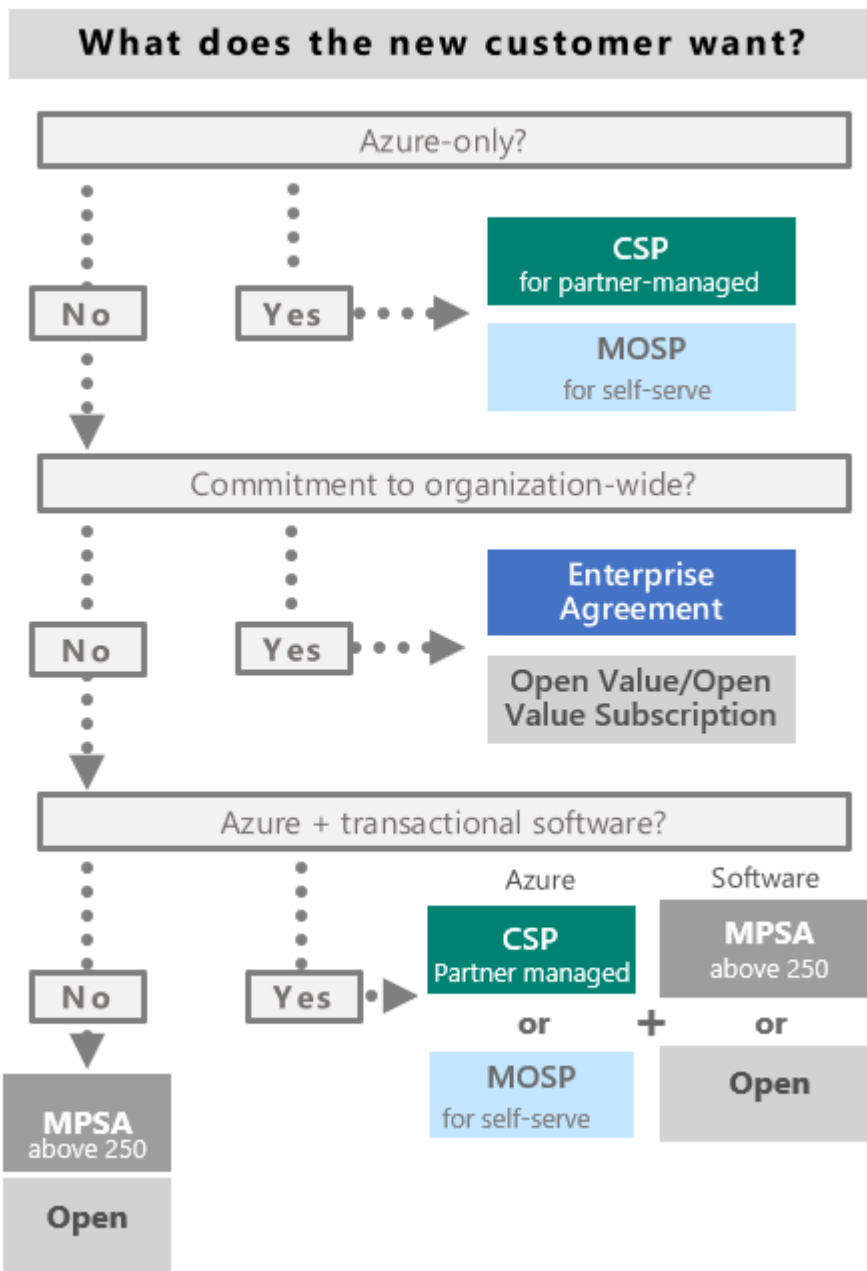

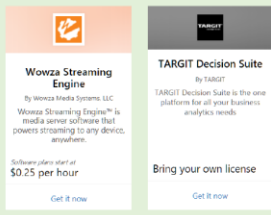


Figure 44: Azure purchase options workflow

Azure Services	Azure Plans	Azure Marketplace
<p><b>For example:</b>                      Websites: \$/hour                      Virtual Machines: \$/hour                      Storage: \$/GB and \$/transaction                      Databases: \$/GB</p> 	<p><b>User Plans: (USL)</b>                      Azure Active Directory                      Azure Information Protection                      Azure Multi-Factor Authentication                      Cloud App Security</p> <p><b>Infrastructure Plans: (MSU)</b>                      StorSimple with Device                      Operations Management Suite</p> <p><b>Support Plans: (MSU)</b>                      Azure Support</p>	<p><b>For example:</b></p> 

**Enterprise Agreement:** all Services, Plans, and Marketplace products and solutions are available  
**CSP:** most Services, User Plans, and BYOL solutions

**Figure 45: How you buy Microsoft Azure**

<p>Server and Cloud Enrolment  <i>As an additional service</i></p> <p><input checked="" type="checkbox"/> Commitment                      Payment quarterly in arrears</p>	<p>Server and Cloud Enrolment  <i>As a component</i></p> <p><input checked="" type="checkbox"/> Commitment                      Upfront Monetary Commitment</p>
<p>CSP  <i>As an individual product</i></p> <p>Payment monthly in arrears</p>	<p>Enterprise Agreement  <i>As an additional product</i></p> <p><input checked="" type="checkbox"/> Commitment                      Upfront Monetary Commitment</p>

**Figure 46: Buying Azure Services**

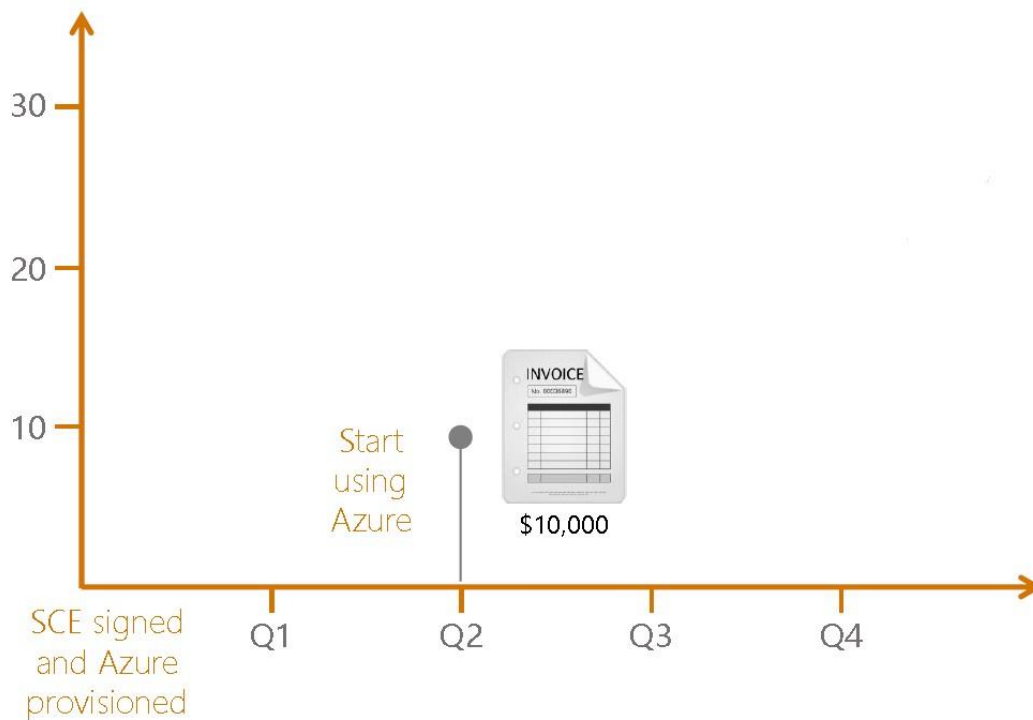
**Examples**

**Example 1**

The Papaya Hire Company are signing an SCE with SQL Server and have met all the requisite minimums for that product. They are interested in Azure but have no immediate plans to use it.

**Key takeaways**

- When the SCE is signed, an Azure Enterprise Enrolment is set up which links Azure spending with the partner and sets baseline pricing
- Customers can just start using Azure –or not!
- No minimums or on-going commitment
- Quarterly billing in arrears for any Azure Services consumed



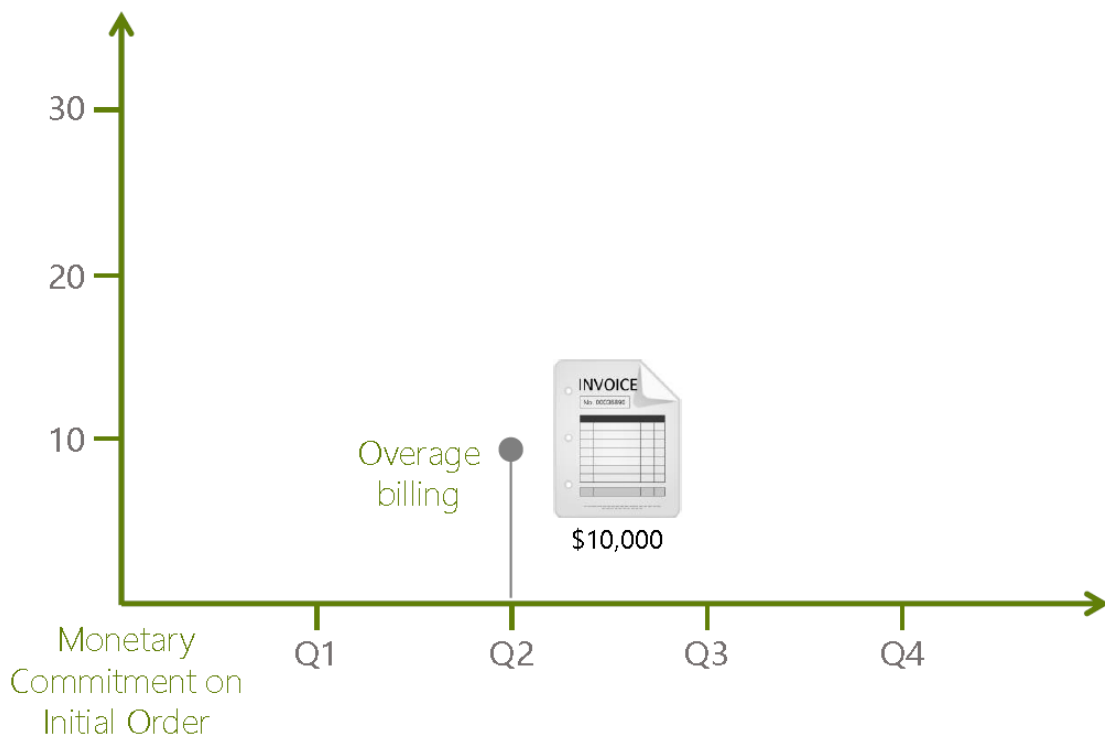
**Figure 47: Azure through SCE – example 1**

**Example 2**

Spring Green Grocers will be signing an EA with 1,500 desktops with the Professional Desktop with Core CAL licensed Per Device. They intend to use Azure consumption services immediately.

**Key takeaways**

- Monetary Commitment of at least \$1,200 is added to the Initial Order, and an Azure Enterprise Enrolment is set up which links Azure spending with the partner and sets baseline pricing
- Usage of Azure Services is decremented from the Monetary Commitment amount
- Overage is either billed quarterly in arrears or at Anniversary



**Figure 48: Azure through EA (monetary commitment) – example 2**

**Example 3**

Periwinkle Packaging Solutions have trialled Microsoft Azure Services and are now ready to move several projects to the cloud. They estimate a spend of \$250,000 per year. They have no other active Volume Licensing agreements and sign an SCE.

**Key takeaways**

- Monetary Commitment of at least \$12,000 is added to the Initial Order, and an Azure Enterprise Enrolment is set up which links Azure spending with the partner and sets baseline
- Usage of Azure Services is decremented from the Monetary Commitment amount
- Overage is either billed quarterly in arrears or at Anniversary



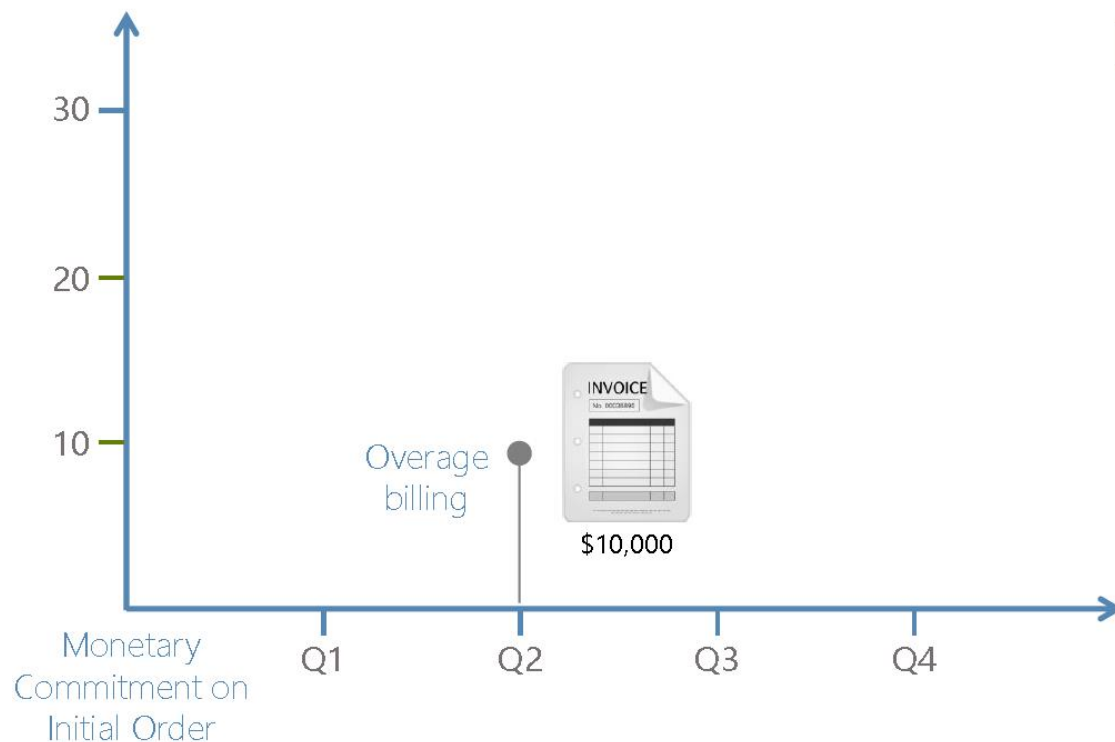


Figure 49: Azure through EA (monetary commitment) – example 3

## Pricing

### Pricing for Azure Virtual Machines

#### VM Instance Types

A virtual machine<sup>122</sup> and its pricing is defined by its series and type, operating system (Windows or Linux) and geographical region (data center). You pay for performance, i.e. it typically costs more to use newer and better performing VM types<sup>121</sup>.

- **General Purpose (A0-A7):**
  - Microsoft's lowest cost Compute.
  - 1-8 core(s) + 0.75-56 GB RAM + 20-605 GB disk, depending on instance.
  - As instance type goes up within the series (from A0 to A4, and from A5 to A7), so do the attributes.
- **Compute Intensive (A8-A11):**
  - Used for high-performance computing, modeling and simulations, and video encoding.
  - 8-16 Intel Xeon E5 core(s) + 56-112 GB RAM + 382 GB disk
  - A8 and A9 offer fast networking with InfiniBand and RDMA
- **General Purpose compute with local SSD (D-series):**
  - Used for apps that demand faster CPUs, better local disk performance, or higher memory.
  - 1-16 core(s) + 3.5-112 GB RAM + 50-800 GB disk
  - More memory, local SSD, and 60% faster than the A1-A7 series
  - DS series supports Premium Storage (purchased separately)
- **2<sup>nd</sup> Generation general purpose compute (Dv2-series):**
  - 35% faster than D-series, with latest generation of CPU.
  - 1-16 Intel Xeon E5 core(s) + 3.5-112 GB RAM + 50-800 GB disk
- **Performance Optimized (G1 – G5):**

- Unparalleled computational performance with latest CPU, more memory, more local SSD.
- 2-32 Intel Xeon E5 core(s) + 28-448 GB RAM + 384-6144 GB disk
- GS series supports Premium Storage (purchased separately)
- G5 instances are on customer dedicated hardware

In addition, for customers with NDA, Microsoft's suggests:

- F-series for low memory scenarios
- N-series with GPU for visualization and complex compute
- H-series for HPC workloads

	Central US	East US	East US 2	US Gov Iowa	US Gov Virginia	North Central US	South Central US	West US	North Europe	West Europe	East Asia	Southeast Asia	Japan East	Japan West	Brazil South	Australia East	Australia Southeast	Central India	South India	West India
A8 – A11 (Compute Inte...		●				●	●	●	●	●			●							
D-series	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●			
Dv2-series	●	●	●			●	●	●	●	●	●	●	●			●	●	●	●	●
DS-series	●	●	●			●	●	●	●	●	●	●	●	●		●	●			
DSv2-series	●	●							●	●										
G-series			●					●		●		●								
GS-series			●					●		●		●								

Figure 50: Azure VM type availability per region

### Sales motions for selling Virtual Machines

- **On-Demand Pricing**

All Virtual Machines provide per hour pricing options. This provides the most flexibility by allowing the customer to pay only for what they use. To walk you through how this works, please review the below pricing examples.

- **Example 1:** A Web Direct customer in the West US Region wants to purchase virtual machine time on a Windows operating system machine. They only need the Basic tier for dev/test purposes and they only need the lowest instance, which is A0, so we have:

*A0 instance + Windows + Basic tier + West US = \$0.018/hour*  
*~\$13/month if used full-time (744h) for the whole month*  
*Or just \$1.80 if they use this only 100 hours during the month*

- **Example 2:** Customer needs to use Premium Storage and has high disk and network bandwidth requirements, so selects GS5, Standard tier, and Linux. They need one VM in Europe (where GS5 is available only in West EU) and another in the U.S. (where GS5 is available only in West US and East US 2). So we have:

*GS5 instance + Linux + Standard Tier + West Europe = \$9.99/hour*  
*GS5 instance + Linux + Standard Tier + West US = \$8.69/hour*

- **Microsoft Azure Compute Option (MACO)**

MACO is an offer that provides Microsoft's best pricing on on-demand Compute. Microsoft can offer MACO to its committed customers through the Server and Cloud Enrollment (SCE) Core Infrastructure Suites (CIS) within the EA. Customers purchase cloud add-on SKUs for all their Windows Server licenses and, in return, receive

discounts on Azure Compute (Virtual Machines and Cloud Services) on-demand hourly prices up to 60% off of web direct prices (see table below). The idea is similar to buying a membership in order to receive better pricing.

For customers that have an SCE with CIS SKUs in their EA, MACO add-ons are available either as Standard or Datacenter edition. Each Standard edition add-on purchases the ability to use 744 hours/month of compute at a discount, and each Datacenter edition add-on purchases the ability to use 7\*744 (i.e. 5,208) hours/month of compute at a discount.

MACO add-ons are plan SKUs, payable up-front, and customers cannot use Monetary Commitment for them.

Once the MACO add-ons are added to the Customer Price Sheet (CPS), the discounts on Compute on-demand hours are automatically applied (and thus these Compute SKUs do not need to be added to the CPS). The user is not tied to a specific Azure instance type or region, and the discounted Compute hours can be paid for as normal (e.g. from Monetary Commitment). MACO can be transacted only once per customer (TPID), and each MACO add-on is valid until the end of the EA contract term.

COMPUTE SERIES	PROGRAMMATIC DISCOUNTS		ADDITIONAL SCE DISCOUNT		ADDITIONAL MACO DISCOUNT		NET DISCOUNT FROM LIST PRICE
A Series Compute	27% - 36%	&	5%	&	35%	=	55% - 60%
D Series Compute	3% - 12%	&	5%	&	50%	=	54% - 58%
G Series Compute	3% - 12%	&	5%	&	15%	=	22% - 29%

Figure 51: Discounts/ Offers for Azure compute series

- **Pre-Commit Pricing (Compute Pre-Purchase Plan, CPP)**

If customers have steady-state, predictable workloads that they can run consistently, Microsoft can provide them greater discounts if they commit to running them full time in its cloud for a set time period through the Compute Pre-Purchase (CPP) plan. Discounts range from 19% to 63% off of Microsoft's on-demand pricing. CPP allows a customer to pre-pay for 744 hours per month for a full year for a particular virtual machine type, operating system, and data center combination. CPP is positioned to compete directly with AWS 1-year Reserved Instances, and thus comparable instances of CPP pricing generally match AWS pricing. CPP is a transitional offer, which Microsoft will retire once it is ready to launch our permanent offering in this space. CPP SKUs are plan SKUs, payable up-front, and do not consume Monetary Commitment, as illustrated by the figure below:

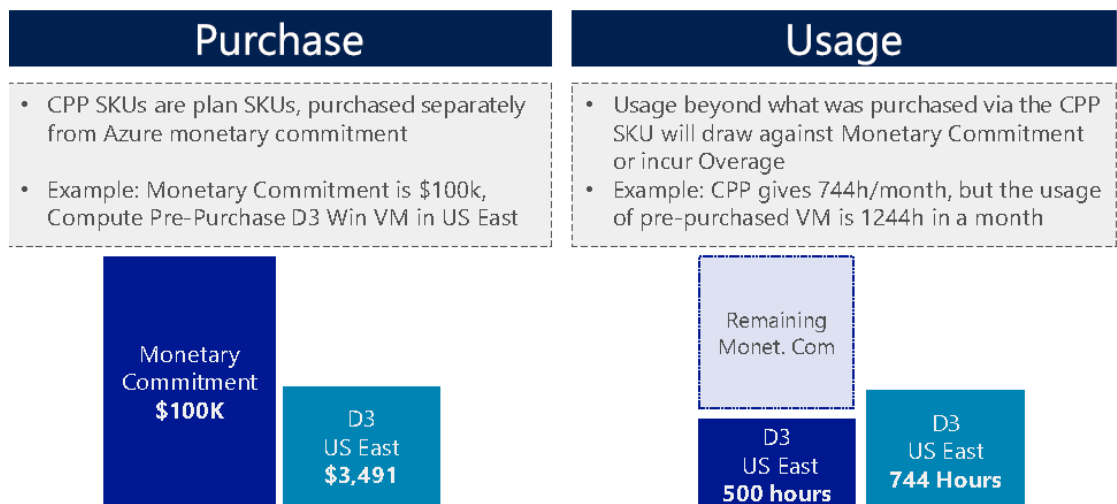


Figure 52: CPP example

With Compute Pre-Purchase Credit Offer, customers will earn a monetary commitment credit equal to 10% of their total spend on CPP SKUs, providing even more value than AWS reserved instances. This offer is available to all customers. Minimum purchase requirement is 10 CPP SKUs, and A-series is excluded (which provides a great opportunity for Microsoft to upsell A-series customers to D/DV2 series).

**Using Hybrid Use Benefit (HUB) to further reduce VM costs**

Customers can use existing on-premises Windows Server licenses to save as they move to the cloud. If the customer has an existing on-premises Windows Server license with Software Assurance (SA), then with Hybrid Use Benefit (HUB), the customer can run Windows virtual machines but get billed at normal Linux rates (which are lower than normal Windows rates).

- For each Windows Server license, the customer gets entitlements to run 16 Windows server cores on Azure virtual machines at Linux pricing. They have to apply a minimum of 8 of these entitlements for a virtual machine. For example, if they run a less than 8-core virtual machine, it will still use 8 entitlements. Customers can stack entitlements. So, to run a 32-core virtual machine, the customer needs two Windows Server licenses (a total of 32 entitlements).
- For each Windows Server Standard license, the customer can start using virtual machines as stated above, but they have to stop using the on-premises version.
- For each Windows Server Datacenter license, the customer can continue using on-premises instances, but they can additionally start using virtual machines as stated above.

Hybrid Use Benefit is a programmatic offer. There are no specific HUB SKUs; the benefit can be applied equally under on-demand, CPP, or MACO through the following steps:

- Customer provisions a non-Windows virtual machine and uploads a Windows image;
- Entitlement is activated via PowerShell at the time of uploading the VM image.

**Positioning Microsoft’s sales motions for Compute**

Microsoft’s sales motions differ in two important dimensions:

- On-Demand Pricing and CPP are targeted directly against AWS on-demand and Reserved Instance offerings, respectively. MACO is a differentiated sales motion, targeting specifically loyal Windows Server customers.
- Azure Hybrid Use Benefit complements and adds value to all of the other 3 sales motions.

Customers can use existing on-premises Windows Server licenses to save as they move to the cloud. If the customer has an existing on-premises Windows Server license with Software Assurance (SA), the Hybrid Use Benefit (HUB) offer provides them the ability to run Windows virtual machines in Azure while only paying base (Linux) compute rates. This drives savings upwards of 45% versus paying for Windows virtual machines hourly.

	On-demand	MACO	CPP
<b>Use case</b>	General usage, most customers	Migrations at unestablished pace, or high volume but spikey workloads	Steady-state, predictable workloads
<b>Flexibility</b>	High	High	Limited
<b>Requirements</b>	MOSP, EA, Open, CSP, MPSA	EA (CIS SCE) + MACO add-ons	EA (EE or SCE)
<b>Pricing strategy</b>	Price matched to AWS hourly instances	Substantial discounts (typically below AWS 1-year reservation pricing) targeted to Windows Server customers	Price-match comparable AWS 1-year Reserved Instances
<b>Azure HUB impact</b>			
Lowers the cost of moving workloads to Azure; Improves value of Windows Server licenses			

Figure 53: Azure HUB impact

### Solution Validation

Azure solution sales teams should help customers to choose the proper virtual machine instance types. Common scenarios with some ground rules on sizing are listed below.

- Dev / test** (A0-A4 or A5-A7 if more memory is needed per core)  
 Customer commonly starts with lowest cost VMs (A series) to develop and test. The low cost helps them work with many deployments and at scale. They will then do price/performance evaluation to choose production VM types, and then do final QA testing with those VMs.
- General purpose production apps** (Dv2 is the primary recommendation, DS for high storage perf)  
 General purpose production applications will perform better with the additional CPU and local storage performance of the D and Dv2 series of VMs. These VMs provide 60% - 75% better performance over A-series VMs at the same core count which will help level out any usage spikes that may occurring in production applications.
- Compute intensive** (Dv2 is the primary recommendation. G series provide more cores and memory. A10 and A11 provide highest CPU perf)  
 These offer higher performing CPUs. Some applications are multi-threaded and can take advantage of virtual cores. AWS VMs support hyper-threading and Azure does not. For many applications, the physical core delivers better performance than a hyper-threaded core. So, a 4-core Azure VM may out-perform a 4 core AWS VM and justify a higher price. Scenarios for compute-intensive VMs include financial services risk, rendering, transcoding, manufacturing, and life sciences.
- High-performance computing (HPC)** (A8-A9 for fast networking, A10-A11 otherwise)  
 HPC applications require low-latency networking for scalability. These applications typically use message passing interface (MPI) and RDMA networking like InfiniBand. Azure is the only public cloud that offers VMs with a second RDMA network. Scenarios for HPC include oil and gas, manufacturing, and scientific research.
- Gaming** (Dv2 series and the GPU-intensive N series)  
 Many gaming applications require a fast CPU but not a lot of memory. Customers are frequently price sensitive and may not see value in buying more memory than they require for a single VM. Other gaming applications require GPU.
- Memory intensive applications** (G series)

Applications like in-memory caches are typically not demanding on CPU, but can consume as much memory as available. Example applications include Cassandra, DataStax, and Redis Cache.

- **Storage intensive** (No offering but D series with SSD is typically used)  
Big Data Applications like Hadoop can take advantage of local storage for scalability and performance. Some applications prefer SSD and others benefit from HDD.

AWS	Cores	Mem	Storage	AZURE	Cores	Mem	Storage
m3.medium	1	3.75	4	D1	1	3.5	50
m3.large	2	7.5	32	D2	2	7	100
m3.xlarge	4	15	80	D3	4	14	200
m3.2xlarge	8	30	160	D4	8	28	400
m4.large	2	8	EBS Only	D2_v2	2	7	100
m4.xlarge	4	16	EBS Only	D3_v2	4	14	200
m4.2xlarge	8	32	EBS Only	D4_v2	8	28	400
m4.4xlarge	16	64	EBS Only	D5_v2	16	56	800
r3.large	2	15	32	D11	2	14	100
r3.xlarge	4	30.5	80	D12	4	28	200
r3.2xlarge	8	61	160	D13	8	56	400
r3.4xlarge	16	122	320	D14	16	112	800
t-2 micro	1	1	EBS Only	A0 Basic	1	0.75	20
t-2 small	1	2	EBS Only	A1 Basic	1	1.75	70

Figure 54: Mapping AWS with Azure VMs

**Pricing for Azure Storage**

Azure provides the cloud storage solution for modern applications that rely on durability, availability, and scalability to meet the needs of their customers. Azure has five types of standard storage—Blobs, Files, Disks, Tables and Queues – where customers’ total cost depends on storage type, geographic region, how much they store, the volume of storage transactions and outbound data transfers, and which data redundancy option they choose (LRS / ZRS / GRS / RA-GRS). Azure also has Premium Storage disks, where billing is based on the selected size of disk only. Storage follows graduated pricing model, where Microsoft has pricing tiers, and applies a lower price for the incrementally higher workloads which define the tier – effectively the more customers use, the lower price they pay.

The type of storage customers need will depend on the type of data they’re storing. **Block blobs** are a good choice for storing documents, media files, and backups. **Page Blobs and Disks** are optimized for representing disks for IaaS VMs - Standard tier uses hard disk drives, Premium tier uses solid state drives and thus achieves better IOPS performance (note, Premium tier is supported by “DS” and “GS” variant VMs only). **Tables** can be used to store flexible datasets, such as user data for web applications, address books, device information, and any other type of metadata. **Queue storage** provides a reliable messaging solution for asynchronous communication between application components. **File storage** offers file shares that can be mounted on the cloud when needed, so that customers can migrate legacy applications that rely on file shares to Azure quickly. Block blobs are by far the cheapest storage option (followed by Tables and Queues, Page Blobs & Disks, and File Storage in the order of slightly increasing price). Premium Storage is nearly double the price of the Standard Page Blob.

The data redundancy options include (in the order of increasing redundancy) locally redundant storage (LRS), zone redundant storage (ZRS), geographically redundant storage (GRS) and read-access geographically redundant storage (GRS). Basic rule is that the more there is redundancy, the higher is the cost to the customer. Microsoft offers Hot storage with lower access costs for frequently used data, and Cool storage with lower capacity costs for more infrequently used data.

#### Example:

A customer in the West US region wants to purchase standard hot block blob storage. They only need LRS data redundancy and estimate the average amount of storage to be 55 terabytes (TB) – which equals to 56,320 gigabytes (GB). They estimate 100k write and 1 million read operations to storage in a month.

West US region + Hot Block blob + LRS data redundancy =	
\$0.0208/GB for the first 50 TB (0 to 51,200 GB) per month	
+ \$0.02/GB for the next 5 TB (51,200 to 56,320 GB) per month =	
\$1064.96 + \$102.40 = \$1167.36 per month	
100k write transactions = 10 write transaction units, where we charge \$0.055 per 100,000 transactions=	
10 * \$0.055 = \$0.55 per month	
1M read transactions = 100 read transaction units, where we charge \$0.0044 per 10,000 transactions=	
10 * \$0.055 = \$0.44 per month	
Total cost = Cost of capacity + Cost of transactions = \$1167.36 + \$0.55 + \$0.44 = \$1168.35 per month.	

This example illustrates graduated pricing tiers – the customer pays a certain price per gigabyte at “the highest tier” for consumption below certain threshold, a lower price at “the 2nd highest tier” for consumption that falls between the tier-2 consumption thresholds, an even lower price for consumption that falls between the thresholds at tier 3, and so on. Also note that the workload in this example can be defined as cool as read and write operations are comparatively rare – if the storage was more frequently accessed, the workload could be defined as hot. So, in this case a Microsoft seller could perhaps suggest cool storage, which offers a lower price per gigabyte (to allow for more storage capacity at a more economical price) but a higher cost on transactions.

#### Pricing for Other Azure Services

Other services include Cloud Services, App Service, StorSimple, SQL Database, CDN, Bandwidth, ExpressRoute, and Media Services. There are services where you can notice similarities in pricing models:

- **Azure Cloud Services**<sup>43</sup> and **Azure App Service** both run in virtual machines, and thus exhibit similarities in terms of pricing, but offer Platform-as-a-Service (PaaS) where the environment already exists and all the customer has to do is deploy the application. Cloud Services pricing is defined by its series and instance type, and geographical region (data center). App Service pricing is defined by the plan tier (Free, Shared, Basic, Standard or Premium), series and instance type, as well as the geographical region (data center). As the platform environment is “built-in”, these services are generally more expensive than Virtual Machines.

- **Azure CDN**<sup>37</sup> and **Azure Bandwidth**<sup>116</sup> follow a graduated pricing model with decreasing price for traffic increments measured in gigabytes. Azure CDN (Content Delivery Network) can be used to send content to end users faster and more reliably, using the servers closest to each user. Azure Bandwidth<sup>19</sup> in practice means egress, i.e. outbound data transfers from an Azure datacenter.

There are also services that have their own unique pricing characteristics:

- **Azure SQL Database**<sup>137</sup> offers two design options - elastic database pools for larger installations demanding more flexibility, and single databases for smaller installations. Pricing of SQL Database options is defined by the service tier (Basic, Standard, or Premium) for single databases or performance (which is measured in Database Transaction Units, DTUs) for elastic pools.
- **Azure Media Services**<sup>87</sup> include Video on Demand (VoD) Encoding, Indexing, Live Channels for (near) real time content delivery, Streaming, and Content Protection – with each service having its own pricing model.
- **ExpressRoute**<sup>50</sup> enables you to create private connections between on-premises and Azure cloud, without going over the public Internet, with two alternative pricing options. Under Metered Data plan, Microsoft charges a fixed monthly fee based on the speed of the port, and a variable fee for outbound data transfer (per gigabyte). Under Unlimited Data plan, only the fixed monthly port fee is charged (as all data is included)<sup>117</sup>.
- **StorSimple** solution manages storage tasks between on-premises and Azure cloud, using a StorSimple device.

## SKUs

### General

- Enterprise Agreement SKUs will regularly have a higher purchase quantity (100hrs, 100GB, etc.), however, all usage will be metered and billed at the same quantities and under the same rules as listed on the individual service overview pages ([www.azure.com](http://www.azure.com)).
- Many Azure SKUs have recent updates to include region specific specifications, where pricing may be differentiated between regions.
- In cases where Azure services have pricing that is based on the volume of usage, Enterprise Agreement discounts generally apply against the lowest volume tier price point. The exception to this is Azure Storage, where EA customers currently receive the highest volume tier price by default.

### Compute

- SKUs are priced hourly, with actual billing based on the rounded down per minute usage.
- A2, A3 and A4 virtual machines are priced as a multiple of the A1 SKU, resulting in no unique SKUs for A2, A3 or A4.  $A2 = 2x A1$ .  $A3 = 4x A1$ .  $A4 = 8x A1$ .
- This pricing is managed by having the deployment of A2, A3 or A4 emit a higher number of hours for every hour of deployment. For example, an A4 instance emits 8 hours for every hour deployed.
- The A0 (XS) SKU is priced at a fraction of the A1 SKU:
  - Cloud Services: 1/4 of A1.
  - Windows VM: 2/9 of A1.
  - Linux VM: 1/3 of A1.

### Monetary Commitment



- For customers purchasing Azure under an Enterprise Agreement, purchasing individual Azure service SKUs is not necessary, as the Monetary Commitment SKU provides a catch all debit account type function where funds apply to all Azure services consumed.
- Exceptions, where services must be purchased individually:
  - Azure Paid Support (Standard, Pro-Direct) and Premier Support.
  - Enterprise Mobility Suite (EMS).
  - Azure Active Directory Premium.
  - Azure Store purchases – bills as Azure EA Overage.
  - Oracle on Azure licenses – bills as Azure EA Overage, much like Azure Store purchases.

Given the number of Azure SKUs, a SKU Map has been created, is intended to provide some direction as to which services are connected to which SKUs.

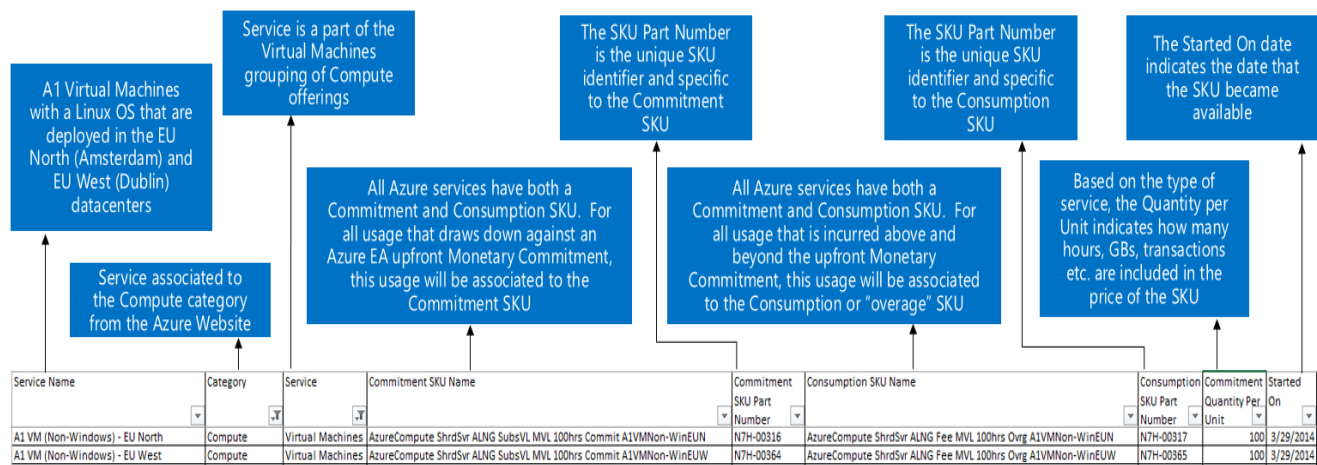


Figure 55: SKU Map

In cases where Azure is purchased under the Enterprise Agreement, upfront purchases are made against the generic Monetary Commitment SKU. This SKU is priced at \$100/month (or local currency equivalent) and provides a simplified SKU against which a purchase can be made without having to select individual services/SKUs against which consumption is planned or may occur.

Some Azure and related Cloud & Enterprise services are currently only available within specific purchase/licensing channels.

Service	Azure Website	Enterprise Agreement	Open
EMS		X	
StorSimple		X	
Azure AD (free)	X	X	X
Azure AD (Premium)		X	
RemoteApp*	X		
Azure Paid Support	X	X	
Azure Store	X	X	
Azure RMS**		X	X
All other Azure services	X	X	X

Figure 56: Purchase channel per cloud service

\*Currently available as a Free Preview.

\*\*Azure RMS is sold separately from the Azure platform services

## Marketing Approach

Microsoft uses most of the marketing engines- PR, online/print ads, local events, major conferences like MMS and TechEd, roadshows etc. It also depends on its partners and channel to sell on their behalf. However, partners are still heavily focused on Microsoft's on-premises business.

## Certifications and Attestations

Certifications and attestations represent verification that control activities operate in accordance with expectations. Operating a huge global cloud infrastructure, across many businesses, comes with the need to meet an array of compliance and regulatory obligations. With this in mind, Microsoft products and services hold key certifications, attestations, and authorizations as applicable to their service.

Several key certifications and attestations deserve to be highlighted:

ISO 27001:2013 certification provides assurance of a broad, risk-based information security program. Microsoft Cloud Infrastructure and Operations—the organization that builds, manages, and secures Microsoft's datacenters globally—was the first major cloud service infrastructure to be certified for ISO 27001. Microsoft's Cloud Infrastructure & Operations (MCIO) team has gone beyond the ISO/IEC 27001:2013 standard (which includes some 150 security controls) to develop over 800 defense-in-depth security controls to account for the unique challenges of the cloud infrastructure and what it takes to mitigate some of the risks involved.

Microsoft is the first cloud computing platform to meet the world's first international standard for cloud privacy—ISO/IEC 27018 as verified by independent auditors. Under ISO 27018, cloud service providers (CSPs) must operate under five key principles:

- CSPs must not use the personal data they receive for advertising and marketing unless expressly instructed to do so by the customer. Moreover, it must be possible for a customer to use the service without submitting to such use of its personal data for advertising or marketing.
- Customers have explicit control of how their information is used.
- CSPs must inform customers where their data resides, disclose the use of subcontractors to process PII and make clear commitments about how that data is handled.
- In case of a breach, CSPs should notify customers, and keep clear records about the incident and the response to it.
- A successful third-party audit of a CSP's compliance documents the service's conformance with the standard and can then be relied upon by the customer to support their own regulatory obligations. To remain compliant, the CSP must subject itself to yearly third-party reviews.

Microsoft also has SSAE 16/ISAE 3402 SOC 1, 2, and 3 attestations in place. These attestations are both type I and type II. They provide assurance of effective control performance.

In 2012, Microsoft became one of the first in the industry to successfully complete a SOC 2 Type 2 and SOC 3 audit (which are designed to better accommodate cloud services) for its cloud infrastructure (datacenters and networks). In 2008, Microsoft was the first major cloud service provider to receive a SAS 70 report (the predecessor to SOC reports) for its cloud infrastructure.

Microsoft was an early adopter of the SOC 1, SOC 2 and SOC 3 in 2011. The SOC audit reports attest to the design and operating effectiveness of controls related to security, availability, and confidentiality.

Moreover, Microsoft meets the US HIPAA/HITECH health data protection requirements and has incorporated those requirements into its ISO 27001 program. Microsoft was the first

major productivity cloud service vendor to offer a HIPAA Business Associate Agreement (BAA) to healthcare entities with access to Protected Health Information (PHI). Microsoft has since extended that to offer a single HIPAA BAA for all of its commercial online services.

Microsoft meets the Payment Card Industry Data Security Standard as an infrastructure provider.

Microsoft's first FISMA Authorization to Operate (ATO) was granted in 2010 for the MCIO cloud organization. Since then, Microsoft enterprise cloud services, including Office 365 and Microsoft Azure, have received provisional authorities to operate (P-ATOs) by the Federal Risk and Authorization Program (FedRAMP) Joint Authorization Board (JAB).

In the United Kingdom, Azure was awarded Impact Level 2 (IL2) accreditation, further enhancing Microsoft and its partner offerings on the current G-Cloud procurement Framework and CloudStore.

The industry organization Cloud Security Alliance (CSA) created a Cloud Controls Matrix to identify primary criteria for service offerings. Microsoft was the first cloud service provider to complete a third-party assessment against the Cloud Security Alliance (CSA) Cloud Controls Matrix (CCM) as part of its SOC 2 audit for Azure. This assessment was completed as a means of meeting the assurance and reporting needs of the majority of cloud services users worldwide.

Microsoft has incorporated many other obligations to its compliance program, providing assurance that it is able to meet obligations such as the European Union Data Protection Directive and California Senate Bill 1386, such as the European Union Data Protection Directive and California Senate Bill 1386.

	Regulatory and Compliance Domain	Office 365	Microsoft Azure	Microsoft Dynamics CRM	Microsoft Intune
Broadly Applicable	ISO 27018:2014	✓	✓	✓	✓
	ISO 27001:2013	✓	✓	✓	✓
	SOC 1 Type 2 (SSAE 16/ISAE 3402)	✓	✓	✓	✓
	SOC 2 Type 2 (AT Section 101)	✓	✓	✓	✓
	CSA STAR 1	✓	✓	✓	No
United States Government	FedRAMP Moderate	✓	✓	✓	No
	CJIS Security Policy, Version 5.3	✓	✓	✓	No
	DISA SRG Level 2 P-ATO	✓	✓	✓	No
	FDA 21 CFR Part 11	✓	✓	✓	No
	ITAR	✓	✓	No	No
Industry Specific	IRS 1075	✓	✓	No	No
	HIPAA BAA	✓	✓	✓	✓
	PCI DSS Level 1	N/A	✓	N/A	N/A
	FERPA	✓	✓	✓	N/A
Region/Country Specific	CDSA	N/A	✓	N/A	N/A
	EU Model Clauses	✓	✓	✓	✓
	UK G-Cloud v6	✓	✓	✓	✓
	Australia Gov ASD	✓	✓	✓	No
	Singapore MTCS	✓	✓	✓	No
	Japan FISC	✓	✓	No	No
	New Zealand GCIO	✓	✓	✓	✓
	EU-US Privacy Shield	✓	✓	✓	✓
China (MLPS, TRUCS, GB 18030)	✓	No	No	No	

Figure 57: Certifications and Attestations for Microsoft's key cloud services

**Key alliances, Key competitors, alternatives to their solution**

Microsoft has alliances with most of the significant ISVs and SIs. For public clouds, their most significant competitors are AWS, VMware vCloud ecosystem, and to a lesser extent

Rackspace and Citrix. Microsoft has partnerships with Rackspace and Citrix, but as each of them have built alternative cloud stack on Linux, it seems difficult to join forces with them and collaborate against AWS.

### Competitive Positioning

Microsoft’s elevator pitch is support for hybrid IT architecture, flexible app model and enterprise-ready core platform, trusted advisor status, and best platform to run windows apps in the cloud.

### Compete Strategy

Based on its strengths, Microsoft narrows its target focus to enterprise customers. Enterprise customers can be further divided into business unit IT and corporate IT. They also have differentiated strategy and tactics for external and internal compete (External – PR, web, events; Internal- sales force, partners, customers). Microsoft’s AWS compete approach is along the below 5 areas:



**Figure 58: High level Microsoft competitive advantage over AWS**

The high-level description of these are as follows:

- Hybrid IT:** Microsoft provides a consistent platform across on-premise datacenters, service provider datacenters, and Windows Azure that enable customers to build and deploy across these environments with common skills and technologies. AWS is only focused on providing services in public cloud and they lack the traditional on-premises and private cloud environments. AWS depends on partners like Eucalyptus for on-premises private cloud environments and BMC for hybrid cloud management. These partners are in reality a customer to AWS and they aren’t really innovating the platform, but just licensing the AWS APIs to provide connectivity to public clouds.
- Flexible App Model:** Windows Azure app model is unique in the sense that customers can easily migrate apps “as-is” from on-premises to Windows Azure using IaaS VMs and later add more PaaS services to the application. This enables a faster on-boarding to the public cloud and lets customer quickly develop apps while leveraging all of the platform richness (scalability etc.). This differentiates Microsoft from competitors like AWS who primarily provide an IaaS offering. AWS pseudo PaaS offering Beanstalk has several restrictions. Again, as with the hybrid IT approach, AWS depends on partners like Heroku and Engine Yard to provide PaaS capabilities on top of IaaS, which makes the platform complex to use.
- Enterprise Ready – Core Platform:** Windows Azure provides better core platform features for high availability and disaster recovery than AWS. In Windows Azure, VMs are built on a durable storage system that automatically replicates data within datacenters and across geographies. With AWS, customers have to manually take snapshots of EBS volumes and put them in S3. Even then, S3 is replicated in the same physical location. Additionally, with Windows Azure, it is easier to build highly available VMs. With AWS, customers have to place instances in separate availability regions, and place a load balancer in front of them. Finally, Windows Azure plans to

provide single instance SLA of 99.9% (in addition to SLA of 99.95% for multiple instances). AWS EC2 provides SLAs for multiple instances only.

- **Trusted partner:** Microsoft makes it easier for customers to adopt cloud on their own terms. Customers can leverage existing Microsoft relationship for world-class support and information. In addition to consumption based model, Windows Azure is well integrated with regular procurement channel – Enterprise Agreements, so enterprises don't have to negotiate a new agreement to use public cloud. Negotiating an agreement with AWS can be challenging (Gartner estimates that it can take 6-12 months to negotiate a customer agreement with AWS). Finally, with Microsoft customers leverage the existing support channels like Premier services.
- **Windows Apps Better Together with Windows Azure:** Business critical apps like SQL Server and SharePoint Server run best on Windows Azure. Microsoft provides single point of support for SQL Server and SharePoint deployed on Windows Azure. This area needs to be explored further, but Microsoft positions its platform (Windows Server and Windows Azure) as the best platform for running first-party apps for the time being.

AWS is constrained by a single answer for every enterprise need, which is the public cloud. AWS is predicated on the belief that public cloud can eventually meet every enterprise need. And while this is likely true in the long run, AWS scale is predicated on enterprise acceptance of a paradigm shift that questions much of the last few decades of IT. Conversely, Microsoft can meet a range of nuanced enterprise needs that allow customers to enjoy public cloud benefits without assuming the risks associated with a technology revolution. AWS needs to convince the enterprise in the wisdom of both the public cloud and AWS whereas the enterprise already sees the value in Microsoft solutions and only needs to be convinced of the value of public cloud integration. The trick for Microsoft is providing the enterprise with a clear migration path to the public cloud that increases IT efficacy, mitigates risk, and assures business compliance. This is where Microsoft's support for hybrid IT architectures become the cornerstone strategy for competing against AWS.

### **Total Economic Impact of Azure PaaS**

Showing the financial impact of investing in Microsoft Azure is an important step in the customer's decision making process.

Customers can realize tremendous return on investment by using Azure PaaS for their application development and deployment. However, many customers lack a holistic framework to evaluate the potential impact of leveraging Azure PaaS for their organizations. Forrester's Total Economic Impact ("TEI") model is a great asset to help customers better evaluate the economic benefits of Azure PaaS.

In June 2016, Forrester published a Total Economic Impact (TEI) study summarizing the business benefits, cost savings, and five-year financial results from interviews with eight enterprise customers who had adopted Microsoft Azure Infrastructure as a Service (IaaS) and recently moved to Microsoft's Azure Platform as a Service (PaaS).

Based on the representative organization, the benefits of Azure PaaS include:

- **IT cost savings** — 80% reduction in IT time required for Azure applications.
- **Resource savings** — fewer DBAs and IT admins needed to manage Azure PaaS.
- **Service time-to-market** — avoiding on-premises deployment and starting services weeks sooner.

- **App dev and test savings** — Integrated tools for developers and test environments that match dev and production.
- **Process savings** — commitment to employee technologies can reduce turnover.
- **New profit and revenue** — Azure apps enable more and larger sales<sup>150</sup>.

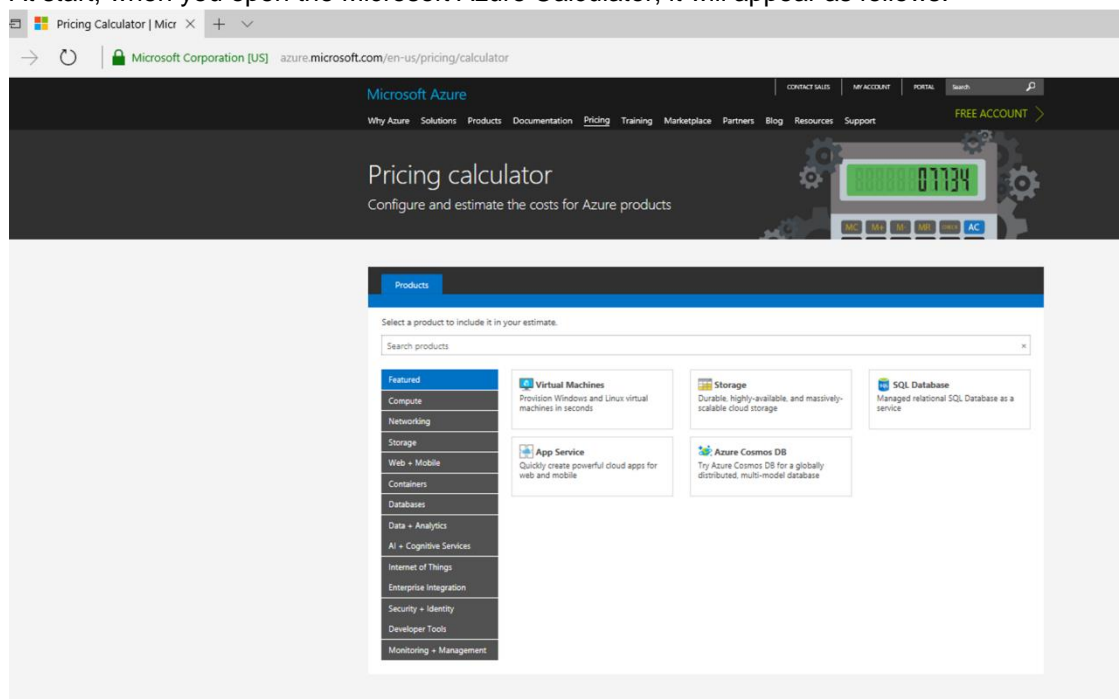
### Microsoft Azure Calculator

Microsoft Azure Calculator lets customers and partners build price estimates for a collection of Azure services. The net price provided by the calculator is only an estimate and must not be used as a quote.

One caveat to note is that the Azure calculator does not include every service available on Azure.com.

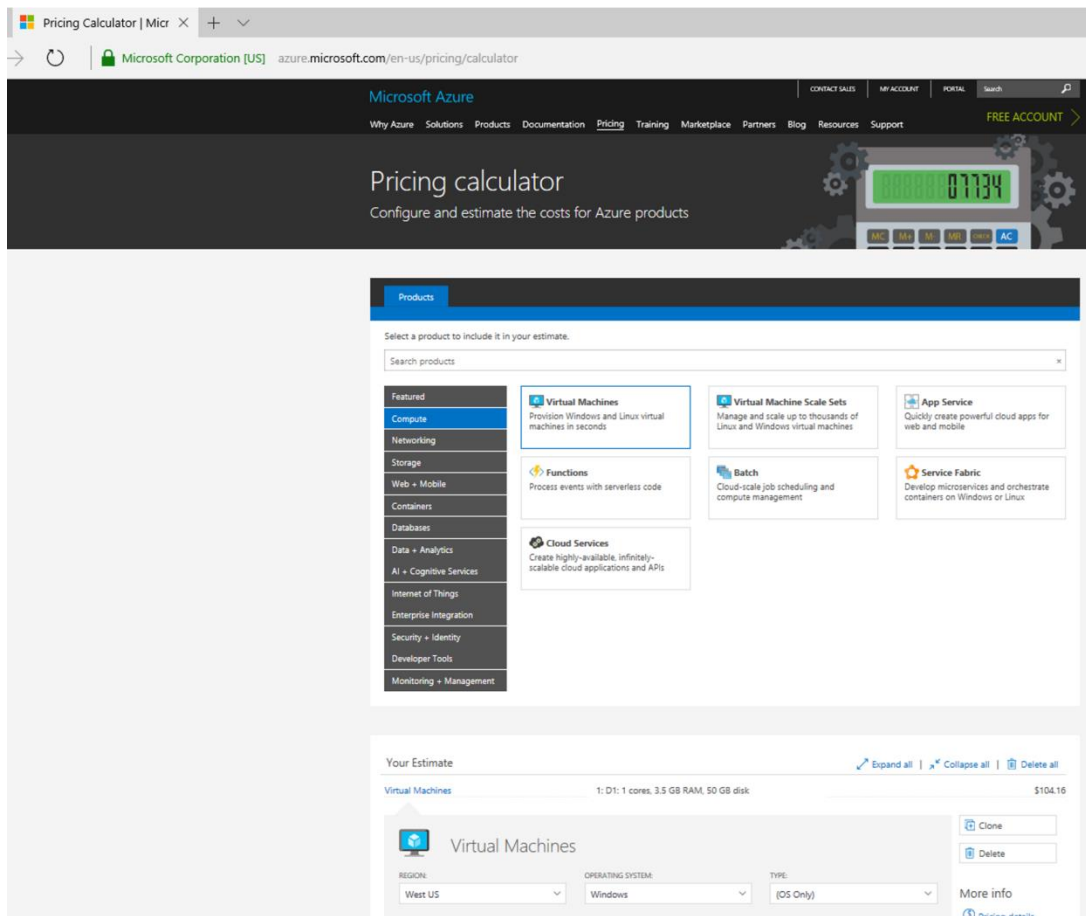
In the example below, we demonstrate how to use the calculator:

- At start, when you open the Microsoft Azure Calculator, it will appear as follows:



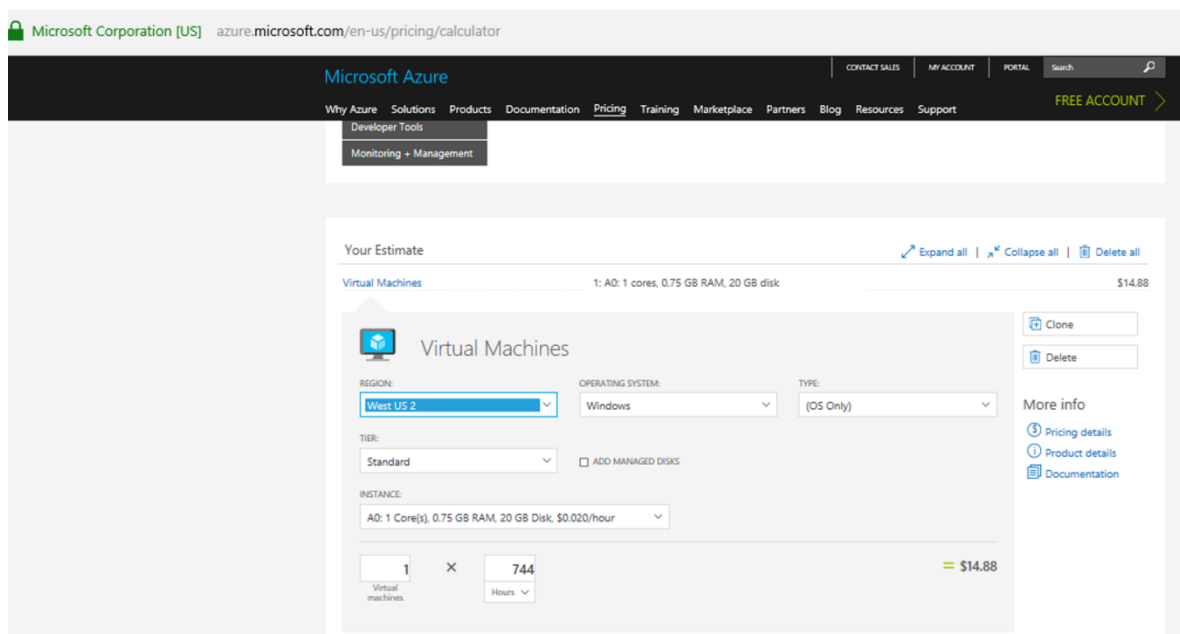
**Figure 59: Microsoft Azure Calculator**

- You can start creating estimates by browsing through the Product Categories or use the search function to add specific Azure services you are looking for.
- Now let us add a virtual machine by clicking on the Compute tab as shown in figure below:



**Figure 60: Microsoft Azure Calculator - Adding a VM (step 1)**

- By clicking on the Virtual Machines tab you can now add a desired virtual machine in any available region as shown in figure below:



**Figure 61: Microsoft Azure Calculator - Adding a VM (step 2)**

As can be observed in the figure above, the net price is shown in the “Your Estimate” block on the bottom right hand side.

You can now add other services such as Storage to the mix and the “Your Estimate” block will automatically update with the pricing information as shown in the figure below:

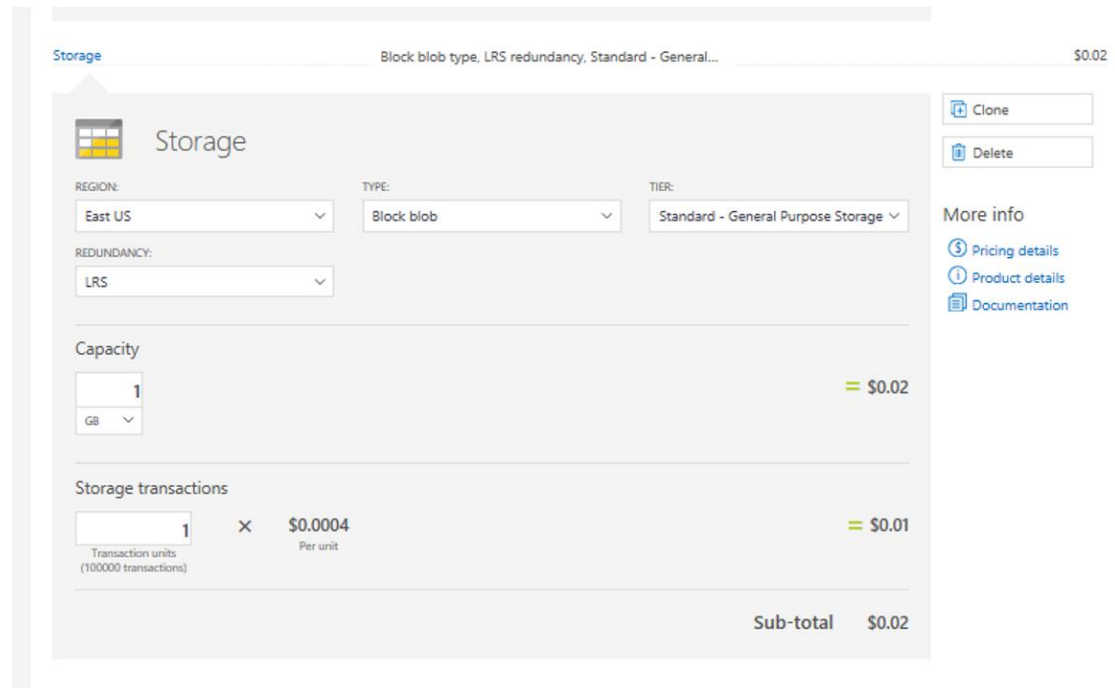


Figure 62: Microsoft Azure Calculator - Adding Storage

## Total Cost of Ownership

### Total Cost of Ownership Calculator for Azure<sup>41</sup>

Demonstrating the potential cost savings of choosing Azure is an important step in the customer's decision-making process.

### TCO & Understanding Benefits for removing On-Prem Infrastructure

- Understanding Return On Investment (ROI) for moving to Cloud is dependent on calculating a Total Cost of Ownership (TCO).
- ROI will typically be measured over a 3-year period for Cloud investments, however every business is different, and models range from 3 to 5 years.
- ROI measurement methods range from Payback & ROI % (Benefits – Costs / Costs) to discounted cashflow calculations including IRR (Internal Rate of Return) & NPV (Net Present Value).
- Most businesses will have a Cost of Capital % as a hurdle rate for any discounted Cashflow calculations.
- Risk reduction & flexibility are also important intangible financial factors to consider in understanding ROI.
- Sensitivity & Inflation are all factors in considering a 3-year TCO.



### Ongoing Azure Subscription Costs & Migration

- When considering costs in an ROI calculation for moving to the Cloud, an Annual Azure subscription will be an ongoing cost over the given investment period.
- Migration costs, typically a one-off cost at the beginning of the project to close down infrastructure, maintenance agreements, depreciation and Service costs.
- Some costs maybe ongoing for more than 1 year and should be built into any ROI calculation.

The Azure TCO calculator helps customers estimate the cost savings of migrating their on-premises infrastructure to Azure.

### Generate a TCO report in 3 steps

- Using the input page, describe the configuration of the physical or virtualized on-premises infrastructure including compute, storage, and networking.

Figure 63: Azure TCO calculator - step 1

- Review and modify assumptions as needed for a better fit with your particular environment.

The screenshot shows the Microsoft Azure TCO Calculator interface. The main heading is "Microsoft Azure Total Cost of Ownership (TCO) Calculator". Below this, there are tabs for "Inputs" and "Assumptions". The "Hardware Costs" section is active, displaying two columns of hardware configurations and their costs. The "Hardware Configuration" column lists various server specifications, and the "Costs (\$)" column shows the corresponding price for each configuration. A "Calculate" button is visible at the bottom right.

Hardware Configuration	Costs (\$)	Hardware Configuration	Costs (\$)
1 Proc, 1 Core/Proc, 0.75 GB RAM	1,173.00	2 Proc, 2 Core/Proc, 14 GB RAM	6,235.00
1 Proc, 1 Core/Proc, 1.75 GB RAM	1,178.00	2 Proc, 2 Core/Proc, 28 GB RAM	6,319.00
1 Proc, 1 Core/Proc, 2 GB RAM	1,415.00	2 Proc, 4 Core/Proc, 14 GB RAM	5,964.00
1 Proc, 1 Core/Proc, 3.5 GB RAM	1,424.00	2 Proc, 4 Core/Proc, 16 GB RAM	7,169.00
1 Proc, 2 Core/Proc, 3.5 GB RAM	1,684.00	4 Proc, 2 Core/Proc, 28 GB RAM	14,551.00
1 Proc, 4 Core/Proc, 7 GB RAM	1,951.00	4 Proc, 2 Core/Proc, 56 GB RAM	14,719.00
2 Proc, 1 Core/Proc, 4 GB RAM	4,332.00	4 Proc, 4 Core/Proc, 32 GB RAM	16,732.00
2 Proc, 1 Core/Proc, 7 GB RAM	4,350.00	4 Proc, 4 Core/Proc, 56 GB RAM	16,876.00
2 Proc, 1 Core/Proc, 14 GB RAM	4,392.00	4 Proc, 4 Core/Proc, 112 GB RAM	17,212.00
2 Proc, 2 Core/Proc, 8 GB RAM	6,199.00		

Hardware maintenance cost as a % of hardware cost: 15 %

Virtual Machine density (Number of vCPUs per physical core): 2

Figure 64: Azure TCO calculator - step 2

- Run the calculation to produce the TCO report which you can review.

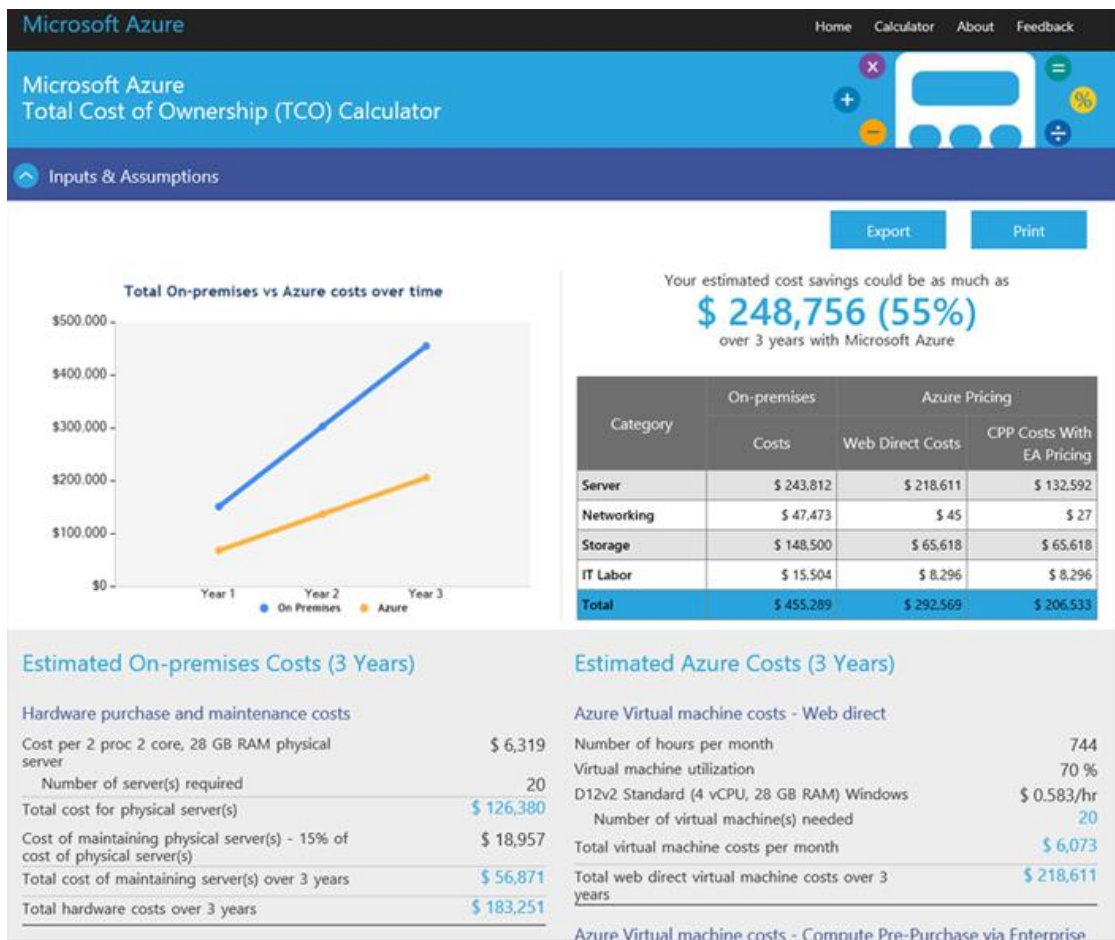


Figure 65: Azure TCO calculator - step 3

### Microsoft Azure Cost Estimator Tool

Microsoft listened to partner's and its field sellers feedback on how difficult it is to create Azure cost estimates for customers and based on that feedback Microsoft released a scenario based calculator to significantly simplify the effort of creating Azure cost estimates (available here).

Microsoft Azure Cost Estimator Tool<sup>89</sup> provides Estimated Retail Price (ERP) – synonymous with MOSP.

For example, as an exercise consider creating a cost estimate for running a Basic SharePoint Server or ADFS for enabling O365 SSO using the current Windows Azure tools. By pivoting around scenarios, "time to proposal" can be significantly reduced for customers, partner and Microsoft sellers. In addition, users have the flexibility of creating estimates by selecting the individual Azure services similar to the current excel based calculators provided by Microsoft.

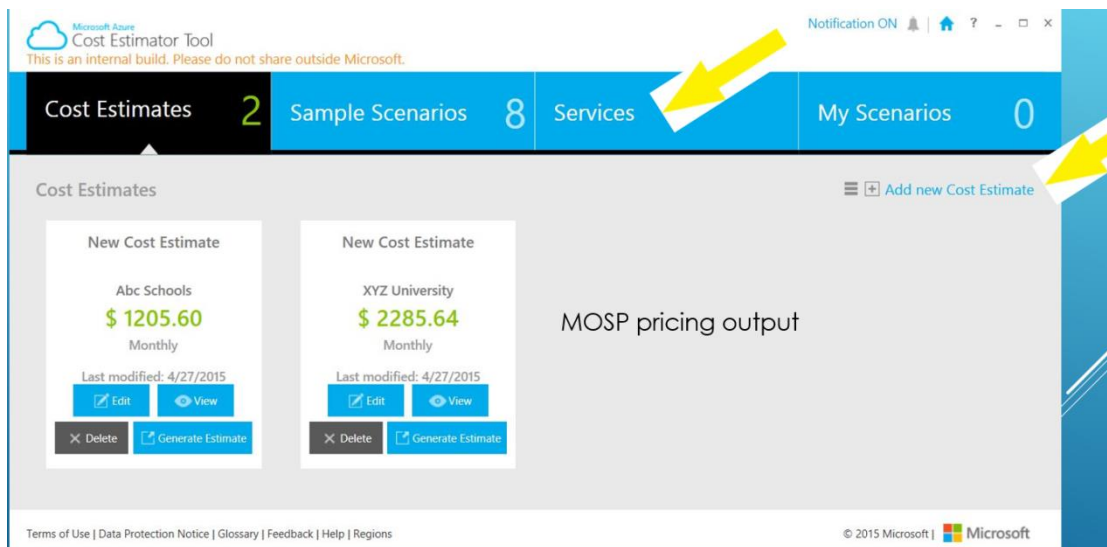


Figure 66: What does the Microsoft Azure Cost Estimator Tool do?

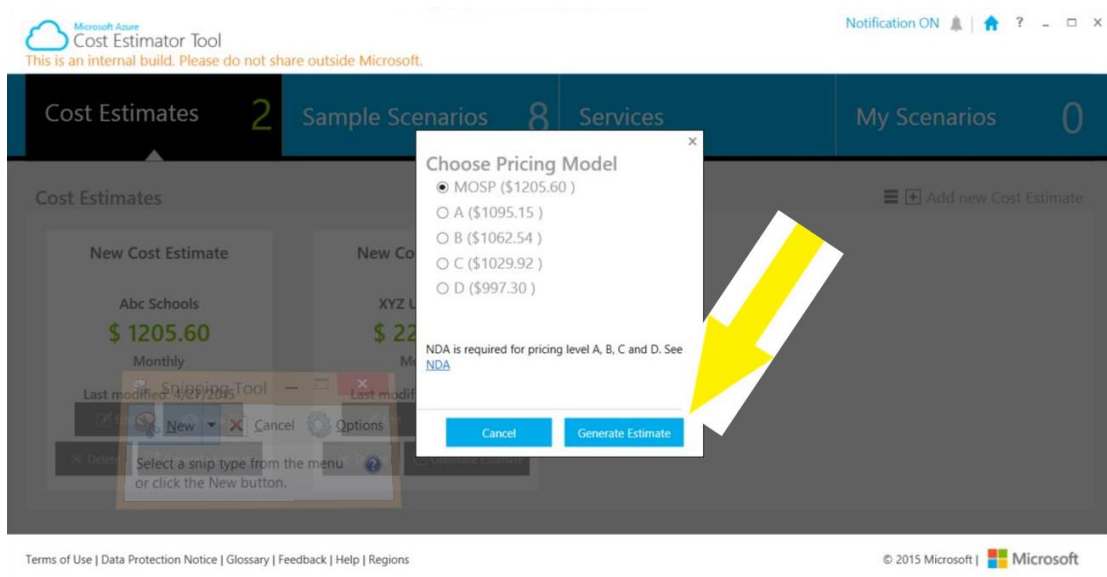


Figure 67: What does the cost estimate through Microsoft Azure Cost Estimator Tool look like?

New Cost Estimate								\$ 2,285.64/month	\$ 27,427.72/year
Pricing Model: MOSP								Scenario Cost	Env Total
Environment	Scenario	Category	Service	Region	Quantity	Usage	Description	Price	
Production	Cost Estimate for XYZ University	Networking	Virtual Networks Static/Dynamic Routing	US South Central	-	744 Hours		\$ 26.78	
		Data + Storage	Block Blob Geographically Redundant	US West	5000 GB	-		\$ 236.82	
		Hybrid Integration	Site Recovery Customer Owned	US West	10 units	-		\$ 160.00	
		Hybrid Integration	Backup	US West	5000 GB	-		\$ 999.00	
		Compute	Virtual Machine A3 Large (4 cores, 7GB RAM) Standard Windows	US West	1 units	744 Hours		\$ 267.84	
		Compute	Virtual Machine A2 Medium (2 cores, 3.5GB RAM) Standard Windows	US South Central	4 units	744 Hours		\$ 535.68	
		Compute	Virtual Machine A0 Extra Small (1 core, 0.75GB RAM) Standard Windows	US South Central	4 units	744 Hours		\$ 59.52	
Support Level: Included								Billing and Community Support	
Total Cost Estimate								\$ 2,285.64/month	
								Prices as of 04/21/2015	

Figure 68: What's in the output of Microsoft Azure Cost Estimator Tool - Pricing Tab?

Pricing Summary				Total Estimated Monthly Price		\$ 2,285.64													
Pricing Model: MOSP				Support Level		Includes Billing and Community Support													
Total Estimated Yearly Price						\$ 27,427.72													
<b>Compute</b>				<b>Web + Mobile</b>				<b>Data + Storage</b>				<b>Analytics</b>				<b>Networking</b>			
Virtual Machines	\$ 863.04	Websites	\$ 0.00	SQL Database	\$ 0.00	HDInsight	\$ 0.00	Virtual Networks	\$ 26.78										
Cloud Services	\$ 0.00	Mobile Services	\$ 0.00	Document DB	\$ 0.00	Machine Learning	\$ 0.00	Express Route	\$ 0.00										
RemoteApp	\$ 0.00	API Management	\$ 0.00	Redis Cache	\$ 0.00	Stream Analytics	\$ 0.00	Traffic Manager	\$ 0.00										
Batch	\$ 0.00	Notification Hubs	\$ 0.00	Storage	\$ 236.82	Data Factory	\$ 0.00	Bandwidth	\$ 0.00										
				StorSimple	\$ 0.00	Event Hubs	\$ 0.00												
				Azure Search	\$ 0.00														
<b>Total</b>	<b>\$ 863.04</b>	<b>Total</b>	<b>\$ 0.00</b>	<b>Total</b>	<b>\$ 236.82</b>	<b>Total</b>	<b>\$ 0.00</b>	<b>Total</b>	<b>\$ 26.78</b>										
<b>Hybrid Integration</b>				<b>Identity + Access Management</b>				<b>Media + CDN</b>				<b>Developer Services</b>				<b>Management</b>			
BizTalk Services	\$ 0.00	Active Directory	\$ 0.00	Media Services	\$ 0.00	Visual Studio Online	\$ 0.00	Scheduler	\$ 0.00										
Service Bus	\$ 0.00	Multi-Factor Authentication	\$ 0.00	CDN	\$ 0.00			Automation	\$ 0.00										
Backup	\$ 999.00							Operational Insights	\$ 0.00										
Site Recovery	\$ 160.00																		
<b>Total</b>	<b>\$ 1,159.00</b>	<b>Total</b>	<b>\$ 0.00</b>	<b>Total</b>	<b>\$ 0.00</b>	<b>Total</b>	<b>\$ 0.00</b>	<b>Total</b>	<b>\$ 0.00</b>										

Figure 69: What's in the output of Microsoft Azure Cost Estimator Tool - Summary Tab?

### EU Model Clauses and DPA

Microsoft's EU Model Clauses and DPA are validated by the Article 29 Working Party, and they benefit Microsoft's enterprise cloud customers automatically through Microsoft's OST (whether they purchase directly or through a reseller). Microsoft was the first major cloud provider to receive such validation.

### Data Retention - Deletion

Microsoft commits to retain data for 90 days after the subscription expires.

Microsoft commits to delete customer data within 180 days after the subscription expires.

### Sub-contractors

- Microsoft provides a list of subcontractors with their names, countries of location, and the services they perform.
- Microsoft provides prior notice of the appointment of a new subcontractor with 6 months in advance (for core Online Services / this is effective since October 1, 2016 - before it was only 14 days).
- Microsoft provides customer's right to exit the agreement due to a new subcontractor.

### Data Location

Microsoft's commitment is limited to certain online services, and to Customer Data that is at rest and that is provided through the use of such online services.

### Customer Waiver of IP Rights

Microsoft does not restrict a customer's right to assert its IP as a condition of using the services, to pursue its claim as part of a class action, or to request a trial by jury.

### SLAs

Microsoft has published formal SLAs, with an uptime percentage of 99.9% on the Office 365 and CRM Online workloads, and uptime percentages ranging from 99.9% to 99.95% on the Azure workloads. The service credits for the workloads range from 10% to 100% of the monthly fee. Microsoft locks the SLA for the term of the subscription.

### **Suspension from Service**

Unless Microsoft believes an immediate suspension is required, Microsoft will provide reasonable notice before suspending an Online Service for a violation of the AUP. Suspension will only be to the extent reasonably necessary.

### **Audits**

Microsoft commits to conduct audits annually and provide full audit reports to customers.

### **Security Standards**

Microsoft commits to comply with ISO 27001 and 27018. Also, Microsoft commits to comply with ISO 27002 and SSAE 16/ISAE3402, and to provide its security policies. Even though all major CSPs now comply to ISO 27018, Microsoft was the first major cloud provider to adopt it.

### **Security Incidents**

Microsoft defines “Security Incidents” as unlawful or unauthorized access to customer data that results in the modification or disclosure of customer data. Microsoft commits to:

- notify customer,
- investigate and provide detailed information to customer, and
- take reasonable steps to mitigate the effects of the same.

### **Limitation of Liability**

Microsoft’s liability (including data breaches) is limited by a “per-incident” cap equal to the amount spent during the 12 months prior to the incident giving rise to liability and it is also limited by an aggregate cap set by the total amount paid under the agreement.

### **Use of Customer Data**

Microsoft commits to use customer data only for purposes compatible with providing those services. Also, Microsoft commits not to use Customer Data or derive information from it for any advertising or similar commercial purposes. Further, Microsoft contractually commits to comply with ISO 27018.

### **Law Enforcement Request for Data**

Microsoft will not disclose customer data to law enforcement unless required by law. Microsoft will attempt to redirect the law enforcement agency to request that data directly from Customer. If compelled to disclose Customer Data to law enforcement, Microsoft will promptly notify Customer and provide a copy of the demand unless legally prohibited from doing so. Also, Microsoft has fallbacks available that make Microsoft’s process more transparent by providing additional detail and there are also some concessions available for data located outside of the US. Also, if a customer insists on a commitment around sealed subpoenas/”no knock” warrants, CELA (Microsoft’s Legal Department) can provide language from the online services field guide to address this request.

### **Compliance with Laws**

Microsoft agrees to comply with all laws and regulations applicable to its provision of Online Services. Customer must also comply with laws applicable to their use of the Online Services.

### **Changes to Terms**

Microsoft cannot change its contractual terms, including privacy terms, during the term of a subscription.

### **Changes to Services**

Microsoft may terminate the service in any country where Microsoft is subject to a government, regulation, obligation or other requirement that is not generally applicable to businesses operating there. However:

- for Office 365, Microsoft commits not to make any material changes to the service's core features and - in case it permanently eliminates a functionality - to provide customer with a reasonable alternative (no exceptions), and
- for Azure, Microsoft commits to notify customer 12 months in advance before removing any material feature or functionality or discontinuing the service (with exceptions).

### **Azure Reference Architectures**

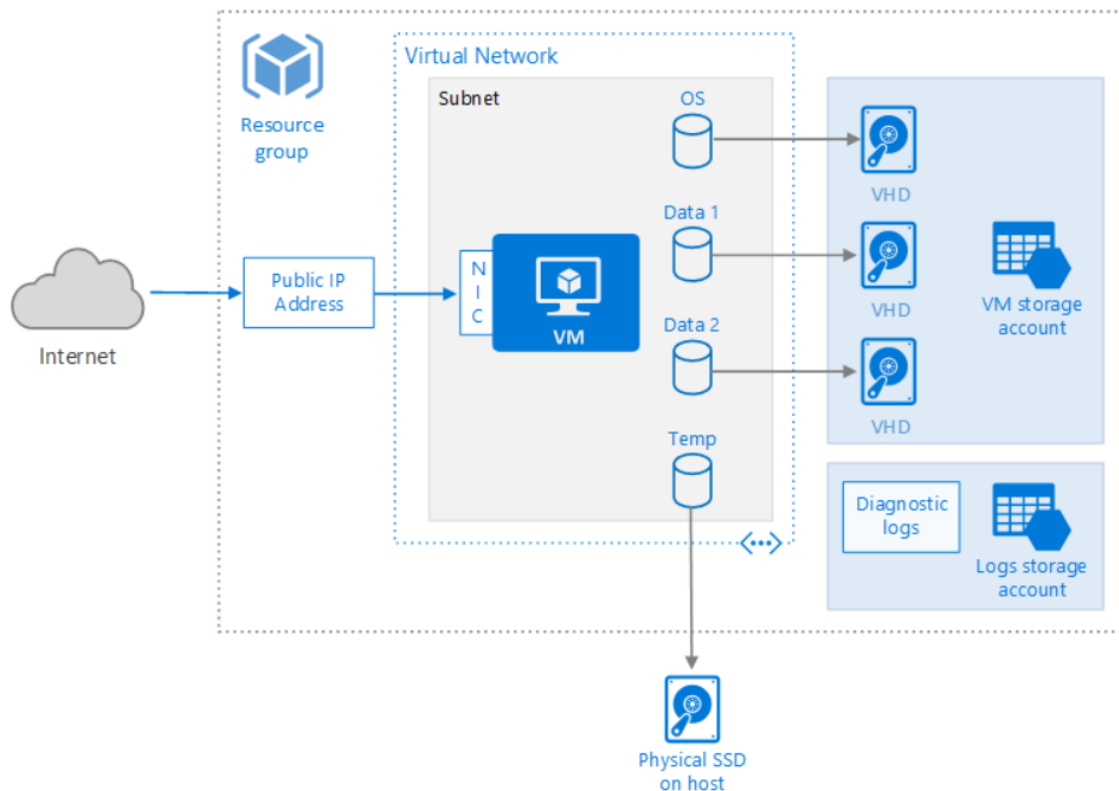
Below we will provide some basic examples of suggested Architecture for Azure cases.

#### **Windows VM Workloads**

Running Windows VM workloads in Azure.

##### **Single VM**

This reference architecture shows a set of proven practices for running a Windows virtual machine (VM) on Azure. It includes recommendations for provisioning the VM along with networking and storage components. This architecture can be used to run a single instance and is the basis for more complex architectures such as N-tier applications.



**Figure 70: Running a Windows VM on Azure – Architecture**

### Architecture

Provisioning a VM in Azure involves more moving parts than just the VM itself. There are compute, networking, and storage elements that you need to consider.

- **Resource group.** A **resource group** is a container that holds related resources. You usually create resource groups for different resources in a solution based on their lifetime, and who will manage the resources. For a single VM workload, you may create a single resource group for all resources.
- **VM.** You can provision a VM from a list of published images or from a virtual hard disk (VHD) file that you upload to Azure Blob storage.
- **OS disk.** The OS disk is a VHD stored in Azure Storage. That means it persists even if the host machine goes down.
- **Temporary disk.** The VM is created with a temporary disk (the **D:** drive on Windows). This disk is stored on a physical drive on the host machine. It is not saved in Azure Storage and might be deleted during reboots and other VM lifecycle events. Use this disk only for temporary data, such as page or swap files.



- **Data disks.** A data disk is a persistent VHD used for application data. Data disks are stored in Azure Storage, like the OS disk.
- **Virtual network (VNet) and subnet.** Every VM in Azure is deployed into a VNet that is further divided into subnets.
- **Public IP address.** A public IP address is needed to communicate with the VM—for example over remote desktop (RDP).
- **Network interface (NIC).** The NIC enables the VM to communicate with the virtual network.
- **Network security group (NSG).** The NSG is used to allow/deny network traffic to the subnet. You can associate an NSG with an individual NIC or with a subnet. If you associate it with a subnet, the NSG rules apply to all VMs in that subnet.
- **Diagnostics.** Diagnostic logging is crucial for managing and troubleshooting the VM.

### VM recommendations

Azure offers many different virtual machine sizes, but we recommend the DS- and GS-series because these machine sizes support Premium Storage. Select one of these machine sizes unless you have a specialized workload such as high-performance computing.

If you are moving an existing workload to Azure, start with the VM size that's the closest match to your on-premises servers. Then measure the performance of your actual workload with respect to CPU, memory, and disk input/output operations per second (IOPS), and adjust the size if needed. If you require multiple NICs for your VM, be aware that the maximum number of NICs is a function of the VM size.

When you provision the VM and other resources, you must specify a region. Generally, choose a region closest to your internal users or customers. However, not all VM sizes may be available in all regions.

### Network recommendations

The public IP address can be dynamic or static. The default is dynamic.

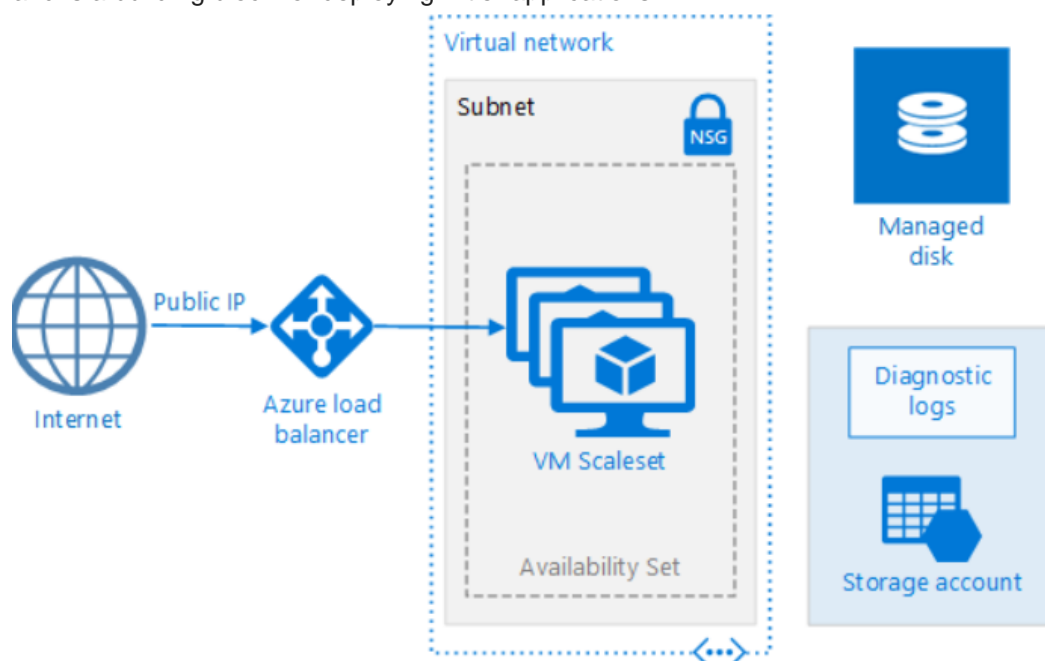
- Reserve a static IP address if you need a fixed IP address that won't change — for example, if you need to create an A record in DNS, or need the IP address to be added to a safe list.
- You can also create a fully qualified domain name (FQDN) for the IP address. You can then register a CNAME record in DNS that points to the FQDN.

All NSGs contain a set of default rules, including a rule that blocks all inbound Internet traffic. The default rules cannot be deleted, but other rules can override them. To enable Internet traffic, create rules that allow inbound traffic to specific ports — for example, port 80 for HTTP.

To enable RDP, add an NSG rule that allows inbound traffic to TCP port 3389.

### Load-balanced VMs

This reference architecture shows a set of proven practices for running several Windows virtual machines (VMs) in a scale set behind a load balancer, to improve availability and scalability. This architecture can be used for any stateless workload, such as a web server, and is a building block for deploying n-tier applications.



**Figure 71: Running several Windows virtual machines (VMs) in a scale set behind a load balancer, to improve availability and scalability – Architecture**

### Architecture

This architecture builds on the one shown in Run a Windows VM on Azure above. The recommendations there also apply to this architecture.

In this architecture, a workload is distributed across several VM instances. There is a single public IP address, and Internet traffic is distributed to the VMs using a load balancer. This architecture can be used for a single-tier application, such as a stateless web application.

The architecture has the following components:

- **Resource group. Resource groups** are used to group resources so they can be managed by lifetime, owner, and other criteria.
- **Virtual network (VNet) and subnet.** Every VM in Azure is deployed into a VNet that is further divided into subnets.
- **Azure Load Balancer.** The load balancer distributes incoming Internet requests to the VM instances.
- **Public IP address.** A public IP address is needed for the load balancer to receive Internet traffic.
- **VM scale set.** A VM scale set is a set of identical VMs used to host a workload. Scale sets allow the number of VMs to be scaled in or out manually, or based on predefined rules.
- **Availability set.** The availability set contains the VMs, making the VMs eligible for a higher service level agreement (SLA). For the higher SLA to apply, the availability set must include a minimum of two VMs. Availability sets are implicit in scale sets. If you create VMs outside a scale set, you need to create the availability set independently.
- **Managed disks.** Azure Managed Disks manage the virtual hard disk (VHD) files for the VM disks.
- **Storage.** Create an Azure Storage account to hold diagnostic logs for the VMs.

#### **Availability and scalability recommendations**

An option for availability and scalability is to use a virtual machine scale set. VM scale sets help you to deploy and manage a set of identical VMs. Scale sets support autoscaling based on performance metrics. As the load on the VMs increases, additional VMs are automatically added to the load balancer. Consider scale sets if you need to quickly scale out VMs, or need to autoscale.

By default, scale sets use "overprovisioning," which means the scale set initially provisions more VMs than you ask for, then deletes the extra VMs. This improves the overall success rate when provisioning the VMs. If you are not using managed disks, we recommend no more than 20 VMs per storage account with overprovisioning enabled, or no more than 40 VMs with overprovisioning disabled.

There are two basic ways to configure VMs deployed in a scale set:

- Use extensions to configure the VM after it is provisioned. With this approach, new VM instances may take longer to start up than a VM with no extensions.

- Deploy a managed disk with a custom disk image. This option may be quicker to deploy. However, it requires you to keep the image up to date.

If you do not use a scale set, consider at least using an availability set. Create at least two VMs in the availability set, to support the availability SLA for Azure VMs. The Azure load balancer also requires that load-balanced VMs belong to the same availability set.

Each Azure subscription has default limits in place, including a maximum number of VMs per region. You can increase the limit by filing a support request. For more information, see [Azure subscription and service limits, quotas, and constraints](#).

### Network recommendations

Place the VMs within the same subnet. Do not expose the VMs directly to the Internet, but instead give each VM a private IP address. Clients connect using the public IP address of the load balancer.

If you need to log into the VMs behind the load balancer, consider adding a single VM as a bastion host/jumpbox with a public IP address you can log into. And then log into the VMs behind the load balancer from the jumpbox. Alternatively, configure inbound NAT rules in the load balancer for the same purpose. However, having a jumpbox is a better solution when you are hosting n-tier workloads, or multiple workloads

### Load balancer recommendations

Add all VMs in the availability set to the back-end address pool of the load balancer.

Define load balancer rules to direct network traffic to the VMs. For example, to enable HTTP traffic, create a rule that maps port 80 from the front-end configuration to port 80 on the back-end address pool. When a client sends an HTTP request to port 80, the load balancer selects a back-end IP address by using a [hashing algorithm](#) that includes the source IP address. In that way, client requests are distributed across all the VMs.

To route traffic to a specific VM, use NAT rules. For example, to enable RDP to the VMs, create a separate NAT rule for each VM. Each rule should map a distinct port number to port 3389, the default port for RDP. For example, use port 50001 for "VM1," port 50002 for "VM2," and so on. Assign the NAT rules to the NICs on the VMs.

### Storage account recommendations

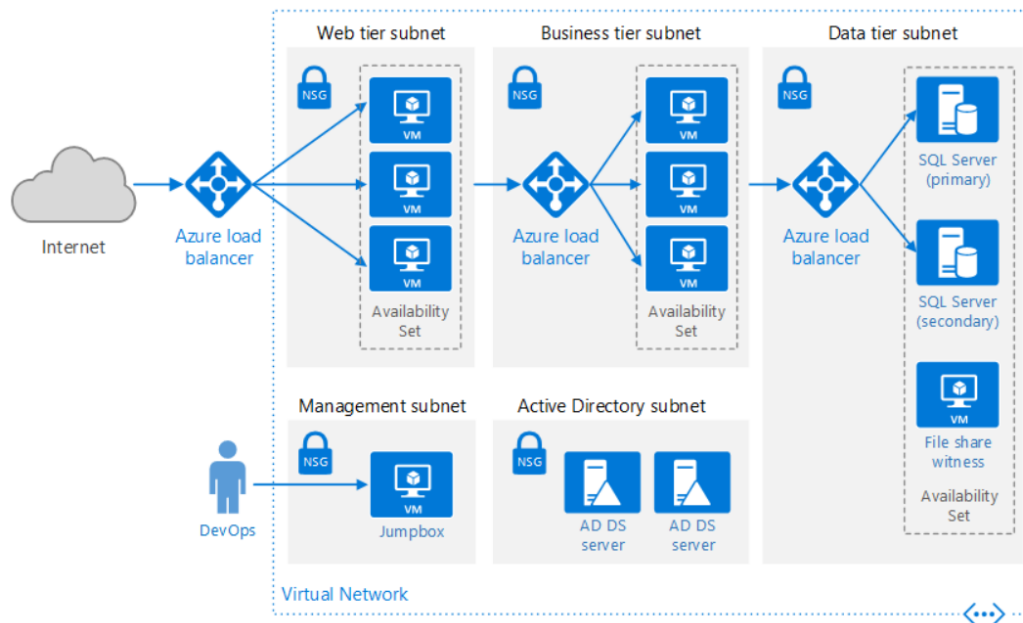
Create separate Azure storage accounts for each VM to hold the virtual hard disks (VHDs), in order to avoid hitting the input/output operations per second (IOPS) limits for storage accounts.

We recommend the use of [managed disks with premium storage](#). Managed disks do not require a storage account. You simply specify the size and type of disk and it is deployed in a highly available way.

Create one storage account for diagnostic logs. This storage account can be shared by all the VMs. This can be an unmanaged storage account using standard disks.

### N-Tier Application

This reference architecture shows a set of proven practices for running Windows virtual machines (VMs) for an N-tier application.



**Figure 72: Running Windows virtual machines (VMs) for an N-tier application on Azure - Architecture**

### Architecture

There are many ways to implement an N-tier architecture. The diagram shows a typical 3-tier web application. This architecture builds on Run load-balanced VMs for scalability and availability. The web and business tiers use load-balanced VMs.

- **Availability sets.** Create an availability set for each tier, and provision at least two VMs in each tier. This makes the VMs eligible for a higher service level agreement (SLA) for VMs.
- **Subnets.** Create a separate subnet for each tier. Specify the address range and subnet mask using CIDR notation.
- **Load balancers.** Use an Internet-facing load balancer to distribute incoming Internet traffic to the web tier, and an internal load balancer to distribute network traffic from the web tier to the business tier.
- **Jumpbox.** Also called a bastion host. A secure VM on the network that administrators use to connect to the other VMs. The jumpbox has an NSG that allows remote traffic only from public IP addresses on a safe list. The NSG should permit remote desktop (RDP) traffic.
- **Monitoring.** Monitoring software such as Nagios, Zabbix, or Icinga can give you insight into response time, VM uptime, and the overall health of your system. Install the monitoring software on a VM that's placed in a separate management subnet.

- **NSGs.** Use network security groups (NSGs) to restrict network traffic within the VNet. For example, in the 3-tier architecture shown here, the database tier does not accept traffic from the web front end, only from the business tier and the management subnet.
- **SQL Server Always On Availability Group.** Provides high availability at the data tier, by enabling replication and failover.
- **Active Directory Domain Services (AD DS) Servers.** Prior to Windows Server 2016, SQL Server Always On Availability Groups must be joined to a domain. This is because Availability Groups depend on Windows Server Failover Cluster (WSFC) technology. Windows Server 2016 introduces the ability to create a Failover Cluster without Active Directory, in which case the AD DS servers are not required for this architecture.

### Recommendations

Your requirements might differ from the architecture described here. Use these recommendations as a starting point.

### VNet / Subnets

When you create the VNet, determine how many IP addresses your resources in each subnet require. Specify a subnet mask and a VNet address range large enough for the required IP addresses, using CIDR notation. Use an address space that falls within the standard private IP address blocks, which are 10.0.0.0/8, 172.16.0.0/12, and 192.168.0.0/16.

Choose an address range that does not overlap with your on-premises network, in case you need to set up a gateway between the VNet and your on-premise network later. Once you create the VNet, you can't change the address range.

Design subnets with functionality and security requirements in mind. All VMs within the same tier or role should go into the same subnet, which can be a security boundary.

For each subnet, specify the address space for the subnet in CIDR notation. For example, '10.0.0.0/24' creates a range of 256 IP addresses. VMs can use 251 of these; five are reserved. Make sure the address ranges don't overlap across subnets.

### Network security groups

Use NSG rules to restrict traffic between tiers. For example, in the 3-tier architecture shown above, the web tier does not communicate directly with the database tier. To enforce this, the database tier should block incoming traffic from the web tier subnet.

1. Create an NSG and associate it to the database tier subnet.
2. Add a rule that denies all inbound traffic from the VNet. (Use the `VIRTUAL_NETWORK` tag in the rule.)
3. Add a rule with a higher priority that allows inbound traffic from the business tier subnet. This rule overrides the previous rule, and allows the business tier to talk to the database tier.
4. Add a rule that allows inbound traffic from within the database tier subnet itself. This rule allows communication between VMs in the database tier, which is needed for database replication and failover.
5. Add a rule that allows RDP traffic from the jumpbox subnet. This rule lets administrators connect to the database tier from the jumpbox.

### Note

An NSG has default rules that allow any inbound traffic from within the VNet. These rules can't be deleted, but you can override them by creating higher priority rules.

### Load balancers

The external load balancer distributes Internet traffic to the web tier. Create a public IP address for this load balancer.

The internal load balancer distributes network traffic from the web tier to the business tier. To give this load balancer a private IP address, create a frontend IP configuration and associate it with the subnet for the business tier.

### SQL Server Always On Availability Groups

We recommend Always On Availability Groups for SQL Server high availability. Prior to Windows Server 2016, Always On Availability Groups require a domain controller, and all nodes in the availability group must be in the same AD domain.

Other tiers connect to the database through an availability group listener. The listener enables a SQL client to connect without knowing the name of the physical instance of SQL Server. VMs that access the database must be joined to the domain. The client (in this case, another tier) uses DNS to resolve the listener's virtual network name into IP addresses.

Configure the SQL Server Always On Availability Group as follows:

1. Create a Windows Server Failover Clustering (WSFC) cluster, a SQL Server Always On Availability Group, and a primary replica.

2. Create an internal load balancer with a static private IP address.
3. Create an availability group listener, and map the listener's DNS name to the IP address of an internal load balancer.
4. Create a load balancer rule for the SQL Server listening port (TCP port 1433 by default). The load balancer rule must enable *floating IP*, also called Direct Server Return. This causes the VM to reply directly to the client, which enables a direct connection to the primary replica.

### Note

When floating IP is enabled, the front-end port number must be the same as the back-end port number in the load balancer rule.

When a SQL client tries to connect, the load balancer routes the connection request to the primary replica. If there is a failover to another replica, the load balancer automatically routes subsequent requests to a new primary replica. During a failover, existing client connections are closed. After the failover completes, new connections will be routed to the new primary replica.

If your application makes significantly more reads than writes, you can offload some of the read-only queries to a secondary replica.

Test your deployment by forcing a manual failover of the availability group.

### Jumpbox

The jumpbox will have minimal performance requirements, so select a small VM size for the jumpbox such as Standard A1.

Create a public IP address for the jumpbox. Place the jumpbox in the same VNet as the other VMs, but in a separate management subnet.

Do not allow RDP access from the public Internet to the VMs that run the application workload. Instead, all RDP access to these VMs must come through the jumpbox. An administrator logs into the jumpbox, and then logs into the other VM from the jumpbox. The jumpbox allows RDP traffic from the Internet, but only from known, safe IP addresses.

To secure the jumpbox, create an NSG and apply it to the jumpbox subnet. Add an NSG rule that allows RDP connections only from a safe set of public IP addresses. The NSG can be attached either to the subnet or to the jumpbox NIC. In this case, we recommend

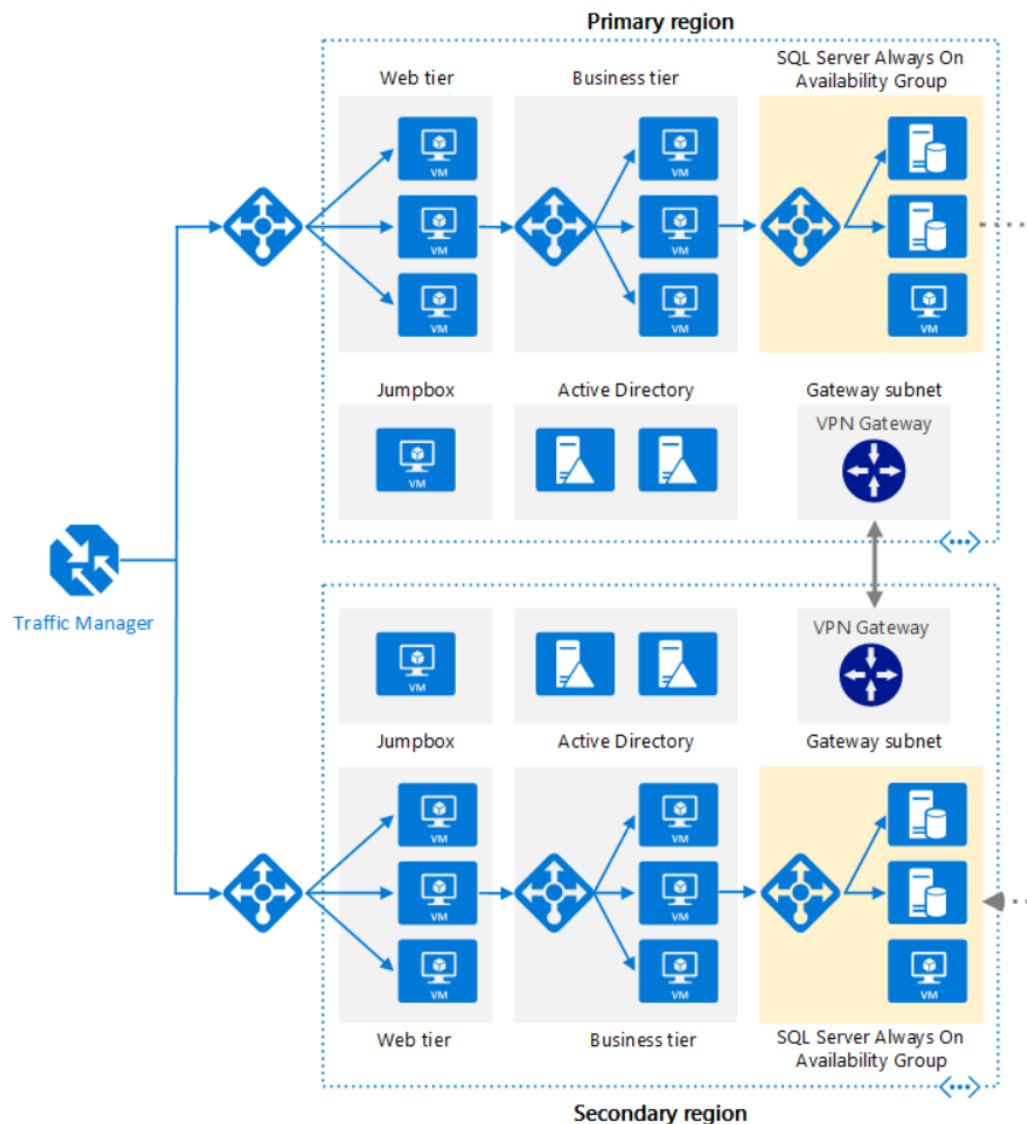


attaching it to the NIC, so RDP traffic is permitted only to the jumpbox, even if you add other VMs to the same subnet.

Configure the NSGs for the other subnets to allow RDP traffic from the management subnet.

**Multi-region Application**

This reference architecture shows a set of proven practices for running an N-tier application in multiple Azure regions<sup>15</sup>, in order to achieve availability and a robust disaster recovery infrastructure.



**Figure 73: Running an N-tier application in multiple Azure regions – Architecture**

**Architecture**

This architecture builds on the one shown in Run Windows VMs for an N-tier application.

- **Primary and secondary regions.** Use two regions to achieve higher availability. One is the primary region. The other region is for failover.
- **Azure Traffic Manager**<sup>143</sup>. Traffic Manager routes incoming requests to one of the regions. During normal operations, it routes requests to the primary region. If that region becomes unavailable, Traffic Manager fails over to the secondary region.
- **Resource groups.** Create separate resource groups for the primary region, the secondary region, and for Traffic Manager. This gives you the flexibility to manage each region as a single collection of resources. For example, you could redeploy one region, without taking down the other one. Link the resource groups, so that you can run a query to list all the resources for the application.
- **VNets.** Create a separate VNet for each region. Make sure the address spaces do not overlap.
- **SQL Server Always On Availability Group.** If you are using SQL Server, we recommend [SQL Always On Availability Groups](#) for high availability. Create a single availability group that includes the SQL Server instances in both regions.

#### Note

Also consider [Azure SQL Database](#), which provides a relational database as a cloud service. With SQL Database, you don't need to configure an availability group or manage failover.

- **VPN Gateways.** Create a VPN gateway in each VNet, and configure a [VNet-to-VNet connection](#), to enable network traffic between the two VNets. This is required for the [SQL Always On Availability Group](#).

#### Recommendations

A multi-region architecture can provide higher availability than deploying to a single region. If a regional outage affects the primary region, you can use [Traffic Manager](#) to fail over to the secondary region. This architecture can also help if an individual subsystem of the application fails.

There are several general approaches to achieving high availability across regions:

- **Active/passive with hot standby.** Traffic goes to one region, while the other waits on hot standby. Hot standby means the VMs in the secondary region are allocated and running at all times.

- Active/passive with cold standby. Traffic goes to one region, while the other waits on cold standby. Cold standby means the VMs in the secondary region are not allocated until needed for failover. This approach costs less to run, but will generally take longer to come online during a failure.
- Active/active. Both regions are active, and requests are load balanced between them. If one region becomes unavailable, it is taken out of rotation.

This reference architecture focuses on active/passive with hot standby, using Traffic Manager for failover. Note that you could deploy a small number of VMs for hot standby and then scale out as needed.

### Regional pairing

Each Azure region is paired with another region within the same geography. In general, choose regions from the same regional pair (for example, East US 2 and US Central).

Benefits of doing so include:

- If there is a broad outage, recovery of at least one region out of every pair is prioritized.
- Planned Azure system updates are rolled out to paired regions sequentially, to minimize possible downtime.
- Pairs reside within the same geography, to meet data residency requirements.

However, make sure that both regions support all of the Azure services needed for your application.

### Traffic Manager configuration

Consider the following points when configuring Traffic Manager:

- **Routing.** Traffic Manager supports several routing algorithms. For the scenario described in this article, use **priority** routing (formerly called **failover** routing). With this setting, Traffic Manager sends all requests to the primary region, unless the primary region becomes unreachable. At that point, it automatically fails over to the secondary region.
- **Health probe.** Traffic Manager uses an HTTP (or HTTPS) probe to monitor the availability of each region. The probe checks for an HTTP 200 response for a specified URL path. As a best practice, create an endpoint that reports the overall health of the application, and use this endpoint for the health probe. Otherwise, the

probe might report a healthy endpoint when critical parts of the application are actually failing.

When Traffic Manager fails over there is a period of time when clients cannot reach the application. The duration is affected by the following factors:

- The health probe must detect that the primary region has become unreachable.
- DNS servers must update the cached DNS records for the IP address, which depends on the DNS time-to-live (TTL). The default TTL is 300 seconds (5 minutes), but you can configure this value when you create the Traffic Manager profile.

If Traffic Manager fails over, we recommend performing a manual failback rather than implementing an automatic failback. Otherwise, you can create a situation where the application flips back and forth between regions. Verify that all application subsystems are healthy before failing back.

Note that Traffic Manager automatically fails back by default. To prevent this, manually lower the priority of the primary region after a failover event. For example, suppose the primary region is priority 1 and the secondary is priority 2. After a failover, set the primary region to priority 3, to prevent automatic failback. When you are ready to switch back, update the priority to 1.

The following Azure CLI command updates the priority:

```
bat Copy
```

```
azure network traffic-manager endpoint set --resource-group <resource-group> --profile-name <profile>
--name <traffic-manager-name> --type AzureEndpoints --priority 3
```

Another approach is to temporarily disable the endpoint until you are ready to fail back:

```
bat Copy
```

```
azure network traffic-manager endpoint set --resource-group <resource-group> --profile-name <profile>
--name <traffic-manager-name> --type AzureEndpoints --status Disabled
```

Depending on the cause of a failover, you might need to redeploy the resources within a region. Before failing back, perform an operational readiness test. The test should verify things like:

- VMs are configured correctly. (All required software is installed, IIS is running, and so on.)
- Application subsystems are healthy.
- Functional testing. (For example, the database tier is reachable from the web tier.)

### Configure SQL Server Always On Availability Groups

Prior to Windows Server 2016, SQL Server Always On Availability Groups require a domain controller, and all nodes in the availability group must be in the same Active Directory (AD) domain.

To configure the availability group:

- At a minimum, place two domain controllers in each region.
- Give each domain controller a static IP address.
- Create a VNet-to-VNet connection to enable communication between the VNets.
- For each VNet, add the IP addresses of the domain controllers (from both regions) to the DNS server list. You can use the following CLI command. For more information, see [Manage DNS servers used by a virtual network \(VNet\)](#).

bat Copy

```
azure network vnet set --resource-group dc01-rg --name dc01-vnet --dns-servers
"10.0.0.4,10.0.0.6,172.16.0.4,172.16.0.6"
```

- Create a Windows Server Failover Clustering (WSFC) cluster that includes the SQL Server instances in both regions.
- Create a SQL Server Always On Availability Group that includes the SQL Server instances in both the primary and secondary regions. See [Extending Always On Availability Group to Remote Azure Datacenter \(PowerShell\)](#) for the steps.
  - Put the primary replica in the primary region.
  - Put one or more secondary replicas in the primary region. Configure these to use synchronous commit with automatic failover.

- Put one or more secondary replicas in the secondary region. Configure these to use **asynchronous** commit, for performance reasons. (Otherwise, all T-SQL transactions have to wait on a round trip over the network to the secondary region.)

## Hybrid Network

### VPN

This reference architecture shows how to extend an on-premises network to Azure, using a site-to-site virtual private network (VPN). Traffic flows between the on-premises network and an Azure Virtual Network (VNet) through an IPsec VPN tunnel.

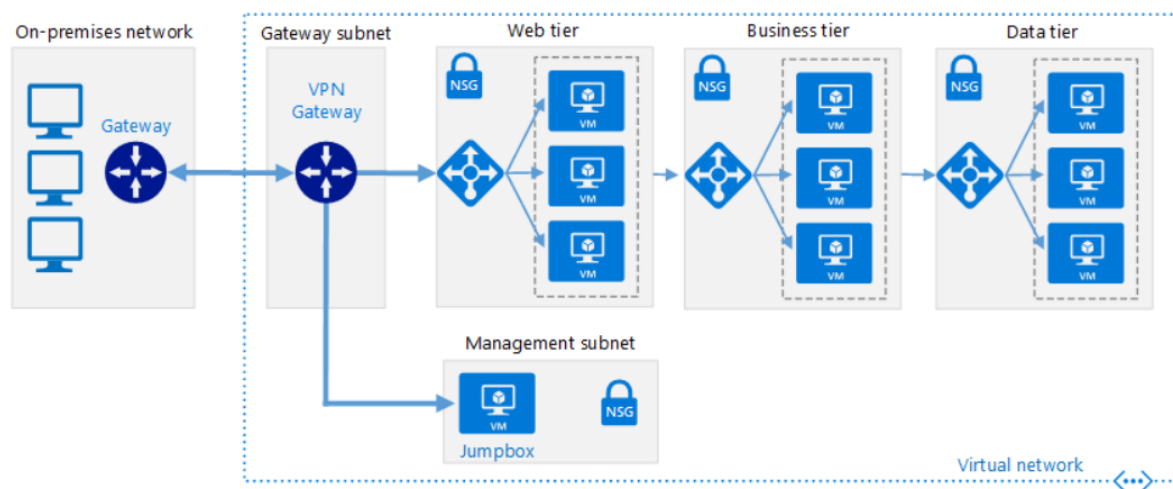


Figure 74: Traffic flows between the on-premises network and an Azure Virtual Network (VNet) through an IPsec VPN tunnel – Architecture

### Architecture

The architecture consists of the following components.

- **On-premises network.** A private local-area network running within an organization.
- **VPN appliance.** A device or service that provides external connectivity to the on-premises network. The VPN appliance may be a hardware device, or it can be a software solution such as the Routing and Remote Access Service (RRAS) in Windows Server 2012. For a list of supported VPN appliances and information on configuring them to connect to an Azure VPN gateway, see the instructions for the selected device in the article About VPN devices for Site-to-Site VPN Gateway connections.
- **Virtual network (VNet).** The cloud application and the components for the Azure VPN gateway reside in the same VNet.

- **Azure VPN gateway.** The VPN gateway service enables you to connect the VNet to the on-premises network through a VPN appliance. For more information, see [Connect an on-premises network to a Microsoft Azure virtual network](#). The VPN gateway includes the following elements:
  - **Virtual network gateway.** A resource that provides a virtual VPN appliance for the VNet. It is responsible for routing traffic from the on-premises network to the VNet.
  - **Local network gateway.** An abstraction of the on-premises VPN appliance. Network traffic from the cloud application to the on-premises network is routed through this gateway.
  - **Connection.** The connection has properties that specify the connection type (IPSec) and the key shared with the on-premises VPN appliance to encrypt traffic.
  - **Gateway subnet.** The virtual network gateway is held in its own subnet, which is subject to various requirements, described in the Recommendations section below.
- **Cloud application.** The application hosted in Azure. It might include multiple tiers, with multiple subnets connected through Azure load balancers.
- **Internal load balancer.** Network traffic from the VPN gateway is routed to the cloud application through an internal load balancer. The load balancer is located in the front-end subnet of the application.

### Recommendations

The following recommendations apply for most scenarios. Follow these recommendations unless you have a specific requirement that overrides them.

#### VNet and gateway subnet

Create an Azure VNet with an address space large enough for all of your required resources. Ensure that the VNet address space has sufficient room for growth if additional VMs are likely to be needed in the future. The address space of the VNet must not overlap with the on-premises network. For example, the diagram above uses the address space 10.20.0.0/16 for the VNet.<sup>1</sup>

Create a subnet named **GatewaySubnet**, with an address range of /27. This subnet is required by the virtual network gateway. Allocating 32 addresses to this subnet will help to prevent reaching gateway size limitations in the future. Also, avoid placing this subnet in the middle of the address space. A good practice is to set the address space for the gateway

subnet at the upper end of the VNet address space. The example shown in the diagram uses 10.20.255.224/27. Here is a quick procedure to calculate the CIDR:

1. Set the variable bits in the address space of the VNet to 1, up to the bits being used by the gateway subnet, then set the remaining bits to 0.
2. Convert the resulting bits to decimal and express it as an address space with the prefix length set to the size of the gateway subnet.

For example, for a VNet with an IP address range of 10.20.0.0/16, applying step #1 above becomes 10.20.0b11111111.0b11100000. Converting that to decimal and expressing it as an address space yields 10.20.255.224/27.

### **Warning**

Do not deploy any VMs to the gateway subnet. Also, do not assign an NSG to this subnet, as it will cause the gateway to stop functioning.

### **Virtual network gateway**

Allocate a public IP address for the virtual network gateway.

Create the virtual network gateway in the gateway subnet and assign it the newly allocated public IP address. Use the gateway type that most closely matches your requirements and that is enabled by your VPN appliance:

- Create a policy-based gateway if you need to closely control how requests are routed based on policy criteria such as address prefixes. Policy-based gateways use static routing, and only work with site-to-site connections.
- Create a route-based gateway if you connect to the on-premises network using RRAS, support multi-site or cross-region connections, or implement VNet-to-VNet connections (including routes that traverse multiple VNets). Route-based gateways use dynamic routing to direct traffic between networks. They can tolerate failures in the network path better than static routes because they can try alternative routes. Route-based gateways can also reduce the management overhead because routes might not need to be updated manually when network addresses change.

### **Note**

After the gateway has been created, you cannot change between gateway types without deleting and re-creating the gateway.



Select the Azure VPN gateway SKU that most closely matches your throughput requirements. Azure VPN gateway is available in three SKUs shown in the following table.

SKU	VPN Throughput	Max IPSec Tunnels
Basic	100 Mbps	10
Standard	100 Mbps	10
High Performance	200 Mbps	30

**Figure 75: Available SKUs for Azure VPN gateway**

#### Note

The Basic SKU is not compatible with Azure ExpressRoute. You can change the SKU after the gateway has been created.

You are charged based on the amount of time that the gateway is provisioned and available. See VPN Gateway Pricing.

Create routing rules for the gateway subnet that direct incoming application traffic from the gateway to the internal load balancer, rather than allowing requests to pass directly to the application VMs.

#### On-premises network connection

Create a local network gateway. Specify the public IP address of the on-premises VPN appliance, and the address space of the on-premises network. Note that the on-premises VPN appliance must have a public IP address that can be accessed by the local network gateway in Azure VPN Gateway. The VPN device cannot be located behind a network address translation (NAT) device.

Create a site-to-site connection for the virtual network gateway and the local network gateway. Select the site-to-site (IPSec) connection type, and specify the shared key. Site-to-site encryption with the Azure VPN gateway is based on the IPSec protocol, using preshared keys for authentication. You specify the key when you create the Azure VPN gateway. You must configure the VPN appliance running on-premises with the same key. Other authentication mechanisms are not currently supported.

Ensure that the on-premises routing infrastructure is configured to forward requests intended for addresses in the Azure VNet to the VPN device.

Open any ports required by the cloud application in the on-premises network.

Test the connection to verify that:

- The on-premises VPN appliance correctly routes traffic to the cloud application through the Azure VPN gateway.
- The VNet correctly routes traffic back to the on-premises network.
- Prohibited traffic in both directions is blocked correctly.

**Microsoft Assessment**

Differentiators <sup>132</sup>	Advantages <sup>132</sup>	Disadvantages
<ul style="list-style-type: none"> <li>• Microsoft emphasizes hybrid clouds and has a compelling hybrid story including a virtualization<sup>49</sup> option that reduces Cloud Lock in risk.</li> <li>• Microsoft is offering the most complete Public Cloud when you look across SaaS, PaaS, IaaS and supporting services like Identity.</li> <li>• Microsoft has the best integration story with its vast partner network and enterprise credibility.</li> </ul>	<ul style="list-style-type: none"> <li>• Microsoft has a very large on-premises install base.</li> <li>• Most IT leaders place a high value on Microsoft (safe bet).</li> <li>• Microsoft owns the only notable non open source server OS.</li> <li>• Microsoft has arguably made the most investments (19 billion+) in Cloud.</li> <li>• More compliance certs than any other cloud.</li> <li>• Azure Marketplace is a big opportunity (outpaced Amazon).</li> </ul>	<ul style="list-style-type: none"> <li>• Microsoft was slow in offering IaaS, they truly believed PaaS was the key to the Cloud.</li> <li>• Microsoft has to transition its salesforce, operations and revenue to the cloud and cloud services.</li> </ul>

**Table 6: Microsoft Assessment**

## Amazon

### Overview

Amazon.com was launched online in 1995 and since then has gone on to become the world's largest online retailer. It is an American multinational e-commerce company whose headquarters is located in Seattle, Washington. Amazon started as an online bookstore but quickly diversified to other products like music, videos, consumer electronics clothing and household products. Amazon apart from offering e-commerce solutions also offers products and services like self-publishing, online advertising, hosting and co-branded credit card. Amazon operates as a retail website that provides shipping in 12 international locations.

### Amazon Web Services

**Amazon Web Services (AWS)**<sup>6</sup>, a subsidiary of Amazon, started in 2004 and launched Amazon Simple Storage Service (Amazon S3)<sup>5</sup> in 2006. AWS promotes its “you ask for it, we build it” customer-focused innovation philosophy. AWS rolls out new services and features aggressively and has released close to 442 updates by mid November 2014 (Source: AWS re:Invent 2014 Day 1 Keynote with Andy Jassy, November 11, 2014). AWS actively seeks to offer the lowest price available and has dropped prices 46 times since launch (Amazon pricing page [aws.amazon.com/pricing/](http://aws.amazon.com/pricing/)).

### History and Culture

Amazon's mission statement is “to be earth's most customer centric company; to build a place where people can come to find and discover anything they might want to buy online”. This culture of customer-centricity is carried over to Amazon Web Services (AWS)<sup>36</sup> and is reflected in the pace at which they have been shipping new products and features as shown below. By 2004, Amazon had developed unique web services based on more than a decade of infrastructure work for the evolution of the Amazon E-commerce platform. They had also opened up these web services through programmatic APIs to developers and witnessed strong uptake and innovation in the developer ecosystem. The combination of these two phenomena led to the birth of AWS, and Amazon positioned it as a platform that offered infrastructure building blocks through a service interface to developers, so they would no longer need to focus on buying, building, and maintaining infrastructure<sup>4</sup>.

Amazon started AWS in 2006 with 1 service, S3, a storage service, followed up by a compute service, E2 in fall of that year. AWS offers 33 services today (and counting); though the industry characterizes these services as IaaS, AWS itself doesn't make a distinction between different cloud service models.

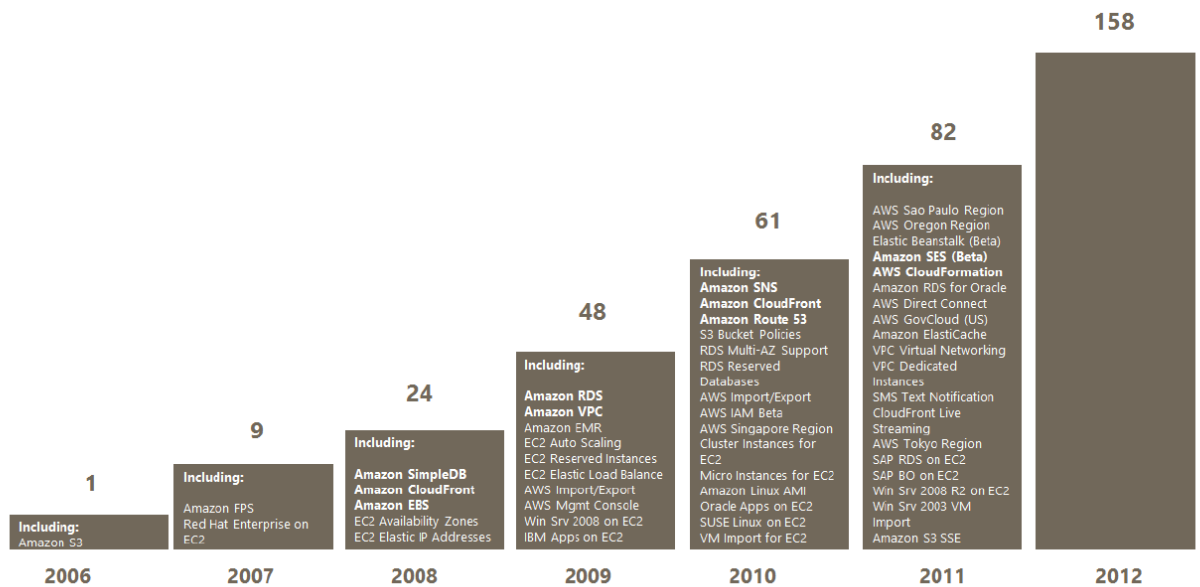


Figure 76: List of new features and services shipped by AWS during the past years

### Vision

AWS pursues a retail strategy in IT, with high volumes and low margins. Its focus on innovation and large volumes allows it to take advantage of experience curves and forward pricing to drive revenue and share first, followed by economies of scale and income. Long term, their goal is to become the ubiquitous utility computing platform. The grandiosity of their vision is reflected in the manner they describe AWS on their website: “Amazon Web Services offers a complete set of infrastructure and application services that enable you to **run virtually everything in the cloud**: from enterprise applications and big data projects to social games and mobile apps.”

### Core DNA – legacy, mindset, corporate values

AWS core DNA is around creating and owning a marketplace. They did it successfully with the e-commerce platform and are hoping to repeat the same with AWS. AWS is fanatically customer-centric (borrowed from Amazon’s corporate value). They start with the customer and everything moves backwards from there.

### Strategy

AWS’s vision is to enable any app to run in the public cloud. The strategy to achieve their vision there can be summed up in the flywheel shown below. The flywheel indicates a virtuous cycle, where AWS higher margins makes it an ideal candidate for Amazon to invest heavily in it, which translates to building of more, richer services in AWS, and stronger customer adoption. As customers use AWS more, AWS buys more infrastructure and gets economies of scale, which lowers its infrastructure costs. As it lowers its infrastructure costs, it is able to lower the prices it charges to customers, which drives more customers to adopt AWS. AWS has lowered prices 24 times since it launched in 2006, including 10 price reductions in 2012 alone. This virtuous cycle gives AWS a business model with highest volumes and lowest costs.

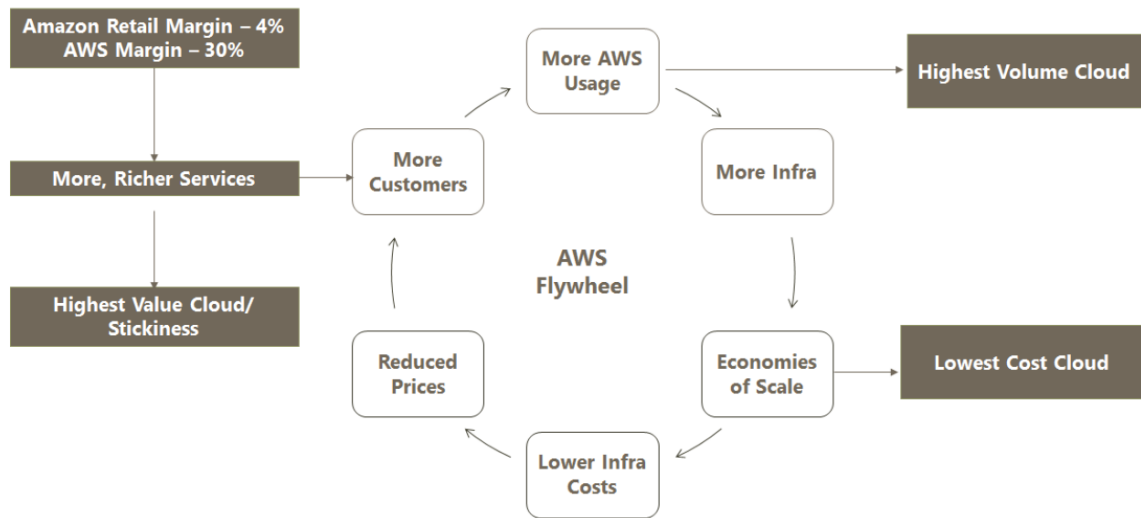


Figure 72: AWS Flywheel gives it a unique business model

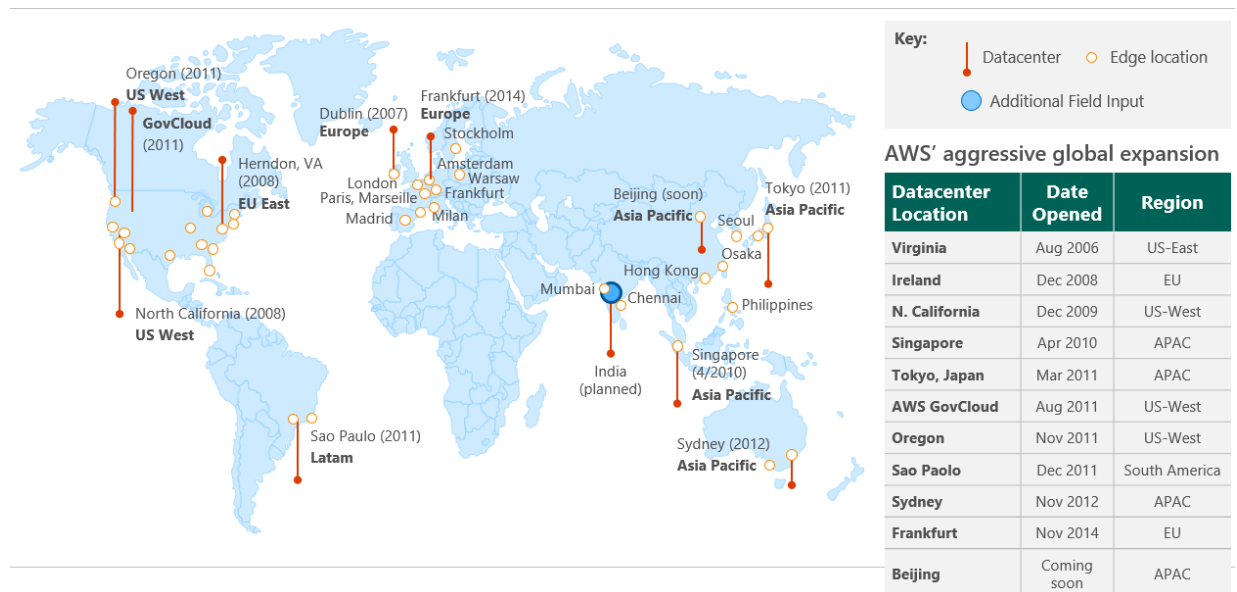


Figure 77: AWS Datacenters & Edge Locations (AWS Global Footprint)

AWS has targeted startups and SMB customers, and have been successful at it. Now, they are expanding the target market to enterprise customers to drive usage and ubiquity of their platform. Enterprise customers represent a market much bigger than the startup market and enterprises are interested in AWS<sup>12</sup>.



Figure 78: AWS target customers, source: AWS

- AWS wants to be the ubiquitous utility cloud computing platform of the future. AWS commands higher margins than Amazon retail (~10X), which makes it a very good investment area, Amazon has developed a core competency in running high scale services, which they are *re-selling* to customers and believe *they do it better than anyone else*.
- AWS is highly motivated to penetrate enterprise accounts. In recent months, it has been ramping up its enterprise sales force significantly. Its focus on innovation and large volume allows it to take advantage of experience curves and forward pricing to drive revenue and share first, followed by economies of scale and income.
- AWS has alliances with almost every significant independent software vendor (ISV) (including Microsoft and SAP) and most of the top system integrators (SIs) (including Capgemini). VMware and Citrix (Cloudstack) have recently started offering interoperability with AWS.

### Sales Strategy

AWS' growth strategy focuses on self-led customer acquisition and expanding usage within existing accounts.

- **Industry Leader**
  - Illustrate AWS growth and brand recognition
  - Showcases a variety of Use Cases
  - Highlight ease of deployment
  - Expertise in certain industries (Media), with dedicated resources and partners
- **Flexible & Open**
  - Demonstrates “pay only for what you need” via online calculators
  - Assures compatibility with existing technology vendor offerings via BYOL model
- **Elasticity, Cost Reduction, Agility**
  - Benefits of auto scaling
  - History AWS price reductions, encourage discounts through higher use
  - Examples of API automation
- **Security**
  - Highlights certifications and AWS functionality for Infrastructure, Applications and Services security
  - Industry-specific clouds: GovCloud for US Government

## Sales Tactics

Amazon has around 400 sellers worldwide and about 150 focus on enterprise customers. AWS sales force consists of 100-150 sellers and several tele-sellers that focus on SMBs, as well as a substantial territory sales force (around 150 sellers) that focuses on the enterprise customers. AWS is aggressively adding sales force as well as solution architects to reach the enterprises. The numbers above are expected to increase dramatically with their current emphasis on hiring.

They pitch to BDMs, and position AWS as the lowest price, most innovative, and market share leader. They sell workload level services like storage, and dev/test. Currently AWS is Leading mind share and market share in cloud infrastructure as a service (IaaS), with extremely high penetration within startups and early adopters, making it the incumbent to own the public cloud space.

- **Self Provisioning**
  - Target marketing efforts and user communication to IT Decision Makers
  - Offer Free Usage Tier to entice potential new customers
  - Less flexibility in negotiating terms
- **Approach CXO**
  - Provide a customized proof-of-concept
  - Leverage key Enterprise Partners and other CXO's
  - Holistic approach looking at all workloads, OS, applications
- **Assign Solutions Architects and Technical Account Managers**
  - Dedicated Engineers and Solutions Architects from design to implementation
  - Focus on solving for business priorities
- **Focus on Selling Consumption**
  - Not focused in upfront commitments; sell consumption tied to real usage.
  - Then finding new workloads to increase footprint

AWS's Sales pitches emphasize on the following points:

- Broadest platform of IaaS capabilities and APIs.
- Rapid platform development with hundreds of new features each year. Large-scale capacity and efficient use leading to continuous price cuts; perception of lowest cost provider.
- Broad ecosystem of ISVs and service catalog options.
- Global platform reach with a single, consistent user interface.
- Turnkey application deployment through AWS Marketplace.

Value Proposition that AWS pitched to customers:

- **Agility**
  - Infrastructure in minutes
  - Experiment often
  - Fail quickly at low cost
- **Scalable**
  - 10 Regions
  - 25 Availability Zones
  - 51 Edge Locations
- **Lower Cost**
  - On Demand
  - Reserved & Spot instances
  - 46 Price reductions without competitive pressure
- **Secure**
  - Certification & Accreditations that matter
  - AWS Cloud Trail, Key Management Service

- Encryption
- Proven
  - Leader in Magic Quadrant
  - Enterprise Support & Architecture Team
  - Thousands of customers and references

Note that AWS is increasingly segmenting customers and deploying unique sales approaches for different account types.

AWS segments its accounts as follows:

AWS Segment	Segment Definition (customer revenue)
Fortune 1000	> \$2B Revenue
Fortune 2000	\$0.5B - \$2B Revenue
SMB	<\$0.5 B Revenue

**Table 7: AWS Customer Segments**

Typical billings for a Fortune 1000 Customer is \$20-25K/month. Some examples of large customers include, Samsung smart TV: \$500K/month, and Netflix: 700-800K/month. The average AWS seller quota is > \$6M and generalist AWS sellers get strong support on sales and deployment from:

- TAMs (Technical Account Manager) - assigned to large customers. TAMs are on point for driving deployment.
- Security Specialists – include ex- FBI, Symantec, RSA folks.
- Dedicated CDN sellers.
- Product specific Business Development specialists (Storage, Hadoop specialists).

AWS Top workloads for Fortune 1000 customers include the following scenarios:

Workloads	Sub-scenarios and buyer
Storage	<ul style="list-style-type: none"> <li>● Archiving and Backup - Central IT</li> <li>● Storage for Websites - e.g. American Greetings</li> <li>● Workload buyer = BDM</li> <li>● AWS uses bots (much like AWS Detector) to identify and target websites that use competing hosters (e.g., Terramark and Rackspace).</li> <li>● Sellers then identify and approach BDMs on Linked-in and sell.</li> </ul>
Dev and Test	<ul style="list-style-type: none"> <li>● SAP Dev / Test is rapidly growing via SAP partnership.</li> <li>● Dev Test on Microsoft is 60% of Dev Test business in Enterprise. Dev test on Linux is dominant in SMB.</li> <li>● Workload buyer = Development Operations or the Application owner in IT.</li> </ul>
App Hosting <sup>46</sup>	<ul style="list-style-type: none"> <li>● Websites are the #1 application hosting workload on AWS. Websites seen as low hanging fruit to get into accounts due to AWS' extremely strong value prop vs. alternatives like Rackspace including &gt;20% cost</li> </ul>



	<p>savings and improved performance via CDN and Auto scale.</p> <ul style="list-style-type: none"> <li>• SharePoint is #1 Microsoft application going to AWS – growing rapidly. AWS has a strong ecosystem of SI partners that focus on moving SharePoint to AWS.</li> <li>• Limited interest in moving Exchange to AWS in the US.</li> </ul>
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Figure 79: AWS Top Scenarios

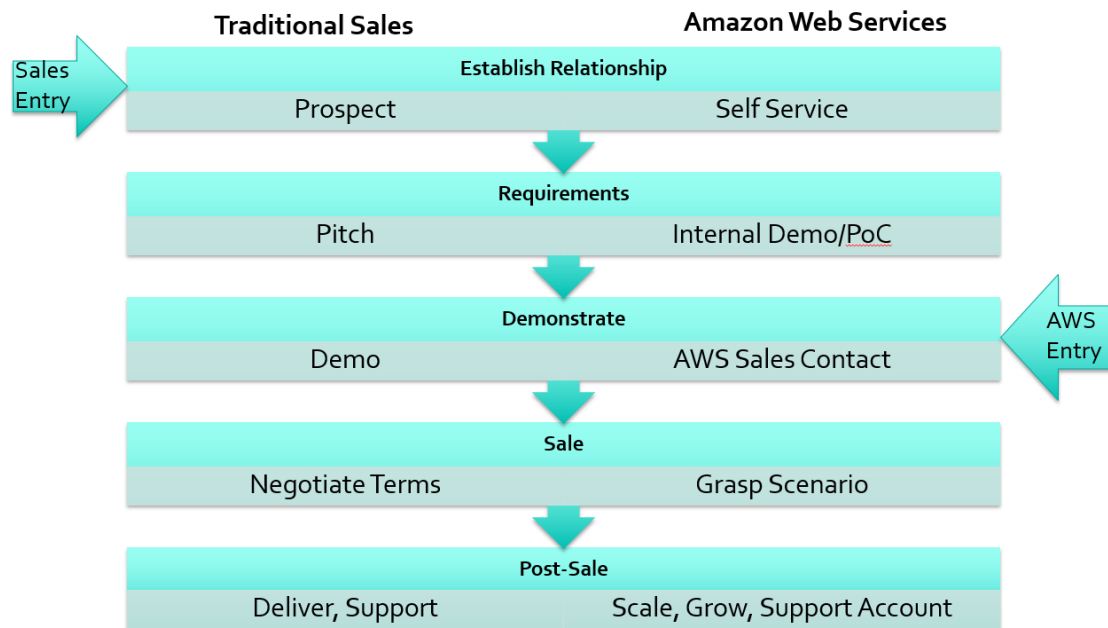


Figure 80: Tradition vs AWS Sales Cycle

### AWS Business Unit Sales Cycle

- Step 1
  - BU-level ITDMs forego the full enterprise procurement process and purchase using a credit card.
  - “Rogue IT” also accounts for AWS adoption that does not require senior-level approval.
- Step 2
  - Sales Representative is selected based on functional expertise matching customer use case.
  - AWS defines enterprise accounts by Fortune 1000 companies (\$2.8B+ annual revenue in 2012).
- Step 3
  - Relationship is cultivated in order to later expand within the account.
  - Sales Representative is responsible for ensuring complete BU customer satisfaction.
  - Builds an understanding of business and IT needs and begins to develop strategy for growth within the account.
- Step 4
  - Sales team members work with BU lead to establish relationship with other BU leads and escalate to the C-level.
  - Discuss business and IT needs across the enterprise, including collaboration with BU Business Decision Makers from multiple lines of business.

- Evaluate existing enterprise IT infrastructure and processes for design, performance and capabilities.
- Step 5
  - Determine company-specific requirements, limitations, regulations, etc.
  - Collaboratively design AWS solutions that address the organization-wide business needs determined by senior executives.
  - Provide ongoing support throughout design, implementation, and operation.



**Figure 81: AWS Business Unit Sales Cycle**

### Typical AWS Engagement Patterns

- Customer CIO mandate the cloud use and team in charge has experience with AWS.
- AWS solution architects run cloud workshops from ½ day to 3 days, covering: what AWS is, how it is used, what applications are best suited for AWS. Architects provide hands-on support to deploy workloads to cloud.
- Customers are invited to AWS EBC in Seattle.
- Business Unity IT is already using AWS
- Customer is not happy with the workload running on third party cloud such as SharePoint on Rackspace.
- Target following pain points:
  - Facing a tech refresh in next 12-18 months
  - Running out of datacenter capacity
  - Outsourced part or all of IT environment
  - Looking to build or extend public websites
  - Growing requirements but reduce budget and staff

### Marketing Approach

AWS primary marketing engine is through PR, online ads, and their digital assets (awareness). In addition, they have started ramping up on local events and user groups. Their target audiences are startups and business decision makers within enterprises.

Their website is a one stop resource for anything on AWS. It is not only extremely well organized, but also easy to navigate and find information. AWS also organizes and

maintains user groups worldwide - 16 (US), 8 (Europe), 5 (APAC), 3 (Japan), and 1 (South America). Moreover, they are running more local training events. These events cover basics of AWS, AWS architect training, and subject specific trainings (on Big Data etc.) as well as AWS summits in 8 cities worldwide.

### **Go-to-Market strategy**

AWS goes to market with a utility based model where customers pay only for what they consume, with no long-term contract or commitments. They start with aggressive pricing, which has allowed them to gain lots of customers and significant market share, which in return allows them to invest in more infrastructure, giving them strong economies of scale to continue to provide better value to customers over time.

**Customer Success** is Amazon's main goal which they aspire to achieve through the following:

- **Attract and retain (Accelerate Enterprise Adoption):** AWS follows a "honeypot" sales approach, attracting customers with a small initial offering and, once in, selling them up the AWS stack and investing them in the larger platform as a whole.
- **Move to the enterprise (High value conversation):** Originally focused on developers and smaller organizations, AWS is now attempting to move into the enterprise market. They are aggressively recruiting and hiring enterprise sellers, including some coming from Microsoft.
- **Rapid release cycle (Consumption):** AWS relies on customer feedback to inform a rapid release cycle and continual innovation.

Their go to market is founded on their Pay As You Go model, which makes up a big portion of their business and is transacted typically through their web site. Other than having low prices on the web, AWS provides better pricing through:

- **Reserved Instances:** This allows customers to reserve capacity (and pay up front) at significant discounts. It represents a big portion of their business.
- **Graduated Pricing:** As customers use more of a specific service like storage, customers pay less per unit as their usage grows.

### **Positioning and Messaging**

#### **Cloud:**

AWS offers low cost, highly innovative flexible and scalable cloud solutions including databases, analytic tools, networking and app services, and management resources with no upfront investment or long-term commitment. An expanding network of managed service provider<sup>86</sup> partners ensure customers are optimizing solutions.

#### **Compute:**

AWS provides a variety of cloud-based computing services including a wide selection of compute instances, which can scale up and down automatically to meet the needs of your application, a managed load balancing service, and fully-managed desktops in the cloud.

#### **Storage:**

AWS provides low-cost data storage with high durability and availability. Pay-as-you-go pricing with no commitment means greater flexibility and agility. High security is available at no extra cost and you get storage choices for backup, archiving, and disaster recovery, as well as block, file, and object storage.

#### **Key Messages**

- The AWS cloud infrastructure is housed in AWS's data centers, designed to satisfy the requirements of the most security-sensitive customers.
- AWS and its partners offer hundreds of tools and features to help customers meet their security objectives around visibility, auditability, controllability and agility.

- AWS helps by sharing the security responsibilities with its customers. AWS manages the underlying infrastructure, and customers can secure anything they deploy in AWS.
- AWS builds its data centers in multiple geographic regions as well as across multiple Availability Zones within each region to offer maximum resiliency against system outages.

**Products & Services**

AWS is primarily an IaaS provider offering infrastructure building blocks - compute, storage, networking, and database along with application and deployment services. AWS also offers a marketplace, an online store that makes it easy to find and launch software that runs on the AWS Cloud with 1-Click<sup>32</sup>.

AWS Marketplace				
Deployment Services	<b>Identity &amp; Access</b> AWS IAM Identity Federation Consolidated Billing	<b>Web Interface</b> Management Console	<b>Monitoring</b> Amazon CloudWatch	<b>Automation</b> AWS Elastic Beanstalk AWS CloudFormation AWS CloudSearch
	<b>Content Distribution</b> Amazon CloudFront	<b>Messaging</b> Amazon SNS Amazon SQS Amazon SES	<b>Parallel Processing</b> Elastic MapReduce	<b>Libraries &amp; SDKs</b> Java, PHP, Python, Ruby, .NET
Application Services	<b>Compute</b> Amazon EC2 Auto Scale	<b>Storage</b> Amazon S3 Amazon EBS	<b>Database</b> Amazon RDS Amazon DynamoDB Amazon SimpleDB Amazon ElastiCache	<b>Networking</b> Amazon VPC Elastic Load Balancing Amazon Route 53 AWS Direct Connect
	<b>AWS Global Infrastructure</b> - 9 Regions, 25 Availability zones, 38 Edge Presence			

**Figure 82: AWS Marchitecture, Source: AWS**

AWS is a platform with multiple services, but the majority of AWS customers use a few foundation services like EC2 and S3.

- **Amazon Elastic Compute Cloud (EC2)**<sup>45</sup>: An AWS service that provides on-demand virtual servers in the cloud. Scalable virtual compute power designed to make computing easier for developers and system administrators. Auto Scaling enables automatic up/down capacity scaling according to predefined conditions. EC2 is a web service that provides resizable compute capacity in the cloud. Amazon EC2’s simple web service interface allows customers to obtain and configure capacity with minimal friction. It provides complete control of computing resources on Amazon’s proven computing environment.
- **Amazon Simple Storage Service (S3)**: A durable and distributed data store in the AWS cloud. It can be used to store and retrieve large amounts of data as objects using standard HTTP protocol. Cloud storage infrastructure for storing and retrieving data from anywhere on the web.
- **Amazon Relational Database Service (RDS)**: An AWS managed service for relational databases in the cloud, including Aurora, a highly scalable and low-cost database which competes with proprietary databases like SQL Server and Oracle. RDS lets businesses set up, operate, and scale a MySQL, Oracle, SQL Server, or PostgreSQL database in the cloud.
- **Amazon Glacier**: A low-cost storage service that provides durable storage for data archiving and backup.

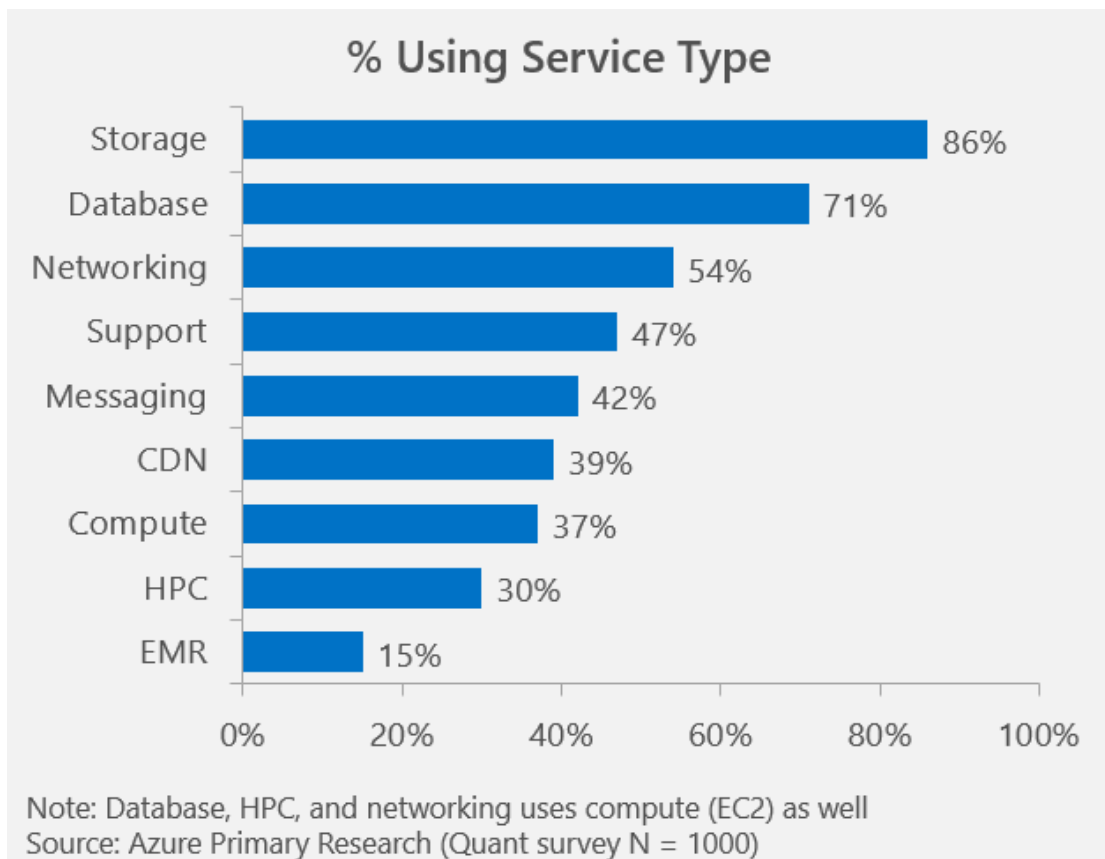
- **Redshift:** Fully managed large-scale data warehouse service in the cloud. Businesses can analyze large-size data sets using the same SQL-based tools and business intelligence (BI) apps in use today.
- **Amazon EMR (Elastic MapReduce):** A web service that enables businesses, researchers, data analysts, and developers to process large amounts of data. Amazon EMR uses Hadoop to distribute data and processing across a resizable cluster of EC2 instances.
- **AWS Elastic Beanstalk:** Service for deploying and scaling web apps and services developed with popular programming languages such as Java, .NET, PHP, Node.js, Python, and Ruby.
- **Amazon VPC (Virtual Private Cloud):** A way for customers to define a virtual network topology that closely resembles a traditional network that they might operate in their own datacenter.
- **Amazon CloudFront:** A content delivery web service to give developers and businesses a way to distribute content to end users with low latency and high data transfer speeds.
- **WorkSpaces:** A desktop computing service that enables customers to provision cloud-based desktops on multiple devices.

Infrastructure building blocks	Platform building blocks	Cross-service offers	Other tools
<b>Compute</b> EC2, auto-scaling, ELB, Lambda	<b>Database</b> RDS, DynamoDB, RedShift, Aurora	<b>Deployment</b> Elastic Beanstalk, Cloud formation, OpsWorks	<b>Management</b> AWS Mgmt. Console, Service Catalog
<b>Storage</b> S3, EBS, Glacier, Storage Gateway, Import/Export	<b>Messaging</b> SQS, SWF, SES, SNS	<b>Analytics</b> EMR, Kinesis, Data Pipeline	<b>Development</b> Command line interface, Mobile SDK, ALM
<b>Networking</b> Direct Connect, Virtual Private Cloud, Route 53	<b>Delivery</b> CloudFront	<b>Apps</b> CloudSearch, AppStream, Zocalo, WorkSpaces	<b>Industry-specific</b> GovCloud
	<b>Caching</b> Elastic cache	<b>Identity</b> Identity and Access Management	<b>Monitoring</b> CloudTrail, AWS Config, CloudWatch, CloudHSM, Key Management Service (KMS)

Amazon Global Infrastructure  
 North America (Northern Virginia, Northern California, Oregon, GovCloud), Europe (Ireland), APAC (Singapore, Tokyo, Sydney, Beijing), South America (Sao Paulo)  
 52 AWS Edge locations offering Amazon CloudFront and Amazon Route 53

**Figure 83: Amazon's Cloud Computing Platform (AWS Stack)**

Compute (EC2) and Storage (S3) are the most popular services.



**Figure 84: AWS Service Usage**

Customers are running a variety of workloads on AWS, but the primary ones include:

- **Business applications:** Oracle, SAP, Microsoft Line of business apps
- **Web applications:** Digital media distribution, gaming, media sharing, social media
- **Big Data and HPC:** analytics for consumer web
- **Disaster Recovery and Archive:** backup and recovery, archive, disaster recovery

### Competitive Situation

AWS considers other hosters and IaaS players like TerraMark and Rackspace to be their primary competitors. For example, AWS sellers use bots to identify and target websites that use competing hosters like TerraMark and Rackspace, and then identify and approach BDMs on LinkedIn and sell them AWS services. AWS is increasingly facing more competition from Microsoft, VMware, CloudStack, and OpenStack and their ecosystems. Though VMware and CloudStack offer interoperability with AWS by leveraging the AWS ecosystem with a set of common interfaces.

focused on developers and smaller organizations, Amazon Web Services (AWS) is now attempting to move into the enterprise market, aggressively recruiting and hiring enterprise sellers. Unlike other major cloud vendors that provide private/hybrid cloud solutions for enterprises however, AWS is focusing on its public cloud offering. However, AWS is increasingly facing more competition from Microsoft, VMware, CloudStack, and OpenStack and their ecosystems.

AWS pursues a retail strategy with high volumes and low margins, attracting customers with a small initial offering and then selling them the AWS stack and larger

platform. AWS' procurement models, security, and privacy issues however, are holding it back from gaining traction with enterprises.

	Azure	amazon web services™
ISO 27001	✓	✓
SOC 1/SSAE 16/ISAE 3402 (formerly SAS70)	✓	✓
SOC 2	✓	✓
SOC 3*	NA	✓
PCI DSS Level 1	✓	✓
CSA CCM	✓	✓
FedRAMP/FISMA	✓	✓
ITAR		✓
DIACAP		✓
HIPAA	✓	✓
Safe Harbor Certified	✓	✓
UK G-Cloud OFFICIAL	✓	
EU Model Clauses	✓	
FIPS 140-2	✓	✓
FERPA	✓	
MPAA		✓

\*The SOC 3 report is a summary of SOC 2. Azure provides the full SOC 2 report to customers under NDA.

**Figure 85: Comparison of key capabilities between Azure & AWS**

**Key alliances, Key competitors, alternatives to their solution**

AWS has alliances with almost every significant ISV vendor and most of the top SIs (most notable being SAP with its HANA suite). Their key competitors include Rackspace, Microsoft, and Google. They also compete with private cloud vendors like VMware and its ecosystem of service providers. Recently, VMware and Citrix (Cloudstack) have started offering interoperability with AWS.

**Risks**

AWS faces several risks including increased competition from Microsoft and Google, hostile regulatory environments, data privacy and security concerns, and slow pace of core IT public cloud adoption by enterprise customers. AWS adoption has been primarily limited to startups and tier-2/3 apps, often running well outside the aegis of corporate IT. Enterprise customers might not choose AWS because of several reasons. They might be:

- Committed to a specific hypervisor or hardware set (VMware or Hyper-V).
- Interested in supporting a hybrid IT architecture that AWS doesn't embrace completely.
- Interested in enterprise-grade SLAs and enterprise management that AWS lacks.
- Not interested in committing to AWS architecture and APIs, because of lack of transparency.

**AWS purchasing options**

Customers pay less for reserved instances, and tiered resources.

- **S3**

When you begin to estimate the cost of Amazon S3, you need to consider the following:

- **Storage Class.** Standard Storage is designed to provide 99.999999999% durability. Reduced Redundancy Storage (RRS) is a storage option within Amazon S3 that you can use to reduce your costs by storing non-critical, reproducible data at lower levels of redundancy than Amazon S3's standard storage. Reduced Redundancy Storage is designed to provide 99.99% durability. Each class has different rates.
- **Storage.** The number and size of objects stored in your Amazon S3 buckets as well as type of storage.
- **Requests.** The number and type of requests. GET requests incur charges at different rates than other requests, such as PUT and COPY requests.
- **Compute**
  - **Clock Hours of Server Time.** Resources incur charges when they are running. For example, from the time you launch a DB instances until you terminated the DB instance.
  - **Database Characteristics.** The physical capacity of the database you choose will affect how much you are charged. Database characteristics vary depending on the database engine, size, and memory class.
  - **Database Purchase Type.** When you use On-Demand DB Instances, you pay for compute capacity for each hour your DB Instance runs, with no required minimum commitments. With Reserved DB Instances, you can make a low, one-time, up-front payment for each DB Instance you wish to reserve for a 1-year or 3-year term.
  - **Number of Database Instances.** With Amazon RDS, you can provision multiple DB instances to handle peak loads. More instances multiply the application footprint and enable data transfer to happen at a higher total rate. You pay for these extra instances only as long as they are running.
  - **Clock Hours of Server Time.** Resources incur charges when they are running. For example, from the time Amazon EC2 instances are launched until they are terminated, or from the time Elastic IPs are allocated until the time they are de-allocated.
  - **Machine Configuration.** Consider the physical capacity of the Amazon EC2 instance you choose. Instance characteristics vary with OS, number of cores, memory, and local storage.
  - **Machine Purchase Type.** With On-Demand Instances, you pay for compute capacity by the hour with no required minimum commitments. Reserved Instances give you the option to make a low, one-time payment for each instance you want to reserve and in turn receive a significant discount on the hourly usage charge for that instance. With Spot Instances, you can bid for unused Amazon EC2 capacity.
  - **Number of Instances.** You can provision multiple instances of your Amazon EC2 and Amazon EBS resources to handle peak loads.
- **Storage**
  - **Provisioned Storage.** There is no additional charge for backup storage of up to 100% of your provisioned database storage for an active DB Instance. After the DB Instance is terminated, backup storage is billed per gigabyte per month.
  - **Additional Storage.** The amount of backup storage in addition to the provisioned storage amount is billed per gigabyte per month.
  - **Requests.** The number of input and output requests to the database.



- **Deployment Type.** You can deploy your DB instance to a single Availability Zone (analogous to a data center) or multiple Availability Zones. Storage and I/O charges vary, depending on the number of Availability Zones you deploy to.
- **Data Transfer.** Inbound data transfer is free, and outbound data transfer costs are tiered.
- **License Included**
  - **Oracle Database 11g.** AWS currently supports Oracle Database 11g Standard Edition One for the “License Included” service model. With this service model, you do not need to separately purchase Oracle licenses. AWS also supports Oracle Database 11g Enterprise Edition, Standard Edition, Standard Edition One for the Bring Your Own License (“BYOL”) service model.
  - **Data Transfer.** The amount of data transferred out of the Amazon S3 region.





Per Instance Options 	Compute 	Storage 	RDS 
<ul style="list-style-type: none"> <li>• Free Tier</li> <li>• On-Demand</li> <li>• Reserved                             <ul style="list-style-type: none"> <li>– All Upfront</li> <li>– Partial Upfront</li> <li>– No Upfront</li> </ul> </li> <li>• Volume discounts</li> </ul>	<ul style="list-style-type: none"> <li>• Clock hours of server Time</li> <li>• Machine Type</li> <li>• Purchase Type</li> <li>• Number of Instances</li> </ul>	<ul style="list-style-type: none"> <li>• Storage Class</li> <li>• Storage</li> <li>• Requests: Put and Get</li> <li>• Data Transfer</li> </ul>	<ul style="list-style-type: none"> <li>• On-Demand</li> <li>• Reserved                             <ul style="list-style-type: none"> <li>– Small</li> <li>– Medium</li> <li>– Large</li> <li>– Extra Large</li> </ul> </li> <li>• Data Transfer</li> </ul>
Save 42-75% with Reserved Pricing	Additional Cost: EBS, LB, EIPs, Auto-scaling, Monitoring	Storage Class: Standard and Reduced Redundancy	Standard or Multi-Availability Zone Deployment

Figure 86: AWS Purchasing Options

**AWS Compute Purchasing Options**

- **On-Demand:**
  - Pay as a you go model
  - Monthly billing
- **Spot Instances:**
  - Bid on spare Amazon EC2 instances and run them whenever your bid exceeds the current Spot Price, which varies in real-time based on supply and demand.
  - Suitable for on/off workloads
- **Reserved Instances:**

Spot instances allow customers to bid for capacity in AWS DC by giving maximum price bids. If customer’s bid exceeds the current Spot Price, his request is fulfilled, and his instances will run until either he chooses to terminate them or the Spot Price increases above his maximum price (whichever is sooner). Thus, there is a risk that AWS takes the instances back anytime they want by increasing the Spot price – which is a concern for majority of workloads, including dev & test.

  - Reserved Instances let you make a low, one-time, upfront payment for an instance, reserve it for a one or three-year term, and pay a significantly lower hourly rate for that instance.
  - Commitment for 1 year or 3-year. This is most common model that Enterprise customers consider to get discount from AWS. Only for AWS Compute.
  - Instance price lock for the period of reservation.

- At the time of the reservation, customer needs to specify:
  - Region in which reservation instance will be running
  - Number & Type of instance (Size and OS)
  - Payment method – All Up Front, Partial Upfront , No Upfront
  - Term of the commitment
- Range of discount depends on payment method & term of commitment. All upfront with 3 years means higher discount.
- Customer is billed for every hour during the entire Reserved Instance term that they select, regardless of whether the instance is running or not.
- Reserved Instance (RI) model is very rigid:
  - Offer only discount for EC2 compute. Lock customer to a particular AWS region and instance price for RI term. If AWS do any price drop they will not get any advantage.
  - If customer sign up for Windows RI, they won't be able to change the size of their reserved instance during their reservation term. If Linux instance, they will be able to change the size in a way that does not change their overall reservation commit. For example if they initially sign up for medium, they have to get 2 smalls.
  - Customer cannot change instance family type for example if they initially sign up for compute intensive instance, they cannot change those instances to high memory.
  - Customer cannot change the OS type as well.
  - Customer pay hourly rate irrespective of their actual usage. That means their effective rate depends on utilization and incase of underutilization it will be high than the contracted price.
  - If customer usage increases beyond reservation contract, they will have to pay regular consumption price for additional instance unless they sign new reservation contract.
  - Customer cannot cancel their reservation contract, upfront fee is non-refundable.
  - Given how fast the innovation is happening on the hardware side, 3 year commitment model also mean they are locking themselves in a particular hardware configuration that could easily become obsolete in future.

### Reserved Instance

Reservation Type	Upfront Fee	Hourly Usage Fee	Minimum Usage Level
Light	Yes	Yes	None <small>If the instance is not used during the hour, there is no charge.</small>
Medium	Yes	Yes	None <small>If the instance is not used during the hour, there is no charge.</small>
Heavy	Yes	Yes	Yes <small>Billed a full month's worth of hours at the start of each month.</small>

Reservation allow to reserve instances types in particular region for 1 or 3 year

Two part Pricing Model – Non-refundable upfront fee and monthly usage

Effective usage rate depends on utilization

**Figure 87: AWS Reserved Instance**

Reserved Instances % Savings Over On-Demand Instances m3.Large – Linux Total Cost of a 1 Yr/3 Yr RI in US East (Virginia)				
	No Upfront	Partial Upfront	All Upfront	On-Demand
1-Year	\$876.00	\$767.12	\$751.00	\$1,226.40
3-Year		\$1,461.40	\$1,373.00	\$3,679.20
Savings 1-Year	29%	37%	39%	
Savings 3-Year		60%	63%	

Prices shown for US East Region as of July 20, 2014

Figure 88: Savings comparison of 1 and 3-year reserved instances over on-demand instances

- **Dedicated Instances:**
  - Provides hardware isolation so that customers can be sure that no other company is running on the same physical host. Targets customers who have regulatory or restrictions that require physical isolation.
- **Enterprise Agreement (EA):**
  - Typically a zero dollar contract i.e. customer is not required to make any minimum purchase.
  - Customer negotiates EA to get better T&C, customer can negotiate both substance and language but AWS will not change the underlying meaning.
  - Customer can request invoicing and consolidate billing.
  - SLA's are standardized and are not negotiable.
  - Customers typically negotiate Breach notification period, privacy policy, giving AWS an ability to use customer as a reference, 60 day notice to change and update the AWS services, liability limits, IP indemnification clause.
  - Discounts are usually negotiated separately from Enterprise Agreement and mostly annually.

**Likely next actions**

Expect AWS to continuously bring in new services and reduce prices. Specifically, their focus is in the following areas:

- Storage applications
- Big Data, Analytics, research services, Data mining – cloud gives an infrastructure and cost structure not available before for running these applications
- Disaster Recovery services
- Mobile apps

**Pricing**

All the AWS services are not monetized equally. In the future, AWS will try to move its existing customers up the stack from EC2 to higher level services, so they can monetize better.

For Government deals, AWS has an offering called AWS GovCloud(US)<sup>11</sup>. The company has recently won over IBM on a CIA deal. To assist educators around the world in providing cloud computing instruction, AWS offers Teaching Grants supporting free usage of AWS for students in eligible courses. The grants provide educators up to \$100 USD in free usage for each student enrolled in courses with Amazon Web Services as part of the curriculum. Each students' \$100 credit will be good for up to 1 year from the time AWS confirms the grant award or until the usage credits have been fully utilized in the 1 year course grant time frame.

Only one grant can be awarded to an individual educator per course, but an individual educator may apply for up to two courses running concurrently. Teaching Grants will enable usage of AWS infrastructure services for coursework and student projects.

The most commonly used AWS pricing models are<sup>10</sup>:

- **Pay As You Go (PAYG)**

On-demand (PAYG) model where consumption is metered, and each consumption meter has a price. AWS offers, pay as you go model, that is you only pay what you use.

Let's take an example to understand this:

Suppose you are using say 10GB of space on AWS infrastructure, now usually what happens is, you estimate your usage say 40GB, reserve it, and pay for that 40GB monthly. But what if you are not using the whole 40GB. Like in our example, you just have 10GB of data, so if you are using AWS, you just pay for that 10GB, and you can always store more as your requirements grow, there is no restriction.

- **Pay less by using more:** AWS bills you for the hour. The more AWS resources you use, the less the hourly rates become.

- **Reserved Instances** (pay less when you reserve)

Reserved Instances (RI) pricing model where the customer pre-pays for capacity and receives discounted pricing in return. Reservations pricing model is available for a variety of AWS services including AWS Elastic Compute Cloud (EC2, i.e. virtual machines), Amazon Relational Database Service (RDS), Amazon Redshift, Amazon Elastic MapReduce (EMR), AWS ElasticCache, and AWS CloudFront. On EC2, AWS provides Standard 1 and 3-year options, as well as a Convertible 3-year option.

RI provides AWS customers with significant discounts (up to 75%) on compute, in exchange for a one or three-year commitment to a specific instance in a specific region.

- Discounts range from 25% to 75% depending on duration and payment terms.
- Customers can pay:
  - Full upfront (you pay the whole amount when you are reserving the instance, and the pricing is least in this case, since you are paying the full payment),
  - Partially upfront (you pay a partial amount when you are reserving the instance, the costs in this model are lesser as compared to No upfront, but is still more expensive than full upfront),
  - or No upfront-monthly (you don't pay anything before you reserve the instance, but since there is no advance payment, the costs are higher than the other two options).
- Customer get highest level of discount with all upfront and three-year term.
- Most attributes of a Reserved Instance cannot be changed after purchase.
- Locks Customers into a price (even if retail rates fall).
- Customers pay for the instance regardless of whether they use the instance or not.

AWS also offers a variety of services for **no additional charge**:

- **Amazon VPC:** Amazon Virtual Private Cloud (Amazon VPC) lets customers provision a logically isolated section of the AWS Cloud where they can launch AWS resources in a virtual network that they define.
- **AWS Elastic Beanstalk:** AWS Elastic Beanstalk is an even easier way for customers to quickly deploy and manage applications in the AWS cloud.

- **AWS CloudFormation:** AWS CloudFormation gives developers and systems administrators an easy way to create a collection of related AWS resources and provision them in an orderly and predictable fashion.
- **AWS Identity and Access Management (IAM):** AWS IAM controls customer's users' access to AWS services and resources.
- **Auto Scaling:** Auto Scaling automatically adds or removes Amazon Elastic Compute Cloud (EC2) instances according to conditions customers define. With Auto Scaling, the number of Amazon EC2 instances customers are using increases seamlessly during demand spikes to maintain performance, and decreases automatically during demand lulls to minimize costs.
- **AWS OpsWorks:** AWS OpsWorks is an application management service that makes it easy to deploy and operate applications of all shapes and sizes.
- **Consolidated Billing:** Gives customers the option to consolidate all the accounts they are using and get tiering benefits.

### Pricing Calculators

AWS offers two types of calculators for customers to foresee what will be their expenses:

- **AWS Calculator**

AWS Calculator is used to calculate customers' monthly expenses, it can be used to foresee, what will be their expenditure if they use a certain set of resources, it also provides them with templates to appraise complete solutions.

- **TCO Calculator**

TCO (Total Cost of Ownership) Calculator is used to compare one service's price to another, or one infrastructure solution to the other, it matches customer's current infrastructure to the most cost efficient AWS offerings.

### AWS Free Tier

AWS Free tier is offered by AWS to their customers so that they can get a hands-on on AWS services, so that they would know what they will be paying for.

The free tier from AWS offer two kinds of free service:

- **Introductory:**

The **Introductory free tier** is given to all AWS customers on their SignUp, and it is valid for 12 months from the day they register on AWS.

The following are the services and their features that are included in the free tier:

- **Amazon EC2<sup>4</sup>**
  - It offers 750 hours of free Windows or Linux t2.micro instance usage per month.
  - So customers can either run 1 instance for 750 hours for one month or two instances for half a month.
- **Amazon S3**

- It offers 5GB of standard storage on S3
  - 20,000 Get requests
  - 2,000 Put requests
- **Amazon RDS**
    - 750 hours of free db.t2.micro instance
    - 20 GB of DB storage: any combination of SSD or Magnetic
    - 20GB of backups with RDS Magnetic storage
    - 10,000,000 IOs
  - **Amazon CloudFront**
    - 50GB Data Transfer Out,
    - 2,000,000 HTTP and HTTPS requests of CloudFront.
  - **Data Transfer**
    - 15GB of data transfer out aggregated out of all AWS services.
- **Non-Expiring:**

The **non-expiring free tier** does not expire even after 12 months, and includes the following services:

- **AWS Lambda**
  - 1,000,000 free requests per month
  - 3.2 million seconds of computing time per month
- **AWS KMS**
  - 20,000 free requests per month
- **Amazon SES**
  - 62,000 outbound messages per month to any recipient when you call Amazon SES.
  - 1000 inbound messages per month.
- **Amazon CloudWatch**
  - 10 Amazon CloudWatch custom metrics, 1,000,000 API requests.
  - 5GB of log data ingestion.
  - 5GB of log data Archive.
  - 3 Dashboards with up to 50 metrics each per month.
- **DynamoDB**
  - 25GB of storage
  - 25 Units of read capacity and 25 units write capacity

### **Fundamental Pricing Characteristics**

There are three fundamental characteristics you pay for with AWS: **compute, storage, and data transfer out**. These characteristics vary slightly depending on the AWS product customers are using. However, fundamentally these are the core characteristics that have the greatest impact on cost.

Although customers are charged for data transfer out, there is no charge for inbound data transfer or for data transfer between other Amazon Web Services within the same region. The outbound data transfer is aggregated across Amazon EC2, Amazon S3, Amazon

RDS, Amazon SimpleDB, Amazon SQS, Amazon SNS, and Amazon VPC and then charged at the outbound data transfer rate. This charge appears on the monthly statement as AWS Data Transfer Out.

### Pricing characteristics of the four most common used AWS products

- **Amazon EC2**

Amazon EC2 changes the economics of computing by charging customers only for capacity that they actually use.

When you begin to estimate the cost of using Amazon EC2, you need to consider the following:

- **Clock Hours of Server Time** – Resources incur charges when they are running. For example, from the time Amazon EC2 instances are launched until they are terminated, or from the time Elastic IPs are allocated until the time they are de-allocated.
- **Machine Configuration** – Instance pricing varies with the AWS region, OS, number of cores, and memory of the physical capacity of the Amazon EC2 instance customers choose.
- **Machine Purchase Type** – With On-Demand Instances, customers pay for compute capacity by the hour with no required minimum commitments. Reserved Instances give customers the option to make a low one-time payment – or no payment at all – for each instance they want to reserve and in turn receive a significant discount on the hourly usage charge for that instance. With Spot Instances, customers can bid for unused Amazon EC2 capacity.
- **Number of Instances** – Customers can provision multiple instances of your Amazon EC2 and Amazon EBS resources to handle peak loads.
- **Load Balancing** – An Elastic Load Balancer can be used to distribute traffic among Amazon EC2 instances. The number of hours the Elastic Load Balancer runs and the amount of data it processes contribute to the monthly cost.
- **Detailed Monitoring** – Customers can use Amazon CloudWatch to monitor their EC2 instances. By default, basic monitoring is enabled (and available at no additional cost); however, for a fixed monthly rate, customers can opt for detailed monitoring, which includes seven preselected metrics recorded once a minute. Partial months are charged on an hourly pro rate basis, at a per instance-hour rate.
- **Auto Scaling** – Auto Scaling automatically adjusts the number of Amazon EC2 instances in customers' deployments according to conditions they define. This service is available at no additional charge beyond Amazon CloudWatch fees.
- **Elastic IP Addresses** – Customers can have one Elastic IP (EIP) address associated with a running instance at no charge.
- **Operating Systems and Software Packages** – Operating System prices are included in the instance prices.
- There are no additional licensing costs to run the following commercial operating systems: Red Hat Enterprise Linux, SUSE Enterprise Linux, Windows Server, Oracle Enterprise Linux. Additionally, AWS has partnered with vendors like Microsoft and IBM so as to give the ability to customers to run commercial software packages on their Amazon EC2 instances. For commercial software packages that Amazon does not provide, such as nonstandard operating systems, customers need to obtain the license from the respective vendors. Customers can also bring their existing licenses to

the cloud through specific vendor programs such as Microsoft License Mobility through Software Assurance.

### **Partners**

AWS partners are categorized into 2 categories – technology partners and consulting partners. Technology Partners include Independent Software Vendors (ISVs), SaaS, PaaS, developer tools, management and security vendors. Consulting Partners include System Integrators (SIs), strategic consultancies, resellers, agencies, and VARs. Currently, there are around 600 partners listed in each category. The entire list is available [here](#). AWS launched a partner network, APN in April 2012 and has over 4000 registered members till date. AWS also has a channel reseller program that was expanded in June 2012. AWS offers a marketplace for partners and includes various partner solutions in the following categories - software infrastructure (341), developer tools (100), and business software (312).

APN is a brand new program, and will take some time to deliver, but AWS is likely to leverage their market leading position to recruit and grow partners through the partner ecosystem of other vendors. APN offers training and enablement, sales resources, and joint partner marketing.

### **Customer Scenarios**

- Scenarios vary among source, but a common refrain for using AWS is “scalability”:
  - Typical for Web sites/apps with influxes of traffic, visits
  - Unique or new projects without known usage requirements
- Customers choose AWS as part of a new project, avoiding internal IT and overtaxed datacenter
- Replacing (or circumventing) data centers is a frequent scenario

#### Key Buying Criteria

- Customer mentioning price, scaling, speed, and agility as core criteria
- Ease of translating workloads to AWS
- IT labor can manage servers in AWS just as easy as (or easier than) on prem
- General outsourcing of IT costs
- Startups and growth companies don't want to worry about managing data centers.

### **Competitive Situation**

#### **AWS strengths vs. Microsoft**

- Early Mover Advantage:
  - Leader in IaaS
  - Rapid Innovation
  - Direct/ Self Service Model
- Broad set of features and APIs for every service.
- Dominant<sup>109</sup> market share in the public cloud market, with extremely high penetration within startups and early adopters, making them the incumbent to own the public cloud space.
- Ability to constantly introduce new features and services at an accelerated pace and widen the feature gap even further.
- Large-scale capacity and its efficient use leading to continuous price cuts; perception of lowest cost provider.
- Broad ecosystem of ISVs and service catalog options.



- Industry certifications and compliance accreditations.
- Pricing flexibility for customers.
- Global platform reach with a single, consistent user interface.
- Low margin, high volume business

#### **AWS weaknesses vs. Microsoft**

- Lack of on-premises assets or integration capabilities with on-premise assets.
- Enterprise management- System Center is a major differentiator. AWS has its own console, but it doesn't include integration with other services and specifically with private cloud implementations.
- Windows Azure offers a flexible app model with integration of IaaS and PaaS capabilities than AWS. AWS depends on partners to fulfill PaaS scenarios.
- SQL/BI: Microsoft has a huge footprint with BI on-premises and SQL DB leads both Amazon RDS and DynamoDB in capabilities (Forrester Cloud DB wave, Nov 2012).
- Cloud Integrated Storage: Microsoft leads in this category; CIS is a top AWS sales scenario.
- Microsoft has a bigger sales force, better account relationships, and broader partner ecosystem than AWS.
- Microsoft overcomes AWS on – support for hybrid IT, Cloud OS product features like Windows Azure flexible app model (IaaS and PaaS), cloud integrated storage, mobile services, and data platform (SQL/BI), and AWS' lack of enterprise grade SLAs. For the last point, Microsoft can position itself as a more trusted advisor in the enterprise space than AWS. Additionally, Microsoft Azure and Cloud OS is considered to be the best platform for running Windows apps. The reasoning behind these areas:
  - Reconciling on-premises infrastructure with cloud services requires a hybrid architectural approach. Organizations are primarily using AWS to augment existing on-premises infrastructure; there remains little sign of organizations embracing AWS services to decommission existing legacy systems. Enabling a hybrid architectural approach to leverage existing, consistent services and policies across internal services and public cloud services is quickly emerging as a primary challenge given almost all organizations' lack of skills and experience in this area. AWS doesn't really offer any hybrid solution and depends on partners to fill this gap. Microsoft is considered to offer the best hybrid solution in the industry today.
  - Even for existing AWS customers, cost isn't the primary driver for adopting public cloud services. For NASA, speed of provisioning was the biggest benefit. For Netflix, the key was avoiding vertical-scale single point of failure infrastructure. For others, it was some combination of scalability, performance, and availability. The flexible app model of Windows Azure gives customers better capabilities in some of these areas like scalability (With AWS, you have to manually design auto-scaling rules, Windows Azure platform takes care of it for PaaS apps).
  - AWS lacks enterprise grade SLAs and transparency in their operations. Most of the enterprises aren't running mission critical workloads on AWS yet, as AWS doesn't take any financial liability for any downtime. Moreover, AWS' architecture and operational procedures are not known to customers, so they cannot prevent or avoid potential issues like the recent outages with AWS Elastic Block Store (EBS). Having knowledge about the AWS architecture might have helped many Elastic Compute Cloud (EC2) customers work around the problem or even potentially detect it and act preemptively.

AWS weakness	Description	What it means to customers	Microsoft strength
Lack of private cloud support & on-premises IT assets	Other than limited 3 <sup>rd</sup> party integration, AWS lacks private cloud support or on-premises IT assets. AWS recently announced partnership with a startup called Eucalyptus to provide a private cloud environment compatible with AWS APIs. In reality, AWS is just providing the Eucalyptus license to their API and some technical support.	AWS and Eucalyptus are not working jointly to innovate the private cloud offering or to build new technology that offers compatibility of broader AWS services with Eucalyptus. Eucalyptus does not run on Windows or support Hyper-V.	Microsoft delivers a truly hybrid platform across on-premises, Azure, and service provider clouds that enable customers to build and deploy apps across these environments with common skills and technologies. Microsoft customers have the flexibility to maintain a consistent platform with integrated virtualization to move workloads between environments without change.
Customer lock-in	AWS locks customers into a proprietary AMI format, making it difficult to move virtual machines on-premises.	Amazon doesn't have any of their own development tools, instead relying on 3 <sup>rd</sup> -party offerings. If customers choose to go to AWS, they are in effect locking themselves into a proprietary ecosystem.	Microsoft Azure (IaaS) supports the standard VHD format enabling the moving of virtual machines "as-is" back and forth between on-premises and the Cloud or a 3 <sup>rd</sup> -party hoster. Companies get a consistent experience across their on-premises datacenters, Microsoft Azure, and/or service provider's datacenter. Customers can use large ecosystem of Microsoft partners and developers.
Enterprise novices	The majority of AWS customers are startups and developers. AWS is just starting to focus on the enterprise and most of their experience is at the business unit level.	Architectural visibility and language frustrates traditional enterprise IT buyers. Transformation to the Cloud can be risky. AWS is still learning how to sell to enterprises. Their enterprise sales teams are not available in every state in the U.S.	Microsoft has significant enterprise experience and expertise and a platform designed for mission critical workloads, whether from Microsoft, Oracle, or others. Microsoft has a bigger sales force, better account relationships, and a broader partner ecosystem than AWS.
Poor support for Microsoft workloads	Because AWS uses a proprietary format, Microsoft workloads are not fully supported.	A proprietary format means that Microsoft workloads are not tested on AWS and receive best-effort support. Customers won't get 1 <sup>st</sup> rate support on issues on AWS.	Common engineering criteria used by Microsoft teams ensures that Azure is the best platform for running Microsoft workloads. Microsoft has a greater advantage with its workloads, where its platform, tools, and support are all designed to ensure seamless interoperability.
No Oracle support	Oracle doesn't support AWS' virtualization engine and assumes no reliability/responsibility for data stored in S3.	What happens to customers who have existing licenses to run Oracle software? With AWS, they would require additional licenses from other vendors. Customers won't get 1 <sup>st</sup> rate support on issues on Oracle on AWS.	Microsoft and Oracle provide best in class, end to end, support for customers running mission-critical Oracle software on Microsoft Azure and Windows Server Hyper-V.
No PaaS solution	Amazon lacks a comparable PaaS solution to complement its IaaS solution; RDS for SQL Server lacks features such as data-	AWS is primarily an IaaS service that depends on partners to fulfill PaaS scenarios. This limits the flexibility of customers and necessitates them to continue to do the same as before (manage	Microsoft Azure offers a comprehensive IaaS & PaaS platform. With IaaS, customers can immediately move apps "as is" to Azure and gain full control over the app environment. As a PaaS, the underlying OS and system management

	sync, multi-AZ deployment for SQL Server, and read replica.	the infrastructure).	tasks are automated, enabling developers to focus on apps. This leads to faster on-boarding to the public cloud and lets customer quickly develop apps while using the platform's richness (scalability, tools, services).
No unified management solution	AWS lacks unified enterprise management between on-premises and the AWS cloud. Partner offerings are limited.	Amazon is relying on a variety of 3 <sup>rd</sup> party partners to provide a singular view of on-premises and cloud deployments. AWS has its own console, but it doesn't include integration with other services and specifically with private cloud implementations.	System Center provides a "single pane of glass" for unified management of on-premises environments and public clouds (Azure & service providers), enabling enterprises to deploy, monitor, and manage apps and infrastructure without the need of 3 <sup>rd</sup> party tools or services.
Rigid pricing	AWS billing is not as flexible as it is by the hour.	The effective rate you pay is dependent on your utilization. When making a reservation, you need to specify exact instance type, instance size, and datacenter location. Your usage has to match these exact dimensions to get the reserved instance pricing. Once reserved, the rate is locked for 1-3 years, despite price drops on on-demand instances.	Microsoft Azure provides by-the-minute rather than hourly billing, saving money when developing and testing applications. There are no charges for stopped virtual machines and users can easily export virtual machines in their test environment back to on-premises for production. MSDN subscribers also get additional monetary benefits.
Lack of SLAs	AWS has carefully worded guarantees and a lack of available SLAs for some services.	AWS EC2 provides SLAs for multiple instances only.	Microsoft Azure provides single instance SLA of 99.9% (in addition to SLA of 99.95% for multiple instances).

**Table 8: AWS weaknesses VS Microsoft strengths**

**Microsoft's Differentiated Value Proposition**

- 1. Hybrid Cloud platform and platform consistency with a single management tool:** Microsoft provides a truly hybrid cloud platform with a common set of technologies and capabilities across on-premises, Microsoft Azure, and Service Provider clouds with a consistent experience across clouds. Azure Stack enables customers to deliver Azure services from their own datacenters. Azure integration into System Center for management and Microsoft Operations Management Suite (OMS) offers a single tool to manage on-premises and cloud platforms.
- 2. Comprehensive Identity and Access management:** Active Directory (AD) is used by thousands of enterprises of all sizes. Unlike AWS's identity service focused only on its own cloud, Azure AD provides a comprehensive identity and access management cloud solution to help control access to thousands of Microsoft and non-Microsoft applications in the public cloud.
- 3. Hyperscale footprint and enterprise grade compliance and SLA:** Microsoft brings more than 20 years of experience and expertise in serving the enterprise market. Microsoft Azure has the largest global footprint in the industry with 32 regions available and eight announced. Azure has 38 compliance certifications and offers 45 financially backed service level agreements (SLAs) across all generally available (GA) services, while AWS offers SLAs for only a few key services.
- 4. Infrastructure as a service (IaaS) + platform as a service (PaaS):** Microsoft Azure offers a comprehensive IaaS + PaaS platform. For example, customers can use SQL Server alongside SQL Database in the same application. Customers can "lift and

shift" existing applications with IaaS or leverage advanced app development capabilities of PaaS. Amazon does not have a comparable PaaS solution to complement its IaaS solution; RDS for SQL Server lacks features such as data-sync, multi-AZ deployment for SQL Server, and read replica.

5. **Leader in the six Gartner's Cloud Magic Quadrants:** Microsoft is considered by Gartner (June 2016) as a leader in the six following Cloud Magic Quadrants: Cloud IaaS, Enterprise Application PaaS, Public Cloud Storage, x86 Server Virtualization, Identity and Access Management Services, and Disaster Recovery as a Service. AWS is a leader in just two of them, Salesforce.com and Google are leaders in one.
6. **Disaster recovery transparency:** AWS does not provide transparency around its architecture for availability and Disaster Recovery for the AWS control plane and higher-level services.
7. **Global geographic footprint:** AWS offers 11 regions including two for the AWS GovCloud (US) region while Azure offers 19 regions, including two regions dedicated for government cloud.
1. **Self-service templating:** Azure offers self-service templating for deployment of stacks of infrastructure. Azure hosts a templating community for customers to share and distribute templates.
2. **Price and billing options:** Existing Enterprise Agreement (EA) customers will benefit by including Azure into their agreements. Azure ExpressRoute is less expensive than AWS Direct Connect.
3. **Expandable storage:** Azure supports expandable block storage volumes to increase the size of a volume, while AWS does not.

#### Win / Loss Insights

##### When & Why Microsoft Wins:

- Hybrid scenarios where customers see the value in bridging their on-premises infrastructure to the cloud.
- Strong account relationship (Warner Bros., PostNL, and iGATE).
- Narrowly targeting specific workloads where Microsoft wins and unified product support (The Hartford [SQL Test & Dev], Cummins Inc, and Burberry [Storage]).
- Heavily invest BIF (Fidelity Investments).
- Tell the compelling Cloud Platform story—on-premises and off-premises (Warner Bros.).

##### When & Why Microsoft Loses:

##### Product Issues:

- Lack product capabilities. Cannot provide capabilities that customers want now, yet AWS offers these capabilities.
  - Certified support from Red Hat Linux on Microsoft Azure.
  - Long-Term Storage Archival solution (like AWS Glacier).
  - Lack of big compute and high memory instances.
  - Multiple networking issues like forced tunneling, multisite, and Static IP.
  - Inability to bring Public IP address ranges to Microsoft Azure virtual network.
- Field inability to communicate future product capabilities. Customers would like to know when the company plans to bridge the gaps, and Microsoft cannot share anything with customers.
- Lack of customer evidences and data points for why Microsoft workloads like SharePoint on Microsoft Azure are better compared to AWS.

##### Sales Issues:

- Late entry or execution issues due to limited technical resources to accelerate deal

velocity and to create a positive cloud experience for customers.

- Lack of a business decision maker (BDM) relationship. Microsoft sellers are challenged in engaging BDMs and lack the understanding of vertical solutions. Whereas, AWS is penetrating through BUIT or agencies and influencing the deals via BU.

**Vertical/Industry Solution Issues:**

Limited ecosystem of vertical ISV applications and a product capability gap to target the vertical scenario specifically in media and entertainment, health and life sciences (big compute and ISV apps for genome analytics), and oil and gas (long-term archival solution and HPC).

**Partner Issues:**

Leading partners like Wipro have the practice on AWS. Even though Microsoft has a relationship with them at a global level, their local account team favor AWS (Philips, Shell, and Asurion).

**Other Issues:**

- Positive perception for AWS and early AWS engagement to define the customers' cloud vision and strategy (Old Castle, PepsiCo, Hess, Sysco, and Premera). Microsoft Azure has limited air cover to drive demand and mindshare.
- Difficult for customers to find technical information on how to deploy the Microsoft Azure solution easily (Nokia Siemens Networks GmbH, and WebMD).
- The field is challenged to address customer security concerns effectively (Booz Hamilton, Kellogg, and KPMG).
- Customers not willing to renew because they did not consume what was procured (deployment challenges).

**Pricing**

Amazon does not have an installed base to protect and has significant balance sheet assets that allows them to consider forward pricing strategies. Amazon has shown willingness to subsidize businesses for a period of time that would be difficult for Microsoft to emulate (e.g. free trial period AWS one year vs Azure 30 days). AWS can be summarized as inexpensive, highly automated, programmatically accessible (components that can be consumed via Web services, in a programmatic way), and no contractual commitment. Customers do not need to buy on Enterprise Agreements (EAs) but if they do, they obtain better terms and conditions than those of the click-through online agreement and can get 15-20% discount when committed to a minimum amount. AWS does very little to cater specifically to SMBs and/or specific industries.

VM Type	AWS instance	Azure instance	AWS specs (cores/RAM)	Azure specs (cores/RAM)	Linux pricing			Windows pricing		
					AWS	Azure	% Azure premium	AWS	Azure	% Azure premium
General Purpose Instances (Current Gen)	m3.medium	Standard D1	1/3.75	1/3.5	\$0.067	\$0.067	0.0%	\$0.130	\$0.130	0.0%
	m3.large	Standard D2	2/7.5	2/7	\$0.133	\$0.134	0.8%	\$0.259	\$0.260	0.4%
	m3.xlarge	Standard D3	4/15	4/14	\$0.266	\$0.268	0.8%	\$0.518	\$0.520	0.4%
	m3.2xlarge	Standard D4	8/26	8/28	\$0.532	\$0.536	0.8%	\$1.036	\$1.040	0.4%

- 1 Must ensure that the right instances are being compared between providers
- 2 Not all providers have the same machine configurations, and differing core/RAM counts directly impact costs and pricing
- 3 Ensure OS requirements are identified and being compared
- 4 Ensure the right purchase models are being compared. AWS has PAYG, SPOT, 1yr and 3yr Reservation

Figure 89: AWS pricing vs Azure pricing

**Partners**

The table below shows the requirements for APN partners as well as the benefits they get from the program. We also compare the APN benefits to the gives/gets for the Azure circle partners.

	Gives	Gets
<b>Azure Circle Managed</b>	<ul style="list-style-type: none"> <li>A completed PSP in the tool</li> <li>Revenue &gt;\$1K per Q</li> <li>All opportunities registered via PSX/ GSX</li> <li>Readiness –training in Windows Azure:                             <ul style="list-style-type: none"> <li>1 seller</li> <li>2 developers</li> <li>1 architect</li> </ul> </li> </ul>	Eligibility for: <ul style="list-style-type: none"> <li>Windows Azure Incentive (SIP)</li> <li>POC BIF</li> <li>DPS Vouchers</li> <li>Discovery Pack</li> <li>Free Dev. &amp;Test Resource (Azure Pass)</li> <li>Training for Developer, Architect and Sellers</li> <li>NDA roadmap briefings</li> </ul>
<b>Azure Circle Platinum</b>	<ul style="list-style-type: none"> <li>All base Azure Circle "gives" with these differences:</li> <li>Revenue: Commitment to drive significant Azure revenue                             <ul style="list-style-type: none"> <li>\$150K National SI</li> <li>\$500K Alliance SI</li> </ul> </li> <li>Readiness: &gt; 3 architects trained</li> </ul>	Same as above plus <ul style="list-style-type: none"> <li>SI dedicated Architect training classes</li> <li>Technical and marketing support for developing repeatable solutions on Windows Azure</li> <li>MS Architect support for complex bid development</li> <li>Access to supplemental funds for POC development and marketing events</li> </ul>
<b>APN Consulting Partner - Standard</b>	<ul style="list-style-type: none"> <li>Revenue &gt;\$1,000/month</li> <li>Online trained – 2 sales, 2 technical</li> <li>Bronze or higher Premium Support</li> <li>\$2000 per year program fee</li> <li>2 public or private customer references</li> </ul>	<ul style="list-style-type: none"> <li>Partner webinars, events and newsletters</li> <li>\$1,000 in AWS Services credits</li> <li>\$1,000 in AWS Premium Support credits</li> <li>Logo designation as "Standard" partner</li> <li>"Standard" listing in the new AWS Partner Directory</li> </ul>
<b>APN Consulting Partner - Advanced</b>	<ul style="list-style-type: none"> <li>Revenue &gt;\$10,000/month</li> <li>Online trained – 5 sales, 5 technical</li> <li>Gold or higher Premium Support</li> <li>2000 per year program fee</li> <li>4 public or private customer references</li> </ul>	Same as above with following changes: <ul style="list-style-type: none"> <li>Logo designation as "Advanced" partner</li> <li>"Advanced" listing in the new AWS Partner Directory</li> </ul>



Figure 90: Comparison of Windows Azure Circle partners and APN partners requirements and benefits

**Mapping between Microsoft Azure and AWS**

Category	Azure	AWS
Infrastructure as a Service	Virtual Machine	Elastic Cloud Compute (EC2)
Object Storage	Azure Blobs (object Blobs)	Simple Storage Service (S3)

Hybrid Storage	StorSimple	Storage Gateway
IPsec Tunnel and virtual private networking	Virtual Network	Virtual Private Cloud (VPC)
Dedicated private network fiber connection from on-premises	Express Route	Direct Connect
Deploy and scale web apps in seconds	Azure App Service ( Web App )	Elastic Beanstalk
Media Services	Media Services	Elastic Transcoder
content delivery network	Azure CDN	CloudFront
Relational Database as a service	SQL Database ( Support SQL Server RDMBS)	Relation Database Service (RDS) (Support MySQL, SQL Server, Oracle, Postgre, MariaDB & Amazon Aurora RDBMS)
Data Warehousing Service	SQL Data Warehouse	RedShift
Integration with on-premises AD	Azure AD	AWS Directory Service
Single Sign on cloud and on-premises web app	Azure Active Directory	
Out of Box Single Sign on for Cloud based SaaS applications like SalesForce.com, BoX, office 365	Azure Active Directory	-
Management Tool	Operations Management Suite	-
Monitoring	Management Service & APIs , SCOM Pack, Azure Diagnostics	CloudWatch, plug-in for System Center
Deployment	Automation , Power Shell , Resource Manager, cross-plat CLI, Microsoft Azure Markup Language and third party such as Chef, Puppet etc. , automatic for Cloud Services	OpsWork, Cloud Formation , CodeDeploy, ElasticBean Stalk

**Table 9: Mapping Azure with AWS per category**

Capability	 Microsoft Azure	 amazon web services™
Compute	Virtual Machines, Worker role, Web role w/elevated privileges, Web role	Elastic Compute Cloud (EC2)
Hosting (lightweight web apps)	Web Sites	Web Sites
Database	SQL Database (formerly SQL Azure)	Amazon RDS, Amazon Redshift (DW Solution)
Big Data	HDInsight	Elastic Map Reduce
Blob storage	Microsoft Azure Blobs	Simple Storage Service (S3)
Table storage	Microsoft Azure Tables	SimpleDB, DynamoDB
Storage – Drives	Microsoft Azure Drives	Elastic Block Storage

App Deployment	Automatically handled	Amazon Elastic Beanstalk, CloudFormation, OpsWorks
Storage – Archive	StorSimple, Blob Storage	Glacier
Hybrid Storage	StorSimple	N/A
Messaging	Microsoft Azure Service Bus, Queues	AWS SNS, SQS
Networking	Virtual Network, Connect, Traffic Manager, Azure DNS	Direct Connect, VPC, Elastic Load Balancer, Route 53
Caching Service	Azure Managed & In-Memory Cache	AWS ElasticCache
Content Delivery	Azure Content Delivery Network (CDN)	AWS Cloud Front
Management	Management Portal, Power Shell, System Center 2012	AWS Management Console
Monitoring	Diagnostics & Service, Management APIs, SCOM Pack	CloudWatch, Alarm
Authentication & Authorization	Windows Live, Accounts and Subscription, Federation Future, Azure Active Directory	Identity & Access Management (IAM), Multi-Factor Authentication (MFA)
Development Tools	Toolkit for Eclipse and Visual Studio	Toolkit for Eclipse and Visual Studio
Supported Libraries and SDKs	.NET, PHP, Java, node.js, Python	Java, .NET, PHP, Ruby, Python
Industry Specific	Azure Media Services, Mobile Services	AWS GovCloud , Elastic Transcoder
Desktop Virtualization	N/A	WorkSpaces

**Table 10: Compare Azure with AWS per capability**

Category	AWS	Azure
IaaS	IaaS consisting primarily of S3 and EC2 was among the earlier offering by AWS. It now evolved to include 15+ services in the areas of storage, compute, deployment, management and security. Even though it offers Windows Server VMs, AWS IaaS is mainly focused on Linux.	Even though AWS had a head start, Azure has now almost caught up. Azure’s IaaS portfolio is as vast as that of AWS. Traditionally very strong in Windows-based offering, now Azure offers Linux VMs. Azure is the primary choice for enterprise customers looking for continuity.
PaaS	AWS came a little late to PaaS, after focusing exclusively on IaaS during the early years. AWS PaaS services include Elastic Beanstalk, Lambda and Amazon Container Services. Amazon support for .Net technologies is still spotty. In same case Amazon has tried to lock in customers with proprietary technologies even when open-source alternatives exist (EC2 container service).	Azure started as a PaaS leader and has cemented its leadership position with innovative services such as Azure Service Fabric and Azure Container Services. Azure has complemented these services with a strong development offering (Azure Tools for Visual Studio). While continuing to support .Net, Azure now supports most leading open-source technologies and frameworks.



Data Platform & Advanced Analytics	Amazon’s offerings in the database space consists of a mix hosted SQL databases (MySQL, SQL Server, Oracle), hosted Hadoop (AWS EMR), home grown NoSQL database (DynamoDB) and a home-grown relational data warehouse (RedShift). AWS is very weak in the Advanced Analytic space – its services lack functionality and maturity.	Azure’s data platform consists of the leading relational database (SQL Azure), big data analytics platform (HDInsight) and data warehouse (Azure SQL Data Warehouse). It also includes innovative offering like DocumentDB, ADLS and ADLA. Azure is very strong in advanced analytics space with Azure Machine Learning and PowerBi.
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**Table 11: Compare Azure with AWS per category**

Services		Azure	amazon web services™
Virtual Machines	Instance variety	18 (Basic, Standard, Compute, Network)*	23 (High Mem, Compute, GPM) + 14 previous gen**
	Support for Microsoft workloads	Direct, Microsoft Support	Best Effort
	Durability of OS and data disk	Durable, Geo-replicated storage	Available within Availability Zone
	VM portability	No conversion required for Hyper-V VHDs	Conversion required to AMIs
	SLA	99.95%	99.95%
Virtual Network	Capabilities	Standard VPN, Secure IPv4 Subnet	VPC across AZ, Dedicated Connection and Instances
	Availability	SLA -99.9%	No SLA
Storage	Capabilities	Geo-replication, StorSimple, Reliable Architecture	Server Side Encryption, Versioning support, Glacier
	Availability	SLA -99.9%	SLA -99.9%
Database	Capabilities	Relational database service, NoSQL database as a service, Database analytics, in-memory cache	Relational database service, PredictiveAnalytics
	Availability	99.95%	99.9%
Service Availability Regions		13	8

\* Note: Azure G-series announced on Oct 20, 2014 will increase this number

\*\*Note: Previous generation instances available and supported, incl. M1, T1, C1, H1, M2, CR1

**Figure 91: IaaS Services comparison (Azure vs. AWS)**

**EU Model Clauses and DPA**

Amazon’s EU Model Clauses and DPA are validated by the Article 29 Working Party. It took a year for Amazon to match Microsoft on this validation. Their DPA is available on an opt-in basis. It excludes customers who buy via resellers.

**Data Retention – Deletion**

Amazon commits to retain data for 30 days after the subscription expires. It is not apparent that Amazon offers a commitment regarding data deletion.

### **Sub-contractors**

Amazon's DPA is not publicly available; however, since such DPA has obtained validation from the Article 29 Working Party, we assume the following:

- Amazon provides a list of subcontractors.
- Amazon provides prior notice of the appointment of a new subcontractor (although we don't know how many days in advance such notice shall be provided).
- Amazon provides customer's right to exit the agreement due to a new subcontractor.

### **Data Location**

Amazon's commitment has the following exceptions:

- When Amazon notifies the customer about moving customer's data.
- When Amazon needs to move customer's data to comply with the law or requests of government entities.
- When Amazon is moving "Service Attributes" (service usage data related to your account), Amazon can move such data to the US region.

### **Customer Waiver of IP Rights**

Amazon continues to limit customers' ability to assert rights against Amazon. Amazon is the only CSP that restricts customer's rights to (i) assert its IP as a condition of using the services, and to (ii) pursue its claim as part of a class action or to request a trial by jury.

### **SLAs**

Amazon's SLA provides the same availability (99.90% - 99.95%) and the same range of credits as Microsoft's (10% - 25%) (except for AWS EC2: up to 30% // MS Azure: up to 25%). However, Microsoft provides SLA's for all of Azure workloads, whereas Amazon only does for a few services (including Simple Storage Service – S3, CloudFront, and Elastic Compute Cloud – EC2). Also, Microsoft calculates the availability differently. In Amazon, every single Virtual Machine ("VM") has to be down in order for downtime to kick in for EC2, and every volume has to be down for downtime to kick in for EBS. In Microsoft, Azure's VM SLA starts counting downtime when any single instance goes down (as long as that VM is part of an Availability Set).

### **Suspension from Service**

Amazon does not contractually commit to provide notice before suspending the online service for a violation of their AUP. Also, Amazon may suspend the service upon notice for any breach of the contract.

### **Audits**

Amazon commits to annual audits but not to provide full audit reports (only summary audit reports).

### **Security Standards**

Amazon has stated that it complies with ISO 27018; however, Amazon still does not contractually commit to comply with it.

**Security Incidents**

Amazon’s commitments with respect to data breaches are very similar to Microsoft’s; however, Amazon does not commit to provide detailed information to the customer of the security incident.

**Limitation of Liability**

While Amazon’s terms provide for a 12-month cap it also excludes all damages which appears to make Amazon’s liability zero.

**Use of Customer Data**

Amazon’s commitments in this matter are essentially equivalent to Microsoft’s. Also, Amazon has stated that it complies with ISO 27018; however, Amazon still does not contractually commit to comply with it.

**Law Enforcement Request for Data**

Amazon’s commitments on this issue are essentially equivalent to Microsoft’s. However, Amazon requires the customer to absorb the costs associated with providing the information.

**Compliance with Laws**

Amazon’s commitments on this issue are essentially equivalent to Microsoft’s.

	Azure	amazon web services™
ISO 27001	✓	✓
SOC 1/SSAE 16/ISAE 3402 (formerly SAS70)	✓	✓
SOC 2	✓	✓
SOC 3*	NA	✓
PCI DSS Level 1	✓	✓
CSA CCM	✓	✓
FedRAMP/FISMA	✓	✓
ITAR		✓
DIACAP		✓
HIPAA	✓	✓
Safe Harbor Certified	✓	✓
UK G-Cloud OFFICIAL	✓	
EU Model Clauses	✓	
FIPS 140-2	✓	✓
FERPA	✓	
MPAA		✓

\*The SOC 3 report is a summary of SOC 2. Azure provides the full SOC 2 report to customers under NDA.

**Figure 92: Compliance/ Certifications Comparison between Azure & AWS**

**Changes to Terms**

Amazon’s commitments on this issue are essentially equivalent to Microsoft’s.

**Changes to Services**

Amazon commits to notify customers of any material change to or discontinuation of the service offerings (with no stated timeframe for notification). However, if Amazon changes, discontinues or deprecates any APIs for the services, then it will use commercially reasonable efforts to continue supporting the previous version of any API changed, discontinued, or deprecated for 12 months after the change, discontinuation, or deprecation (except if doing so (a) would pose a security or intellectual property issue, (b) is economically or technically burdensome, or (c) is needed to comply with the law or requests of governmental entities).

**Amazon Assessment**

Differentiators	Advantages	Disadvantages
<ul style="list-style-type: none"> <li>Amazon is all about the public cloud first and foremost. It has called private cloud “false cloud”. If a company is of similar mindset this can be advantageous and help drive change<sup>24</sup>.</li> <li>Amazon got it right (in terms of demand) out of the gate with IaaS and data/storage services and is leading the marketplace still after several years.</li> </ul>	<ul style="list-style-type: none"> <li>Amazon started in the cloud and didn’t have to transition services and offerings to the cloud.</li> <li>Amazon was the earliest to market with IaaS and data storage enabling them to control more of the market than its competitors.</li> <li>Amazon is viewed as the market leader in the public cloud (especially in IaaS) today.</li> </ul>	<ul style="list-style-type: none"> <li>Amazon is struggling with customer support and customer relationships.</li> <li>Amazon has no significant SaaS or PaaS offerings and services that enable it to compete at the level Google and Microsoft are.</li> <li>Amazon’s hybrid story is weak.</li> </ul>

Table 12: Amazon Assessment

**VMWare**

**Overview**

VMware’s roots are in traditional server virtualization, yet the company is currently focused on changing perceptions. Its goal is to be viewed as a serious player in the cloud and remain a preferred vendor for enterprise IT. VMware’s strategy focuses on the following three key areas:

- The Software Defined Data Center (SDDC)
- Hybrid Cloud Infrastructure and Management
- End-user Computing

VMware enjoys tremendous IT implementer/pro loyalty, and with its high margins, solution partners could build extremely profitable VMware practices during the last decade. Through new products and partnerships, VMware is now trying to compete with Microsoft in the broader IT infrastructure market. The company seeks to increase its market share with existing customers through new offers while further entrenching its legacy data center solutions.

## VMware Agreement Types

VMware's menu of license agreements is relatively straightforward. Below is a brief overview of VMware's 3 key license agreements, starting from the bottom with little customer spend/seats, and ending with the complex, enterprise-caliber agreement.

### Volume Purchasing Program (VPP)

The Volume Purchasing Program (VPP) offers entry-level customers significant, incremental discounts for purchasing a minimum of \$25K in eligible VMware products. Customers enroll in VPP, accumulate points with each purchase, and receive rewards.

Each VMware product is assigned a specific VPP point value, with 1 point equating to roughly \$100 USD, or the equivalent in local currency. For example, vSphere Enterprise Plus is worth 35 VPP points regardless of the country or currency the product was purchased.

**VPP Policies and Discounts** – VMware has established four discount levels that range from 4-12% for qualifying orders, based on the end customer's accumulated VPP point total. The discounts may be applied to License purchases, and do not apply for Service and Support.

- For most products, 1 VPP point = ~\$100
- The point value of a given product is the same across all geographies
- The point dollar ratio may vary over time by SKU
- Points are valid for up to 2 years, after which they roll-off

### VPP Benefits:

- **Budget Predictability:** VPP offers customers the ability to better plan their budgets since discounts are guaranteed for at least 2 years.
- **No Commitments:** VPP members have no obligation after making the initial qualifying purchase.
- **Rewards for Customer Loyalty:** VPP rewards customer loyalty by allowing points from purchases to accumulate over time.
- **Account Visibility:** VPP tools provide visibility through easy-to-use online account management tools.
- **Simplified Program Rules:** VPP offers parity through simplified program rules and common global entry thresholds and discounts.
- **"Family-Friendly" Rules:** "Family-Friendly" program rules allow related subsidiaries/legal entities to pool purchases and earn higher family discounts.

### Enterprise Purchasing Program (EPP)

The Enterprise Purchasing Program (EPP) is a token-based program that provides customers with an alternative beyond the Volume Purchasing Program (VPP).

EPP is designed for mid-level customers, offering both better discounts and greater flexibility, without the complexity of more robust agreements. EPP is restricted to region-based customers, not global customers. EPP grants access to future upgrades, ensuring customers can obtain the "latest and greatest" VMware products.

EPP is a token-based licensing program, meaning customers purchase "tokens" to allocate toward usage of a VMware product. EPP token details include:

- Minimum purchase order of 2,500 tokens (\$250K, 1 token = \$100).

- Tokens can be redeemed any time for additional License purchases or Services and Support.
- Upon token redemption, license keys are immediately delivered to customer.
- Customers can add a minimum of \$50K in tokens (500 tokens) to an active contract at any time.
- Tokens can be distributed to different departments for added flexibility.
- Tokens expire after 3 years.

### Enterprise License Agreement (ELA)

The Enterprise License Agreement (ELA) is the ideal contractual agreement designed specifically for global customers. It offers attractive financial and operational benefits unavailable in the per-product, transactional agreements between VPP and EPP. ELA lets customers obtain VMware product licenses over a fixed period of time with a fixed price through its lifecycle, as well as a fixed renewal fee.

ELA is the best route to mitigating global license compliance issues; VMware uses a dedicated auditing team to research their customer's license compliance.

Unlike the VPP and EPP, the terms of the ELA are entirely dependent on the needs of the customer. Recently dropped from a minimum of \$650K, minimum enrollment in the ELA now starts at \$250K but can be negotiated with a dedicated partner at as low as \$150K. But again – ELA is more dependent on a needs-basis rather than a minimum purchase order.

Benefits of ELA:

- Discounted licenses, support, and training throughout the ELA term
- Single volume license keys to simplify deployment
- Fixed pricing and renewal fee with pre-defined cost on future maintenance
- No true-up due at the end of the term that may impact renewal pricing
- Global Deployment Rights
- Global Consolidation of Multiple Enterprise Agreements for ease of management



Figure 93: Overview of VMware's 3 key license agreements

Moreover, customers could also choose one of the following programs/ buying options:

- **Subscription Purchasing Program (SPP)**, which provides the flexibility to purchase VMware subscription services for anywhere between 1 month to 3 years. Moving away from volume, perpetual purchases, the Subscription Purchasing Program (SPP) is a vehicle for acquiring VMware hosted subscription services. A purchase of SPP Credits creates a Fund that can be redeemed for services that include VMware vCloud Air and VMware Horizon Air. SPP terms can range from 1 month to 3 years. The below chart is a simplified depiction of these agreement terms. Consider the below challenges commonly resolved by SPP:
  - IT department needing speed in internal procurement to meet unpredictable or urgent needs.
  - IT wishes to try VMware cloud services with an On-Demand model.
  - Existing budget that will expire, and has yet to identify the services mix needed over the next 12 months.
  - Searching for ways to efficiently manage multiple VMware subscriptions across multiple departments.
  - You need the flexibility of adjusting a subscription solution deployment strategy based on anticipated or unanticipated changing business conditions.

	Paid Monthly	Paid Annually	Prepaid
1 Month Term	Monthly	NA	NA
3 Month Term	Monthly	NA	One-Time, Upfront
12 Month Term	Monthly	Annual	One-Time, Upfront
24 Month Term	Monthly	Annual	One-Time, Upfront
36 Month Term	Monthly	Annual	One-Time, Upfront

Figure 94: SPP Terms

- **Cloud Credits Purchasing Program (CCPP)**, which is designed for customers who want to add public/hybrid cloud to their IT strategy. CCPP is ideal for VMware Solution Provider Partners and customers who want to improve business agility while reducing IT capital expenditures on new equipment. Customers purchase Cloud Credits from their VMware Solution Provider Partner and allocate those credits towards specific Infrastructure as a Services (IaaS) demands as they see fit, including:
  - Compute
  - Storage
  - Networking
  - Operating System
  - Support for shared infrastructure

Customers are considering enrolling in CCPP if they:

- Have deployed VMware solutions and have an interest in extending those solutions to public/hybrid cloud scenarios.
- Have security concerns and would like better control over individual business units.
- Want to observe and report public and hybrid cloud business usage.

### Strategy

VMware Sales Approach—Drive Customers to Enterprise License Agreements (ELAs)

- Deal value must exceed US\$250,000 to qualify, and licenses deployed are valid perpetual licenses.
- Unlimited ELA permits the customer to deploy unlimited quantities of a product, or group of products, for a fixed period of time. Limited ELAs exist but are not as popular. ELA terms are typically two to three years.
- VMware sells automation with licensing implications that customers do not understand or know about. In addition, VMware does not “disclose” all licensing requirements.
- The ELA renewal price is fixed and determined at inception.
- When the ELA period ends, the customer can no longer legally deploy net new licenses and their licenses are no longer covered by Support and Subscription.
- VMware has recently adopted a “will not lose on price” approach to counter competitors price advantage and has discounted ELA pricing heavily to win deals or renew existing ELAs.

### Products

- **ESX:** A hypervisor that can run directly on server hardware without the need for an operating system in between.
- **vCenter Operations Management Suite.** A system operation suite offering unified management, visibility on infrastructure, operating system, app efficiency and policy-based automation.
- **vSphere (ESXi):** A server virtualization solution that bundles vCenter and ESX together and that enables virtual machine creation.
- **vCloud Suite:** vSphere (ESXi hypervisor)–based private cloud infrastructure software that includes virtualized compute, networking, storage, and integrated management tools. A build and run, vSphere-based, private cloud with policy-driven operations, automated provisioning, and automated operations management.
- **vRealize Suite:** Hybrid cloud management tools that capitalize on policy and automation.
- **vCloud Air:** Infrastructure service for customers to extend their on-premises environments to VMware and third-party–owned data centers. Also includes integration with third-party platform services.
- **Airwatch:** Enterprise mobility solution primarily focused on device and application management.
- **NSX:** Network virtualization product targeted at enterprise data centers. It aims at helping enterprises more easily manage their datacenter network<sup>148</sup>.
- **vSAN:** Hypervisor-converged storage, also a part of VMware’s EVO offerings. Storage virtualization aimed at creating a virtual layer of storage that’s easy to manage<sup>148</sup>.



- **vCloud Hybrid Service (vCHS).** A cloud service that extends the (virtualized) datacenter into the cloud, using the same management tools and portals for datacenters operated by VMware or third parties. It's an appealing choice to customers who are standardized on VMware technologies and management tools.
- **EVO:RAIL:** Hyper-converged virtual appliance available through select hardware partnerships.
- **Integrated OpenStack:** Fully supported OpenStack distribution for vSphere-based infrastructure.

### Positioning and Messaging

- Apps at business speed:  
Enterprises can deploy apps in minutes or even seconds with policy-driven provisioning that dynamically matches resources to continually changing workloads and business demands.
- A datacenter on customers' terms:  
The VMware platform extends the benefits of compute virtualization across the infrastructure, including storage and network, whether on-premises or a hybrid or public cloud.
- Business-aware IT control:  
Every app gets the right availability, security, and compliance with automated business continuity, policy-based governance, and virtualization-aware security & compliance.

### Pricing

The nice thing about vCloud Air pricing is that it doesn't include any hidden charges. It's very apparent what costs are subscription based, as opposed to usage-based or one-time charges. This is especially relevant when speaking about bandwidth. You get a base amount of 10/50Mbps and you can expand this to 1/10Gbps with a direct connection. And from there you don't pay for outbound (or egress) data charges. This is important because outbound data volumes are sometimes hard to predict. Other cloud vendors are often vague about egress data transfer charges and often base them on poorly understood metrics, such as API calls like 'GETS'. Say there is a traffic spike that hits your cloud systems, such as if you suffer a DDoS attack that hammers your website. With other cloud charging models you will be penalised with high outbound data costs.

Included services are often another cause of confusion. vCloud Air includes services you would typically pay for elsewhere – such as Firewalls, Load Balancers, and High Availability Redundancy. These items are included at no extra charge whereas in other clouds you would have to pay for these either as subscription services, such as an ELB, or with additional virtual machines to host these services.

Finally, with regard to making accurate cost comparisons it is important to note the components that are often overlooked. For on-premises solutions these overlooked costs often include ones associated with maintaining infrastructure, expanding and upgrading infrastructure, upgrading applications, and mobilising to perform disaster recovery testing. For other cloud solutions, what is often overlooked are the additional components and tools needed for monitoring cloud availability, application performance, brokering cloud services and billing reconciliation.

### vCloud Air Pricing Calculator

The vCloud Air Pricing Calculators below are available to help you estimate your costs of using various vCloud Air services. Configure the type of service and features you're looking for and get pricing information quickly.

vCloud Air offers many solution including Virtual Private Cloud, Dedicated Cloud and Disaster Recovery.

**Pricing Calculator**

Welcome to the vCloud Air Pricing Calculator. Configure the type of service and features you're looking for and get pricing information quickly. This tool is for pricing purposes only and does not provision any resources, nor does it sign you up for any services.

Need help making a decision? [Contact Sales](#)

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**Choose Your Desired Service**

**Virtual Private Cloud**

Logically isolated, multi-tenant compute platform, including storage and networking.

**Disaster Recovery**

Business continuity protection for your on-premises clouds.

**Dedicated Cloud**

Physically isolated compute platform, including storage and networking.

**Choose Core Subscription Options**

CURRENCY: USD (dropdown)

DATA CENTER REGION: US - Santa Clara (dropdown)

SUBSCRIPTION TERMS: 1 month (dropdown)

STORAGE:  Standard Storage  SSD Accelerated Storage

**Base Configuration**

<b>COMPUTE</b> 10 GHz vCPU 20 GB vRAM	<b>STORAGE</b> 2 TB of Standard Storage	<b>NETWORK</b> 10 Mbps of Bandwidth 2 Public IP Addresses	<b>SUPPORT</b> 24-7 Support Subscription Included
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**Subscription Summary**

10 GHz vCPU / 20 GB vRAM	\$642
2 TB of Standard Storage	\$120
10 Mbps of Bandwidth	\$229
2 Public IP Addresses	\$50
24-7 Support Subscription Included (Tied to Compute)	\$128
<b>Base Price</b>	<b>\$1,169 / month</b>

**Choose Optional Add-Ons**

**Your Estimated Total**

Pricing: Per Hour | Per Month

**\$1,169 / month**

Figure 95: vCloud Air Pricing calculator

### Competitive Situation

There are 3 prominent competitors in the server virtualization space: VMware, Microsoft, and Citrix (Xen). Companies such as Oracle, AWS, and Red Hat provide offerings as well, but have relatively little share. Of the major players, VMware owns the overwhelming majority of the virtual server market as well as the majority of existing installed virtualized workloads, although Microsoft has been making incremental gains due to lower price points and enhanced offerings in Windows Server 2012 R2.

VMware is re-positioning itself to aggressively compete with Microsoft in the broader IT infrastructure market and increase wallet share with existing customers. The centerpiece of

their strategy is to become the “Software Defined Data Center” (SDDC) company of the future. SDDC includes compute virtualization, storage virtualization, network virtualization, and automation tools that can be used in a private, hybrid, or public clouds. VMware is complementing SDDC with a Hybrid Cloud strategy (in competition with Windows Server and Microsoft Azure) that promotes a choice of deployment options and end user tools that focus on expanding into desktop virtualization and mobile device management (in competition with Microsoft System Center).

## VMware vs. Microsoft

### VMware Strengths vs. Microsoft

- A strong portfolio of advanced datacenter and cloud management tools within the vCloud suite.
- A Hybrid cloud strategy where engagement with hosting service providers could provide a network of global public cloud options for VMware customers.
- A strong relationship with high-level technical decision makers (CIOs, IT decision makers and IT implementers) as well as a reputation for product leadership and innovation among IT pros.
- The 2012/2013 SDDC campaign garnered a lot of press attention as well as brand recognition among the IT community.
- Dominant market share in the hypervisor market; extremely high penetration within large enterprises.
- A reputation for being the standard in virtualization.
- First mover entrenchment leads to high switching costs for existing customers to migrate to new virtualization platforms.

### Microsoft's Differentiated Value Proposition

1. **Complete Cloud story:** Microsoft offers a true hybrid platform and consistent experience across three clouds (on-premises, Microsoft Azure public cloud, and a hosting service provider) or any combination of clouds. The customer chooses their cloud roadmap and Microsoft supports them with a consistent platform and experience.
2. **Lower total cost of ownership (TCO):** Microsoft goes beyond simple virtualization with Windows Server and Systems Center. This allows customers to take advantage of advanced features such as virtualized networking, storage, automation, and management without having to buy additional functionality. Because there's no need for expensive add-ons, businesses get a lower TCO and licensing than VMware. The table shown at picture below is intent to explain customers how expensive acquiring VMware products can be.

From the Microsoft side, it's clear that choosing Windows Server + System Center + Azure provides all the features that customers need in terms of Compute, Storage, Network and BCDR (Backup and Disaster Recovery).

VMware on the other hand has different licensing models for its products:

- **Compute:** In order to get a compute infrastructure, customers will need to acquire vSphere and vCenter.
- **Storage:** The new Software-defined storage solution from VMware is vSan, which is sold separately from vCenter and vSphere<sup>149</sup>.
- **Network:** The new Software-defined networking solution from VMware is NSX<sup>147</sup>, which is sold separately from vCenter and vSphere.

- BCDR: vCloud is VMware’s public cloud solution and vCloud Air Disaster Recovery is VMware’s offer to BCDR.

Information	Hosts	Procs per Host	Total Procs
Host configuration	5	4	20

Component	Microsoft	VMware
Windows Server Guest	\$61,550.00	\$61,550.00
Compute	Included	\$102,720.00
Storage	Included	\$49,900.00
Network	Included	\$139,900.00
System Center/vCenter	\$36,070.00	\$5,995.00
On Prem BCDR	Included	Included
Public Cloud BCDR	\$2,700.00	\$38,500.00
<b>Total</b>	<b>\$100,320.00</b>	<b>\$398,565.00</b>

Software	Unit Price	Information found at
Windows Server Datacenter	\$6,155.00	<a href="http://download.microsoft.com/download/f/3/9/f39124f7-0177-463c-8a08-582463f96c9d/Windows_Server_2012_R2_Licensing_Datasheet.pdf">http://download.microsoft.com/download/f/3/9/f39124f7-0177-463c-8a08-582463f96c9d/Windows_Server_2012_R2_Licensing_Datasheet.pdf</a>
System Center Datacenter (L+SA 2yr)	\$3,607.00	<a href="http://download.microsoft.com/download/b/4/a/b4a98a4e-2f43-489d-8761-5362c8c2c328/System_Center_2012_R2_Licensing_Datasheet.pdf">http://download.microsoft.com/download/b/4/a/b4a98a4e-2f43-489d-8761-5362c8c2c328/System_Center_2012_R2_Licensing_Datasheet.pdf</a>
vSphere w/ OpsMgr Ent+ (1yr Basic support)	\$5,136.00	<a href="http://www.vmware.com/products/vsphere/pricing.html">http://www.vmware.com/products/vsphere/pricing.html</a>
vSan	\$2,495.00	<a href="https://blogs.vmware.com/virtualblocks/2015/06/21/vmware-vsan-vs-nutanix-head-to-head-pricing-comparison-why-pay-more/">https://blogs.vmware.com/virtualblocks/2015/06/21/vmware-vsan-vs-nutanix-head-to-head-pricing-comparison-why-pay-more/</a>
NSX Enterprise	\$6,995.00	<a href="http://www.theregister.co.uk/2016/05/04/vmware_hikes_nsx_price_adds_cheaper_versions/">http://www.theregister.co.uk/2016/05/04/vmware_hikes_nsx_price_adds_cheaper_versions/</a>
Azure Site Recovery (50 VMs)	\$2,700.00	<a href="https://azure.microsoft.com/en-us/pricing/calculator/">https://azure.microsoft.com/en-us/pricing/calculator/</a>
vCloud Air Disaster Recovery (50 VMs)	\$38,500.00	<a href="http://vcloud.vmware.com/service-offering/pricing-guide">http://vcloud.vmware.com/service-offering/pricing-guide</a>

More Info: <http://www.vmware.com/products/nsx/compare.html> <http://www.vmware.com/products/virtual-san/compare.html> \*Assuming virtual machines with 2GHz CPU and 4 GB RAM with total 1 TB storage

Figure 96: Total cost of ownership Microsoft vs. VMware (<http://datacenter-tco-tool.azurewebsites.net/home>)

3. **Comprehensive platform:** Windows Server integrates many features including the operating system, virtualization/hypervisor, networking, storage, and identity to form a comprehensive platform and offers all these features out of the box while VMware either charges for additional functionality or has to rely on third parties.
4. **More mature Cloud offering:** VMware’s cloud experience is largely limited to the world of virtualization. They don’t have the experience or longevity Microsoft has in the Cloud, and lack comprehensive cloud offerings such as platform as a service (PaaS) or software as a service (SaaS) options. This means when customers standardize on their solutions it is more work.
5. **Extensible and comprehensive management platform:** System Center provides much faster “Mean Time To Resolution” than VMware by providing in-depth management that is extensible through Physical, Virtual, OS, Application level but also Public and Private cloud in a single-pane-of-glass. Only System Center provides a comprehensive cloud management suite that includes Infrastructure provisioning, infrastructure monitoring, automation and self-service, application performance monitoring and IT service management.
6. **Business Continuity and Disaster Recovery:** Windows Server 2016 delivers great new capabilities around Software-defined Datacenter for Compute, Storage and Networking. Along with System Center and OMS, Microsoft delivers a complete set of technologies for the datacenter from platform to management. In the public cloud, Azure also allows companies to extend their datacenter and provides mechanisms to use Microsoft global presence in a Disaster Recovery scenario.  
On the other hand, VMware fails to provide a simple solution for a complete Software-defined datacenter. Its products are bundled in to suites, which many times end up in a situation where customers are buying what they don’t need in order to have

features they didn't ask for. In addition to that, Compute, storage and Networking sell separately, and while this may be a good approach for customers refreshing storage, for instance, Windows Server provides everything customers need in a single SKU. For public cloud disaster recovery solution, VMware offers vCloud Air Disaster Recovery, which has a good appeal for VMware customers, but since VMware is not investing in vCloud Air, new customers are likely to consider other solutions that provide a richer set of features, such as Azure Site Recovery.

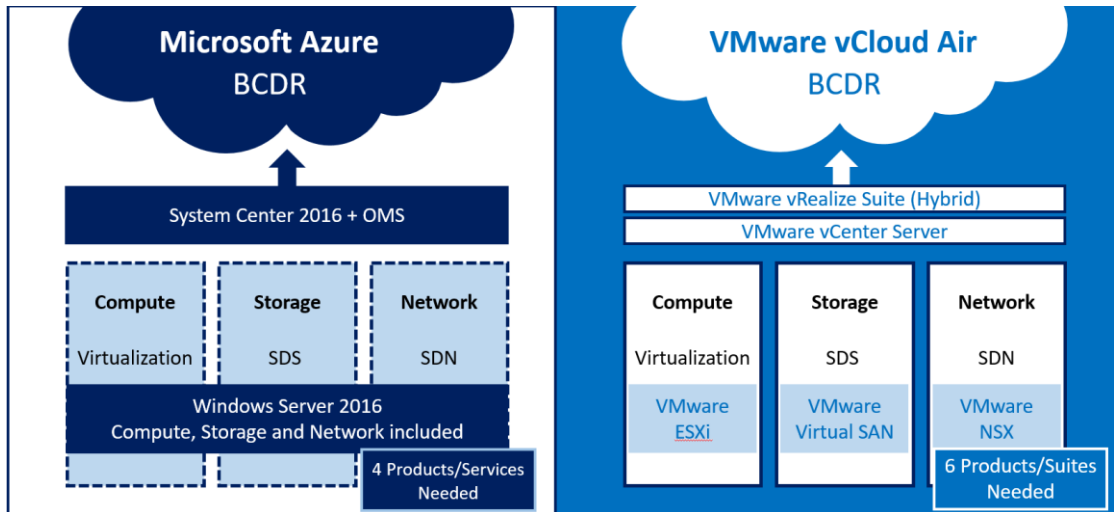


Figure 97: Azure vs VMware BCDR

**Competitor claims**

VMware says	Microsoft says
Virtualizing Microsoft with VMware vSphere enables the best of both worlds— optimizing compute resources while maintaining application flexibility.	Virtualizing Microsoft workloads on vSphere creates complicated support models. Microsoft teams use common engineering criteria to ensure that the Microsoft platform (Windows Server, System Center & Microsoft Azure) is the best platform for running Microsoft workloads.
SDDC's the ideal architecture for private, public, and hybrid clouds, extending virtualization to all datacenter resources.	With the Cloud OS, Microsoft delivers a true hybrid platform to extend from a customers' datacenters to service providers and Microsoft Azure public clouds. Whether in a private, public, or service provider cloud – customers receive a consistent set of tools for development, management, and identity across the entire infrastructure and the ability to easily virtualize, deploy, manage and automate their workloads.
VMware's branch office solution centrally manages OS Figures while ensuring employees have fast, secure access to the apps and data they need to maximize productivity.	Windows Server and System Center ensure excellent app service and reduce complexity and costs. VMware's branch office focus is limited to desktop virtualization with the Horizon Branch Office Desktop.

Figure 98: VMware vs Microsoft claims

**VMWare Assessment**

Differentiators	Advantages	Disadvantages
<ul style="list-style-type: none"> <li>• Significant private cloud customer base.</li> </ul>	<ul style="list-style-type: none"> <li>• Currently offer vCloud Air themselves.</li> <li>• Still has significant portion of Virtualization marketplace.                             <ul style="list-style-type: none"> <li>○ It provides IaaS based on vSphere in VMWare datacenters.</li> </ul> </li> <li>• Has a decent volume of specialists and experts in the marketplace.</li> </ul>	<ul style="list-style-type: none"> <li>• Initially encouraged hosters to offer IaaS with vCloud. This saw low uptake and interest.</li> <li>• VCloud Air isn't a complete public cloud platform                             <ul style="list-style-type: none"> <li>○ It's mostly VMs</li> <li>○ Customers can also buy some Google Cloud Platform services through vCloud Air e.g. blobs.</li> <li>○ VMWare has no significant SaaS, PaaS, or storage/data offerings and services.</li> </ul> </li> </ul>

**Table 13: VMWare Assessment**

**Oracle**

**Overview**

**Oracle** positions itself as a “one-stop shop” strategic IT vendor, offering a portfolio that spans apps to hardware, with database (DB), business intelligence (BI) and Cloud. Oracle's goal is to be the top enterprise technology vendor and to fully own the customer, from application down to platform. The company uses a “win at all costs” mindset, defined by the Larry Ellison cult of personality. Oracle is business-centric, avoiding an IT conversation where possible. It lavishes attention on the top 0.5-1 percent of customers (2,000–3,000 accounts), darkening the skies with a variety of account reps. Oracle uses its legacy of being a trusted mission-critical platform to give customers a perception of a high risk in migrating off the Oracle platform. Oracle pushes that appliance for everything—Exadata is the solution to all that ails customers, lead with industry or horizontal apps, BI, or middleware, and end up with Oracle hardware in the data center.

### Recent Trends

- In recent years, Oracle has been seen as behind its competition in adopting new technologies such as in-memory computing, big data analytics, and cloud integration.
- Synonymous with “relational database” for many years and still feeding off this legacy.
- While Oracle originally saw the cloud as a threat to its business, now it is moving aggressively to roll out a cloud strategy. However, Oracle’s cloud initiatives mostly consist of acquired technology with very little integration between them.
- Brash PR—make strong competitive claims, occasionally running afoul of regulatory bodies.

### Recent Trends

- In recent years, Oracle has been seen as behind its competition in adopting new technologies such as in-memory computing, Big Data analytics and Cloud integration.
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- Brash PR – make strong competitive claims, occasionally running afoul of regulatory bodies.

### Products

Oracle has built a broad product portfolio around its core database through acquisition, including Sun Microsystems, Siebel, JD Edwards, PeopleSoft, and BEA, allowing for wide cross-sell to its 380,000 customers.

#### Key Oracle Products

- **Oracle Database 12c (2013 release):** Oracle’s flagship product sold primarily through its high-end Enterprise Edition (EE), with add-on options such as Real Application Clusters (RAC), Advanced Compression, and Advanced Security. Strong “Tier 1” market perception reinforced through pervasive global advertising.
- **Maintenance and Support (M&S):** Annual fee of 22 percent of net license price (after discounts). M&S includes Oracle Premier Support, product upgrade rights, update rights, and bug fixes. More than 95 percent of customers choose to pay the M&S annuity given the packaged support offering and unavailability of bug fixes outside M&S. This accounts for a significant portion of Oracle revenue and profit.
- **Oracle Exadata Database Machine:** Oracle’s flagship integrated hardware/software (HW/SW) appliance, targeted at both data warehousing (DW) and online transaction processing (OLTP) workloads. Exadata runs on Sun x86 servers, Oracle Linux, or Solaris, and requires Oracle Database 11gR2 and RAC. Exadata is a central focus of Oracle’s GTM strategy. The newest version is X3-2, available in 1/8, 1/4, 1/2 and full rack versions. Every Oracle database seller carries a commitment to sell Exadata.
- **Oracle Database Appliance (ODA):** Smaller database DB appliance, not to be confused with Exadata, targeted at DB consolidation and OLTP for departmental and midmarket workloads.
- **Oracle Exalogic Elastic Cloud:** Oracle’s middleware and WebLogic application server appliance, positioned as a private cloud offering.

- **Oracle Exalytics In-Memory Machine:** Oracle's in-memory high-performance analytics and reporting appliance. Oracle launched a 1/8 rack Exalytics appliance to encourage customer adoption.
- **Oracle "Big Data" Appliance:** A big data offering packaging Cloudera Hadoop and Oracle NoSQL Database with Sun HW into an appliance form. Oracle launched a smaller version called Big Data Starter Rack to attract more customers.
- **Oracle BI Enterprise Edition (OBIEE):** Foundational Oracle BI product, including technology acquired from Hyperion, Essbase, and Siebel BI. Offers reporting, impromptu query, and dashboard capabilities. Oracle is the number three player in the BI market, after SAP (Business Objects) and IBM (Cognos).
- **Fusion Applications:** Oracle's next-generation, Java-based application suite, developed from the ground up to succeed and complement acquired applications (Siebel, JD Edwards, PeopleSoft), as well as Oracle's own E-Business Suite.
- **Oracle MySQL:** Open source database acquired along with Sun Microsystems.

### Strategy

- Company's goal is to be the top enterprise technology vendor and to fully own the customer, from application down to platform.
- "Win at all costs" mindset, defined by the Larry Ellison.
- Business centric – keep the conversation out of IT where possible.
- Lavish attention on top 0.5-1% of customers (2-3K accounts), darken the skies with a variety of account representatives.
- Utilizes their legacy of being a trusted mission critical platform to give customers a perception of a high risk in migration off the Oracle platform.
- Appliance for everything – Exadata is the solution to all that ails you, lead with industry or horizontal apps or BI or Middleware, end up with Oracle HW in your data center.

### Go-to-Market Approach

- Offer "best of breed" enterprise technologies in each layer of the IT stack.
- Vertically integrate technologies within the stack to maximize share of wallet in Enterprise IT.
- Deliver an industry wrapper to enable a business centric conversation and to establish relevancy/leadership.
- Separate product sales from consulting. The product sales team is technology focused with the consulting business providing vertical expertise.
- Require costly support programs with enterprise licenses.

### Positioning

- **Enterprise Data Quality:** A comprehensive platform that delivers consolidated, consistent and authoritative master data across the enterprise and distributes this master information to all operational and analytical applications.
- **Reduce IT Complexity:** Best-in-class systems combined with the software and expertise to transform existing environments into a truly optimized data centers by providing integrated, pretested solutions, key technologies built in throughout the stack, optimized storage and automated lifecycle management.



- **Business in the Cloud:** Unmatched breadth and depth of offerings for public, private, and hybrid cloud computing at every level of the technology stack with flexible and modern, and advanced capabilities including social and mobile technologies and built-in business insight.

#### Sales Tactics

- Customers remain committed to Oracle for three to five years and perceive incremental Oracle licenses as free from Oracle after paying the fixed annual license fee. This reduces the marginal cost of new server licenses to practically zero.
- For database agreements in the ULA, Oracle usually requires that all licenses at the end of the ULA period be converted to Enterprise Edition CPU-based licenses.
- Customers are typically required to pay Oracle maintenance and support even if they decide to exit the ULA at a later date, making the TCO end up considerably higher than original estimates.
- Oracle's primary tactic is keep customers from ending ULA, and customers are rarely able to negotiate smaller ULAs.
- Oracle is typically able to negotiate a higher license growth rate in its ULAs than is ever experienced by customers, which generally causes customers to overpay, often dramatically.
- Oracle will often give large product license discounts which are recouped through expensive support, maintenance and consulting over the customer's lifetime
- Oracle Key Accounts Program - relationships with its large and high-value customers.
- Strategic Customer Program & CIO Advisory Board - pair strategic customers with Oracle senior executives and provide access to other resources for sharing best practices and knowledge.
- Customers below the top tier still cite challenges and variations in account support, especially when trying to consolidate the Oracle products they use.

#### Licensing

- **Oracle Unlimited License Agreement (ULA):**
  - Structured on a deal-by-deal basis, whereby a customer pays for the right to use as many Oracle licenses as they want within a certain period of time (usually three years)—a negotiated list of Oracle products (Database, Middleware, Applications) will be covered.
  - It's an all-you-can-eat type site license. It was launched in the U.S. in 2007 and is continuing to grow rapidly worldwide.
  - Customers pay a substantial upfront license fee + maintenance and support.
  - No additional license payment required even if the number of licenses exceeds the estimated amount (no True-up).
- **Maintenance & Support:**
  - Maintenance and Support is a profitable business for Oracle, pricing at 22% of net licensing cost, with renewal rates greater than 95%, and a worldwide 90% gross margin. In many countries, it's mandatory with limited benefits.
  - Premier Support: Standard support included with license purchase.
  - Extended Support: Once Premier support expires, Extended Support provides three extra years of support for specific Oracle releases.
  - Sustaining Support: Once Extended support expires, Oracle offers support for all Oracle products as long as technical support is maintained.

## Competitive Situation

### Oracle Strengths vs. Microsoft

- Strong relationships with CIOs, IT decision makers and IT implementers.
- Known vendor, industry leading functionality.
- Leader in revenue share with extremely high penetration within large enterprise accounts.
- Customer perception of high switching costs for to migrate to new platforms.
- High ranking management air cover for sales engagements.
- Oracle continues to build out cloud portfolio and acquire cloud customers via acquisitions, e.g. Eloqua (Dec 2012 – \$871M), Acme Packet (Feb 2013 – \$2.1B)

### Oracle Weaknesses

- Fear of vendor lock-in among existing customers, many of whom are looking to try/ actively trying alternate vendors.
- Higher cost premium solution in a commoditizing market drives customers to seek lower TCO alternatives.
- Fewer out of the box features compared to SQL Server 2014.
- Unclear public cloud roadmap (IaaS or PaaS).

### Microsoft's Differentiated Value Proposition

1. **The world's most popular relational database management system (RDBMS):** Customers and analysts agree—SQL Server, not Oracle, is the market-leader for RDBMS platforms. In terms of deployment share, Microsoft has consistently earned its leadership position in a highly competitive market. Gartner represents Microsoft SQL Server as the leading RDBMS offering in their 2016 Magic Quadrant for Operational database management systems (DBMS). Customers continue to choose SQL Server for a variety of reasons, including industrial-strength security, ease of use, and lower total cost of ownership (TCO) for the most mission-critical Tier-1 deployments.
2. **All-inclusive platform with lower TCO:** Microsoft provides a comprehensive data management platform that complements and extends the capability of the core RDBMS, all through a singular, integrated product. Capabilities like compression, encryption, consolidation, analytics, Master Data Management, Extract, Transform and Load (ETL), and reporting are all included with SQL Server, while Oracle charges extra for each of those components. If a customer does not elect to include one of those “optional” capabilities in their latest contract with Oracle, adding those functions can have significant cost implications.
3. **Lead in security:** SQL Server continues to lead in lowest security patches across the major DBMS vendors (NIST) for six years running. Fewer vulnerabilities translates to less time spent patching servers and inherently more secure databases. Unlike Oracle, advanced security features like Transparent Data Encryption and Always Encrypted are included with SQL Server Enterprise without buying additional products.
4. **Enterprise-Ready Cloud:** Despite strong positioning in the press by their leadership, Oracle continues to lag behind Cloud market leaders like Microsoft. Their database as a service (DaaS) offerings are still in their infancy, and the balance of their Cloud

portfolio primarily supports only Oracle-centric applications. Oracle’s Cloud offerings are generally not flexible enough to accommodate varying architecture patterns that incorporate Hybrid Cloud—a key market differentiator for Microsoft. Microsoft continues to demonstrate thought leadership with offerings like the Azure Marketplace, Cortana Analytics, and Internet of Things (IoT) Suite—areas that Oracle simply cannot match.

- 5. Powerful and intuitive BI/big data:** Between PowerBI and Microsoft Office, Microsoft provides a market-leading BI platform that can run on any device against any backend (on-premises, cloud, hybrid). Oracle’s BI offerings continue to lag behind the market leaders because of a fractured product portfolio and they completely disappeared from Gartner BI Magic Quadrants in 2016.

## Google

### Overview – Google Apps

Google Apps<sup>61</sup> is less than 1% of Google's revenue and Google can subsidize Google Apps without facing financial hardship. The free edition for businesses with 10 or less employees was discontinued in Dec 2012. According to Gartner, some large enterprises are moving forward with buying Office licenses only for the employees that need it and having the rest of the employees use Google Apps. Google changed their compensation model for sales representatives to incent co-sales with partners. Co-sales fully count towards a direct salesperson’s quota and representatives are also evaluated on pipeline and lead generation. Google has a direct sales team of 500+ Full Time Employees (FTEs) in the US (45% Public Sector, 55% Private Sector) (Public Sector: 150-170 FTEs (80-90 FTEs focus on federal sales, 70-80 FTEs focus on education); Enterprise sales representatives: 60-75 FTEs; Mid-market: 60-75 FTEs; Small Business: 80-90 FTEs) (Source: Google Apps Sales Motion Competitive Analysis, Jan 2013 Kaiser Associates).

Google has 23 data centers including 4 planned facilities - 14 in US, 6 in Europe, 2 in Asia, 1 in South America.

It has 171 Public Peering locations and 60 Private Peering locations globally.

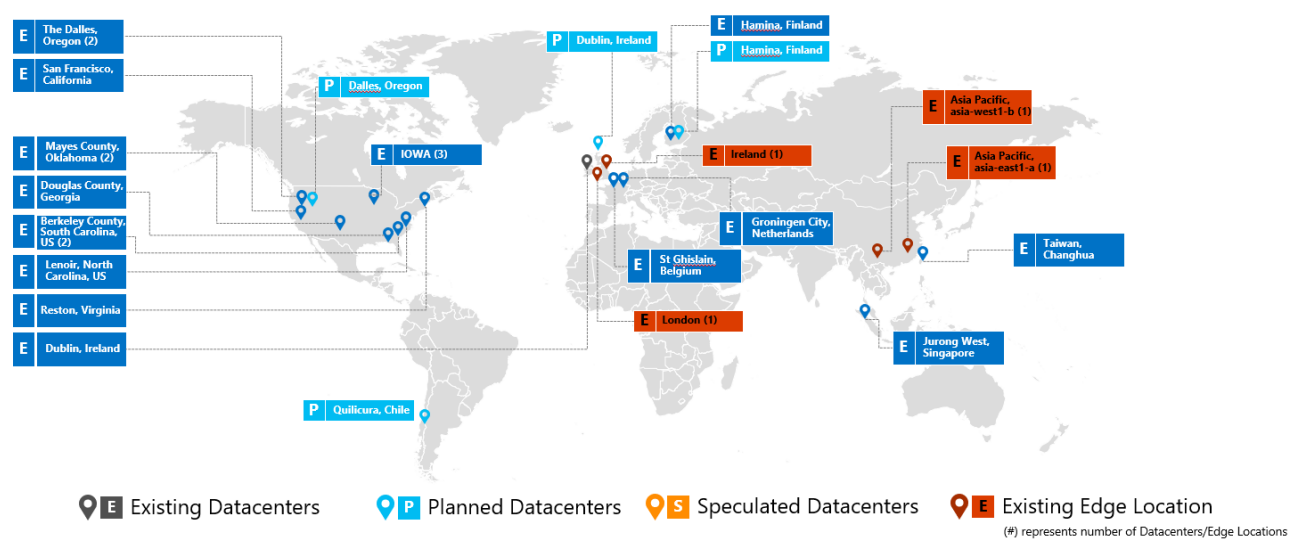


Figure 99: Google Datacenter Global Mapping

**Strategy**

Google deals directly with resellers without distributors. They introduced their Services Partner Program (= Google Apps Partner Program) in 2009 and now have over 10,000 resellers worldwide. The Services Partner program has four tiers, SMB Authorized, SMB Premier (Of 150 new seats required to be a SMB Premier reseller, 60% of those seats must be actively logging into Apps at least once a week. Inactive seats sold do not count towards the 150 seats required to maintain SMB Premier status), Enterprise Authorized, and Enterprise Premier. Over 97% of these partners are in the SMB Authorized tier. Google offers partners a lifetime 20% margin on Apps for Business (\$10/user/year on \$50). The partner bills the customer and prepays Google in advance for 1 year or monthly subscription. The value proposition for partners are value-added services (VAR-app development, adaptive planning, SI-managed hosting solutions, data security and encryption), price, and ease of integration. Google is relying more on partners to close large deals by taking deals above 5000 seats direct vs the 2000 seat level that we were seeing in June 2013. Google Apps for Government is priced the same as Google Apps for Business. The difference with this version is that it meets a specific requirement of many government agencies: keeping data stored only on servers in the United States. Google Apps for Education<sup>52</sup> targets Universities and non-profits with fewer than 30000 users and has the same applications as the business edition but is free for students and ad-free. The aim is to anchor students to their eco-system and have the students want to use Google Apps in their professional settings as well. There are no rebates since the product is free.

- Google App Engine<sup>58</sup> was released as a preview in April 2008.
- GCP promotes its “run like Google runs” emphasis on scalability and performance.
- GCP is a late entrant to the IaaS market, but is moving quickly. Expect significant improvements to GCP in 2015.
- GCP introduced “Moore’s Law Pricing” and actively seeks to undercut all competition on price.

**Google Cloud Platform Strategy**

- GCP wants to be the default choice for application developers building cloud applications of the future.
- GCP pursues a disruptive strategy in IT, pitting application developers against “legacy IT”. Its focus on innovation and performance appeals to application developers, and its advertising revenue enables it to undercut competitors in pricing.
- GCP is growing its ISV and partner ecosystem. Leveraging the success of Android, it is onboarding partners and SIs who’re building cloud-backed mobile applications for enterprises.

**Products<sup>136</sup>**

- **Google Apps for Work (GAW):** Suite of products from Google that includes a Service Level Agreement (SLA) which covers only the core services: Gmail, Google Calendar, Google Talk, Google Docs/Sheets/Slides, Google Drive, Google Groups, Google Sites, and Google Apps Vault<sup>123</sup>.

Google Apps for Work (GAW) is a suite of productivity services for content creation, communication, and collaboration, hosted and delivered by Google as a cloud service<sup>124</sup>.

Google touts the simplicity of the end-user experience, a diminished burden for IT departments when managing an entirely cloud-based service, and a complete end-to-end productivity solution. Customers across small and medium businesses and Enterprise customer segments use GAW. For verticals, GAW takes its largest share in Education, then Media and Entertainment, Telecommunication, Professional

Services, Hospitality and Travel, Logistics, and Retail, with some recent success in Government.

GAW targets current Microsoft Office customers and cloud-migration scenarios and uses two core strategies followed by fairly consistent sales tactics.

- **Google Docs, Sheets, and Slides:** Designed to compete with Microsoft Word, Microsoft Excel spreadsheet software, and the Microsoft PowerPoint presentation graphics program<sup>136</sup>.
- **Google Apps for Business (GAFB):** Earlier acronym for Google Apps for Business, rebranded as Google Apps for Work.



Figure 100: Google Apps

#### Positioning and Messaging

#### Google Apps Benefits

- Everyone has the updated document
- Access anywhere, anytime
- Easy to manage
- More face time, more desk space
- Comprehensive APIs
- Easy web development
- Less time managing spam

## Discover a better way of working

**Security first**



- Your work is always backed up
- You own and control your data
- Increased security and reliability
- Strong encryption and authentication
- 24x7x365.25 (that's right: no rest, even on leap years).

**Stay connected anywhere**



- Free your team from cubicles
- Be productive anywhere
- On any mobile device
- With device management capabilities

**Work better together**



- Work together in real time
- Work together across distances
- Work together across organizations

**Get stuff done faster**



- Familiar tools that millions already use
- Powerful search and easy to share
- Less trips to IT – no installs needed

**Invisible IT that just works**



- Up and running in 3 steps
- Save time and money
- No more patches
- New features, as soon as they are ready
- No hardware or client software
- Count on our 24/7 customer support

**Go green**



- Reduce your costs and your environmental footprint
- Get sustainable with carbon-neutral IT

Figure 101: Google Apps Pitch

## Offering

	P1	P2	M	K	E1	E3	E4	Google Apps For Business	Google Apps For Business with Vault
<b>Cost</b>	\$6/month	\$12.5/ month	\$15/month	\$4/month	\$8/month	\$20/month	\$22/month	\$5/month \$50/year	\$10/month
<b>Users</b>	25	25	300	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited
<b>Admin Console</b>	Simplified	Simplified	Full	Advanced	Advanced	Advanced	Advanced	Advanced	Advanced
<b>Mobile Device Management</b>	EAS	EAS	EAS	EAS	EAS	EAS	EAS	EAS + Android Advanced	EAS + Android Advanced
<b>Hybrid</b>			•	•	•	•	•	basic	basic
<b>Collaboration</b>	10 GB pooled + 500 MB/user	10 GB pooled + 500 MB/user	10 GB pooled + 500 MB/user	SharePoint Access	10 GB pooled + 500 MB/user	10 GB pooled + 500 MB/user	10 GB pooled + 500 MB/user	Sites: 500MB/user + 10GB pooled	Sites: 500MB/user + 10GB pooled
<b>Personal Storage</b>	SkyDrive Pro: 7 GB/user	SkyDrive Pro: 7 GB/user	SkyDrive Pro: 7 GB/user		SkyDrive Pro: 7 GB/user	SkyDrive Pro: 7 GB/user	SkyDrive Pro: 7 GB/user	Drive: 5 GB/user	Drive: 5 GB/user
<b>Social</b>	SharePoint	SharePoint	SharePoint		Yammer Enterprise	Yammer Enterprise	Yammer Enterprise	•	•
<b>Email, Calendar</b>	25 GB	25 GB	25 GB	1 GB	25 GB	25 GB	25 GB	25 GB	25 GB
<b>Support</b>	Basic Phone	Basic Phone	9x5	24x7	24x7	24x7	24x7	24x7 light	24x7 light
<b>IM/Presence, Voice, Video Conferencing</b>	•	•	•		•	•	•	•	•
<b>Web Apps</b>	•	•	•	•	•	•	•	•	•
<b>Office Client</b>		•	•			•	•		
<b>Video Broadcast</b>								•	•
<b>eDiscovery</b>						•	•		Email only
<b>Data Loss Prevention</b>						•	•		
<b>Email Archiving</b>				Unlimited mailbox	Unlimited mailbox	Unlimited mailbox	Unlimited mailbox		Separate store unlimited for term of contract
<b>Rights Management</b>						•	•		
<b>Enterprise Voice</b>							•		
<b>One size fits all</b>									

Figure 102: Google Apps Offering

**Google Apps for Work strengths:**

- **Simplicity:** GAW's strength is simplicity in product design, administration, and messaging. Its high brand awareness and simple product experience help spur penetration and adoption.
- **Low cost:** GAW is pitched as a low-cost service with two simple pricing options: Google Apps for Work (US\$50 per user, per year) and Google Apps for Work Unlimited (US\$120 per user, per year). Region-wide price cuts and deep discounting of individual deals are common.

- **Mobility:** The GAW product experience is optimized for mobile, with a focus on Android and iOS devices. GAW customers get free Mobile Device Management (MDM) and Mobile Application Management (MAM) capabilities with Android for Work to secure corporate data on Android devices, and Project Fi wireless service will at some point contribute to this effort in tangible ways.
- **Cool Factor:** Millennial preference and overall perception of Google as the “cool company” that builds driverless cars, Wi-Fi balloons, and cancer-detecting pills helps to generate both positive PR and end-user adoption.

**Google Apps for Work weaknesses:**

- **Limited capabilities:** Google Apps for Work does not offer business intelligence and enterprise content management, enterprise social, or advanced information-protection capabilities. And it does not offer enterprise-grade videoconferencing capabilities yet, although efforts are clearly underway.
- **Reliance on third parties:** To close many product and feature gaps, customers must rely on third-party services from the Google Apps Marketplace. These services are not covered by the GAW service level agreement or by Google support. Customers must incur the cost of these additional services and the complexity of integrating them with other line of business (LOB) applications.
- **Lack of choice and flexibility:** Google does not offer customers any choice of deployment models. They do not support on-premises or hybrid deployment methods. This limits a customer’s ability to adopt the cloud in a phased and deliberate manner.
- **Privacy, security, compliance:** Google is still working to gain enterprise trust. The company has been sued for privacy violations over mining Gmail data for advertising purposes and commingling user data across services and disclosing that data to advertisers without permission. The EU’s Article 29 Working Party wrote a letter with recommendations to Google to improve its Privacy Policy<sup>64</sup>. In April 2014, during a lawsuit, Google admitted the company had been scanning student email<sup>71</sup> data for advertising purposes<sup>138</sup>. With its deep investment in search advertising and a product strategy that depends on pushing consumer services to commercial customers, Google’s commitment to respecting privacy has not picked up until recently.

Infrastructure building blocks	Platform building blocks	Cross-service offers	Other tools
<b>Compute</b> Compute Engine, App Engine, Container Engine	<b>Big Data</b> <a href="#">BigQuery</a> , <a href="#">PubSub</a>	<b>OS</b> Integration into Android “L” operating System	<b>Management</b> <a href="#">Kubernetes</a>
<b>Storage</b> Cloud <a href="#">Datastore</a> , Cloud SQL, Cloud Storage	<b>Services</b> Translate, Prediction, Endpoints	<b>1st Party products</b> Maps, Search, Apps	<b>Development</b> GitHub Integration Android IDE
<b>Networking</b> Load Balancing, Interconnect, DNS	<b>Management</b> Deployment Manager	<b>Google for Work</b> Packaged offering of Google Apps and GCP for business	
Google Global Infrastructure North America (19 DCs), Europe (12 DCs), APAC (4 DCs), South America (1 DC) 131 edge caching locations providing acceleration and expanding footprint into Australia, Africa.			

**Figure 103: Google's Cloud Computing Platform (GCP Stack)**

**Value Proposition**

Low cost, highly innovative flexible and scalable cloud solutions.

- No upfront investment or long-term commitment required.
- Provisioning eliminates lengthy procurement process and enables rapid scaling.
- Expanding network of managed service provider partners to ensure customers are optimizing solutions.
- **Agility:**
  - Infrastructure in minutes
  - Experiment often
  - Fail quickly at low cost
- **Scalable:**
  - 3 Regions
  - 8 Availability Zones
  - 131 Edge Locations
- **Lower Cost:**
  - On Demand
  - Automatic Discounting
  - Moore's Law" pricing
- **Secure:**
  - Certification & Accreditations that matter
  - Encryption of data at rest and between datacenters
- **Proven:**
  - Global Network
  - Global Service
  - Scale
  - Performance

#### **Key Service Offerings**

Most Used Services:

- Google App Engine (GAE): Platform as a Service
- Google Compute Engine (GCE): IaaS
- Google BigQuery: Analytics / BI

Key recently introduced Solutions:

- Google Container Engine: (GKE): Use declarative syntax to define application requirements, then run and manage Docker containers on GCP's virtual machines to enable and autoscale.

#### **Customer Overview**

GCP gained their initial footprint with developers and are shifting focus to enterprise. Revenue per account is typically <\$50K, leaving significant room for growth within these accounts.

#### **Customer Type:**

- Education comprises most of all accounts, but GCP is starting to see growth in SMB accounts.
- Enterprises are evaluating GCP for mobile application development, but not much uptake.

#### **Products in Use:**

- Most customers today are using Google AppEngine.
- There is significant growth in the number of BigQuery customers in the last year.

#### **Geographic Distribution:**



- Google has the greatest presence in North America (primarily Silicon Valley Startups), but its focused efforts on growth in Asia have yielded a few significant wins.

#### **Top Industries:**

- Education
- Consumer Services
- Media/Entertainment

#### **Core strategies**

- A “wedge” approach, using Gmail, Google Drive, or Hangouts videoconferencing to gain a foothold in an account, and then introduce the entire GAW suite.
- A “coexistence” environment, with GAW operating in tandem with Office 365 in the hope that users and account reps will successfully lobby for wider GAW adoption.

#### **Sales tactics**

- Target at-risk Microsoft accounts such as legacy Exchange, dark Enterprise Agreements (EAs), non-annuity, low deployments/active usage, or kiosk opportunities.
- Develop strong relationships with business decision makers (BDMs) capable of taking IT decisions outside of IT and/or without IT’s knowledge.
- Lead with simplicity and innovator brand recognition, “good enough” features, simple license terms, and lower perceived cost.

#### **Go-to-Market Strategy**

##### **Fill the gap and price war:**

- **Attract and retain:** GCP follows a “honeypot” sales approach, attracting small customers with a cheap/free initial offering and convincing them to “lock in” on Google’s platform for everything.
- **Move to the enterprise:** Originally focused on developers and smaller organizations, GCP is now attempting to move into the enterprise market. They are aggressively recruiting and hiring enterprise sellers.
- **Rapid release cycle:** GCP relies on customer feedback to inform a rapid release cycle and continual innovation.
- **Industry and Workload focus**
- **Developer Ecosystem**
- **Under-cut on price**

#### **Recent GCP Trends**

- Aggressively hiring solution architects
- Increasing compensation to partners
- Ramping up Enterprise Sales Force
- Promoting containers and cross/cloud compatibility vision
- Global expansion of services and datacenters
- Undercutting competitor prices

#### **Sales Strategy**

- **Industry Leader:**
  - Illustrate Google growth and brand recognition

- Showcases a variety of Use Cases
- Highlight ease of development
- Global scale, network, and performance
- **Flexible & Open:**
  - Built on open source.
  - Assures compatibility with existing technology vendor offerings via BYOL model
- **Elasticity, Cost Reduction & Agility:**
  - Benefits of auto scaling
  - Moore's Law pricing
  - Automatic discounts rather than reserved instances
- **Security:**
  - Touts physical security assets and existing certifications

#### Sales Tactics

GCP growth strategy focuses on self-led customer acquisition and expanding usage within existing accounts.

- **Self-Provisioning:**
  - Target marketing efforts and user communication to Developers and Business Decision Makers
  - Offer Free Usage Tier to entice potential new customers
- **Lighthouse Wins:**
  - Identify and Pitch high profile customers with “cool factor”.
  - Provide discounted/free services and support.
  - Holistic approach demonstrating going “all in” to “run like Google”.
- **Assign Solutions Architects and Technical Account Managers:**
  - Dedicated Engineers and Solutions Architects from design to implementation.
  - Focus on case studies.
- **Focus on selling the future:**
  - Sells vision
  - Sells inevitability of businesses wanting to run like Google

#### Pricing<sup>62</sup>

##### GCP Purchasing Options

Customers pay less for sustained use and tiered resources<sup>62</sup>.

- **Per Instance Options:**
  - Free Tier
  - On-Demand
  - Sustained Use Discounts  
Google Compute Engine offers an automatic Sustained Use Discount, by automatically applying discounting to instances when they run for a certain amount of time each month, meaning customers do not need a multi-year commitment to get the same or better discount. The longer they use an instance in a given month, the greater the discount they get. Sustained Use Discounts can net as much as 30% off the standard on-demand rate.
- **Compute:**
  - Per minute billing
  - Machine Type
  - Purchase Type
  - Number of Instances

- **Storage<sup>63</sup>:**
  - Storage
  - Requests: Put and Get
  - Data Transfer (outbound and inter-region)
- **Relational Databases:**
  - On-Demand
  - RAM/Storage Tiering
  - I/O
  - Egress

### Competitive Situation

#### Google Cloud Platform Strengths

- Cloud DNA Global Platform with Operational Excellence
- Brand Halo
- Global Network and Datacenters
- Excellent relationship with developers (Talent Pool)
- Pull through from Android Operating System
- Advertising revenue enabling price drops

#### Google Cloud Platform Weaknesses

- Enterprise Support
- History of deprecating services.
- View of market slanted greatly toward "21<sup>st</sup> century" applications
- Still catching up. Lots of services still in beta or preview
- Limited ability (or desire) to support customers with Windows Workloads
- GCP lack of integration capabilities with on-premises assets
- GCP lack of integrated management capabilities

#### Microsoft's Differentiated Value Proposition

1. **Full Office experience on cross-platform with one subscription:** Microsoft Office is a robust productivity application used by more than one billion users worldwide. Customers can install and use Microsoft Office (Office 365) on up to five PCs/Macs per user and up to five tablets and five phones per user, to become more productive virtually anywhere.
2. **Modernized communication services:** With the newly released Skype for Business capabilities (Skype Meeting Broadcast, Public Switched Telephone Network (PSTN) Conferencing, Cloud Private Branch Exchange (PBX), and PSTN calling<sup>1</sup>), voice, video, and web meetings are combined in one connected user experience and platform, saving companies substantial costs in customers' communication infrastructure.
3. **Advanced security and compliance capabilities:** Office 365 abides by industry standards such as encryption at rest and anti-virus/anti-spyware (AV/AS) through Exchange Online Protection (EOP) while delivering advanced security and compliance capabilities to enable customers to protect sensitive data. Data Loss Prevention (DLP) and Mobile Device Management (MDM) gather threat intelligence Advanced Security Management, Management Activity API, and protect against even unknown security threats (Advanced Threat Protection [ATP]) while giving them best in class control over data access (Customer Lockbox) and compliance capabilities (Advanced eDiscovery, Archiving, Auditing).
4. **Modern collaboration and enterprise social:** Gartner recognized Microsoft as the Leader in the 2015 Magic Quadrant for Social Software in the Workplace. Office 365

delivers a powerful suite of collaboration<sup>9</sup> apps, such as Yammer, Skype for Business, OneDrive, Delve, and Outlook—all built on an intelligent platform comprised of Office Graph and Office 365 Groups, for customers to realize a frictionless way to work together using the tools of their choice, while discovering and building upon the existing body of knowledge in their organization.

5. **End user and organizational analytics:** Office 365 provides personalized intelligence tools, for data to have impact given the sheer volume of information customers face today. Power BI Pro is a business analytics service that enables information workers to visualize and analyze data with greater speed, efficiency, and understanding. Delve Analytics empowers individuals through rich dashboards that provide insights on time and relationships, with the goal of helping individuals get time back and spend it effectively.
6. **Privacy by design:** Microsoft is unique among major cloud service providers with over 10 years of privacy experience and having a cloud specific privacy policy that provides strong commitments to customer data safeguarding and privacy protection. Microsoft contractually commits to not mining customer data of Office 365 customers for advertising purposes. Office 365 contractually commits to not mining customer data for advertising purposes. The Microsoft Cloud is the first cloud computing platform to conform to ISO/IEC 27018, which prohibits the use of personal data for advertising and marketing.
7. **Document and formatting fidelity:** Opening Office docs in Google Docs has often led to frustration with loss of document integrity and loss of formatting. As a result, Google finally announced Native Microsoft Office file support in Google Drive. However, early teardowns and analyses indicate this is not entirely true, and that Google still has work to do.
8. **Robust offline experience:** Microsoft Office, a robust productivity application used by more than one billion users worldwide, allows users to edit and save documents efficiently on desktops, tablets, and phones, even when offline.
9. **Hybrid Cloud:** Microsoft provides the flexibility to build a hybrid solution so employees can share information on-premises or in the cloud. Google Apps delivers its solutions online only, so clients are left with no choice but to move to the cloud immediately.
10. **Data location transparency:** Office 365 customers know where their data is stored, who has access to it, and when. Data location information is currently accessible to customers via the Office 365 Trust Center website. Customers own their data, so that if an Office 365 customer decides to leave the service, they can take their data with them. Google stores data by pieces into several Data Centers.
11. **Includes 60 Skype World min/month<sup>1</sup> for Home Users:** Call landlines in over 60 countries/regions with 60 free Skype world minutes per month. Use Skype world minutes from any device where Skype is installed, whether it's from a mobile phone, tablet, TV, or other device.
12. **Office 365 Home users get 1 TB of storage:** Office 365 Home/Personal/University customers get 1TB of OneDrive storage at no additional cost for documents, photos, and videos, so they can edit and share them from anywhere, on all devices.
13. **Innovative tools for students and teachers:** Microsoft Office 365 Education<sup>102</sup> suite includes popular and differentiated digital tools that are getting positive reviews from teachers and students: Sway<sup>140</sup>, Office 365 Groups and Office Mix<sup>111</sup>.
14. **Rich clients offering advanced formatting, data analysis, and offline capabilities for Education:** Institutions that purchase Office for faculty and staff through an Academic Volume Licensing program can include an Office 365 ProPlus subscription for all students and teachers, enabling them to install, on their own and for free, the latest version of Microsoft Office rich clients on up to five PCs or Macs. Office's richness makes everyday tasks faster and easier allowing students and teachers to maximize their creativity, analysis and innovation regardless of internet availability. In contrast, Google offers no rich desktop apps and offers limited offline functionality to desktop users via web apps on Chrome Browsers only.

- 15. Privacy from Day One for Education:** Microsoft is unique among major cloud service providers with over 10 years of privacy experience and having a cloud-specific privacy policy that provides strong commitments to customer data safeguarding and privacy protection. Microsoft works hard to balance privacy and innovation to protect students in the digital world. In contrast, Google’s historical commitment to respecting students’ privacy has not picked up until recently. In April 2014, during a lawsuit, Google admitted they had been scanning student email data for advertising purposes<sup>70</sup>. Although Google insists they are now committed to respecting student privacy.
- 16. Accessibility from Day One for Education:** Schools get accessibility updates on an ongoing basis and can create an inclusive<sup>82</sup> learning environment. Inclusive design is integrated in Microsoft’s engineering culture. Microsoft is creating new ways to enable students and teachers with disabilities to create, communicate, and consume content from any device. Microsoft is also committed to making it easier for every student and teacher to author content that is fully accessible. In contrast, Google’s historical commitment to this area has been low. Several universities that use Google Apps have received complaints and lawsuits<sup>72</sup> by blind students alleging that the universities were not providing equal access to students with disabilities.

<sup>1</sup>Not available in all countries.

Compare	Microsoft	Google
Suite	Office 365	Google Apps
Productivity	Microsoft Office	Google Docs
Email (incl. Calendar & Contacts)	Exchange Online	Gmail, Google: Calendar, Contacts
Collaboration	SharePoint Online	Google: Sites, Drive, Groups
UC	Lync	Google: Talk, Voice, Hangouts
eDiscovery	Exchange Online, SharePoint Online	Google: Message Discovery, Vault
AV/AM/AS	Exchange Online Protection	Gmail, Google Message Security
Social	SharePoint Online, Yammer	Google Plus

Figure 104: Microsoft vs Google

	Windows Azure	Amazon Web Services
<b>Compute</b>		
<b>Service</b>	Virtual Machine	Elastic Cloud Compute (EC2)
<b>Virtualization</b>	Hyper-V	proprietary Xen
<b>VM File Format</b>	Virtual Hard Disk( VDI)	Amazon Machine Image (AMI)
<b>Scale up/Down</b>	Auto scale	Auto Scaling
<b>Containers</b>	Docker Containers for Linux and Windows Server Container	EC2 Container Service(ECS) that supports Docker
<b>Billing</b>	Per Minute	Per Hour
<b>Pricing Model</b>	On-Demand, RI and Spot	PAYG, Enterprise Agreement, Pre-purchase
<b>SLA</b>	99.95%	99.95%

Figure 105: Azure vs AWS - Compute comparison

	Windows Azure	Amazon Web Services
<b>Storage</b>		
<b>Object Storage</b>	Azure Blobs (object Blobs)	Simple Storage Service (S3)
<b>Storage Table</b>	Azure Tables	Simple DB, Dynamo DB
<b>Block Storage</b>	Azure Page Blobs	Elastic Block Storage (EBS)
<b>File Storage (Network Shared Storage)</b>	Azure Files (Support SMB Protocol )	Elastic File System (Support NFS protocol)
<b>Guaranteed IOPS</b>	Provisioned IOPS	Premium Storage
<b>long term archival storage</b>	-	Glacier
<b>Infrequent access</b>	-	Standard S3 - IA
<b>Data Transfer via Disks</b>	Azure Import & Export	AWS Import & Export
<b>Data transfer via storage appliance</b>	-	AWS Snowball
<b>Hybrid Storage</b>	StorSimple	Storage Gateway

Figure 106: Azure vs AWS - Storage comparison

	Windows Azure	Amazon Web Services
<b>Storage Replication Options</b>		
<b>3 or more copies within a single facility</b>	LRS	S3 RR
<b>Across multiple facilities</b>	ZRS	S3 Standard
<b>Cross Region</b>	GRS	Cross Region
<b>Read Access to Cross Region</b>	GRS-RA	Cross Region
<b>Replication for Block Storage</b>	Azure Drives (all of the above)	EBS (available within AZ)
<b>Availability SLA (blob storage)</b>	99.9%	99.9%
<b>Durability Expectation (blob storage)</b>	Not Published	99.9999999999%

Figure 107: Azure vs AWS - Storage replication options comparison



	Windows Azure	Amazon Web Services
<b>Data</b>		
<b>Relational Database as a service</b>	SQL Database ( Support SQL Server RDMBS)	Relation Database Service (RDS) (Support MySQL, SQL Server, Oracle, Postgre, MariaDB & Amazon Aurora RDBMS)
<b>Data Warehousing Service</b>	SQL Data Warehouse	RedShift
<b>NoSQL</b>	<u>DocumentDB</u>	Dynamo DB
<b>Caching</b>	<u>Redis Cache</u>	Elastic Cache
<b>Queues</b>	Azure Queues	Simple Queue Service (SQS)
<b>Managed Search</b>	Azure Search	<u>CloudSearch</u>

Figure 108: Azure vs AWS - Data comparison

	Windows Azure	Amazon Web Services
<b>Networking</b>		
<b>IPsec Tunnel</b>	Virtual Network	Virtual Private Cloud (VPC)
<b><u>Vnet to Vnet connectivity -region</u></b>	Vnet to Vnet via VPN Gateway	VPC Peering
<b><u>Vnet to Vnet connectivity across regions</u></b>	Vnet to Vnet via VPN Gateway	Internet Gateways (IGW)
<b>Private network connection from on-premises</b>	Express Route (NSP & Exchange Provider)	Direct Connect
<b>Load Balancer (Layer 4 &amp; 7)</b>	Azure Load balancer (Layer 3) , Application Gateway (Layer 7)	Elastic Load Balancing (ELB) (Layer 3 & 7)
<b>DNS</b>	Traffic Manager	Route 53

Figure 109: Azure vs AWS - Networking comparison

	Windows Azure	Amazon Web Services
<b>Analytics &amp; IOT</b>		
<b>Managed Hadoop Clusters</b>	HDInsight	Elastic Map Reduce
<b>Predictive Analytics</b>	Machine Learning	Amazon Machine Learning
<b>real-time stream processing</b>	Streams Analytics	Amazon Kinesis
<b>Orchestrate and manage data transformation</b>	Data Factory	Data Pipeline
<b>ingest , persist and process millions of events</b>	Event Hubs	Lambda
<b>Infinite analytics optimized store</b>	Azure DataLakes & DataLake Analytics	-

Figure 110: Azure vs AWS - Analytics & IOT comparison

	Windows Azure	Amazon Web Services
<b>PaaS</b>		
<b>Managed Compute</b>	Cloud Services (Web & Worker Role)	
<b>Window Client Apps in Cloud</b>	Remote App	Workspaces
<b>Virtual Desktop (Windows 7 Client)</b>	-	Workspaces
<b>Backend Code Execution</b>	App Service <u>WebJobs</u>	Lambda
<b>Web &amp; Mobile</b>		
<b>Deploy and scale web apps in seconds</b>	Azure App Service ( Web App )	Elastic Beanstalk
<b>Build and host the backend for any mobile app</b>	Azure App Service (Mobile App)	AWS Mobile Services ( Cognito , Mobile Analytics and AWS SNS, Mobile Hub and Mobile SDK)
<b>publish APIs</b>	Azure App Services (API App) & API Management	API Gateway

Figure 111: Azure vs AWS - PaaS and Web & Mobile comparison

	Microsoft Azure	Amazon Web Services
<b>Virtual Machine/Disk Comparison</b>		
<b>Service</b>	Virtual Machine	Elastic Cloud Compute (EC2)
<b>Virtualization</b>	Hyper-V	proprietary Xen
<b>Disk Architecture</b>	Page Blobs (3 way replica) + geo-replication	Elastic Block Storage (EBS - Mirror) Snapshot to S3 for durability
<b>Disk Performance</b>	Premium Storage (80,000 IOPS Max)	Provisioned IOPS (48,000 IOPS Max)
<b>Scale up/Down</b>	Scale Sets	Auto Scaling
<b>Containers</b>	Docker Containers for Linux and Windows Server Container	EC2 Container Service(ECS) that supports Docker
<b>Billing</b>	Per Minute	Per Hour
<b>Pricing Model</b>	PAYG, Enterprise Agreement, Pre-purchase	On-Demand, RI and Spot
<b>Deployment Orchestration</b>	Resource Manager (ARM) Azure Automation	Ops Works Cloud Formation
<b>SLA (multiple instances)</b>	99.95%	99.95%

**Figure 112: Azure vs AWS - Virtual Machine/Disk comparison**

	Microsoft Azure	Amazon Web Services
<b>Application Services</b>		
<b>Web &amp; Mobile Applications</b>	Web Apps, API Apps, Mobile Apps, Power Apps	Elastic Beanstalk, Mobile Hub
<b>Backend Process Logic</b>	Azure Functions, Web Jobs, Logic Apps	Lambda
<b>Messaging</b>	Azure Queues Service Bus (Queues, Topics, Relay)	Simple Queue Service
<b>Workflow</b>	Logic Apps	Simple Workflow Service
<b>App Testing</b>	Dev/Test Labs (Backend)	Device Farm (Front End)
<b>API Management</b>	API Management	API Gateway
<b>App Streaming</b>	RemoteApp	<a href="#">AppStream</a>
<b>Media Streaming</b>	Live and OD Streaming	-
<b>Transcoding</b>	Media Services Encoding	Elastic Transcoder
<b>Notifications</b>	Notification Hubs	Simple Notification Service

Figure 113: Azure vs AWS - Application Services comparison<sup>21</sup>

**EU Model Clauses and DPA**

Google’s EU Model Clauses and DPA have not been validated by the Article 29 Working Party, and they need to be opted into by customers. Google’s DPA does cover customers who purchase through a reseller.

**Data Retention – Deletion**

Google does not offer a commitment with respect to data retention.

Google commits to delete: 1) customer deleted data (as in when the customer sends it to trash) within 180 days after such deleted data is unable to be recovered; and 2) customer data within 180 days after the subscription is terminated due to non-payment. There is no commitment regarding data that the customer does not delete. Also, Google has added the following condition to all its deletion commitments: “unless applicable legislation or legal process prevents it from doing so”.

**Sub-contractors**

- Google provides a list of subcontractors with their names only.
- Google provides prior notice of the appointment of a new subcontractor with 15 days in advance.
- Google provides customer’s right to exit the agreement due to a new subcontractor.

#### **Data Location**

Google does not offer this commitment for SaaS, but it does provide it for PaaS (e.g., Google Cloud Platform Service). Also, Google provides some transparency to customers regarding data location.

#### **Customer Waiver of IP Rights**

Google does not restrict a customer's right to assert its IP as a condition of using the services, to pursue its claim as part of a class action, or to request a trial by jury.

#### **SLAs**

Google's SLA provides the same availability (99.90%), but their credits are lower than Microsoft's (Google: up to 50% // MS: up to 95%). Microsoft calculates that availability differently. Microsoft has the concept of "scheduled downtime" which is calculated based on availability across all users (no credits if email is unavailable only to key exec users) and does not count against our 99.90% commitment (Exchange Online does not have scheduled downtime). G Suite<sup>66</sup> does not have the concept of scheduled downtime (so it is more challenging for them to meet their 99.90%).

In Google, an incident must impact at least 5% of the users to impact their downtime calculation. Microsoft does not require such minimum threshold.

Service credit for 'suites' is applied only to proportionate value of the service that is unavailable.

Google does not pay customers money if the service is down; it offers service credits in the form of extra days on the end of the contract unless they are monthly paying customers who then get a monetary credit back to the account. Finally, Google has the ability to modify the SLAs during the subscription term.

#### **Suspension from Service**

Google may at its sole discretion suspend the provision of any service at any time if required to comply with any applicable law. Note that as drafted this could apply to laws applicable to Google not just violations of law by customer or its end users.

#### **Audits**

Google's commitments in this matter are essentially equivalent to Microsoft's.

#### **Security Standards**

Google's commitments in this matter are essentially equivalent to Microsoft's.

#### **Security Incidents**

Google's commitments with respect to data breaches have become even more comparable to Microsoft's with their latest DPA. For example, Google's definition of Data Incident has now aligned with ours to exclude accidental losses. In addition, Google no longer commits to work with customers to address the breach. Finally, Google's commitment excludes security incident scenarios caused by the customer.

#### **Limitation of Liability**

- **In the US:** Google's liability (including data breaches) is limited by a cap equal to the amount spent during the 12 months prior to the incident giving rise to liability.

- **In the EU:** Google's liability (including data breaches) is limited by a cap equal to 125% of 12 months' fees or 50,000 euros, whichever is higher. This will be the case regardless of whether the customer signs the DPA or not.

**Use of Customer Data**

Google's commitments in this matter are essentially equivalent to Microsoft's. Google commits not to process customer data for advertising purposes or serve advertising in the Services. Also, Google commits to comply with ISO 27018. However, Google makes different commitments on its use of customer data depending on the contract and the region.

**Law Enforcement Request for Data**

Google's commitments on this issue are essentially equivalent to Microsoft's. However, Google will also release customer data if the request is related to exceptional circumstances involving danger of death or serious physical injury to any person.

**Compliance with Laws**

Google's commitments on this issue are essentially equivalent to Microsoft's.

	Azure	Google Cloud Platform
ISO 27001	✓	✓
SOC 1/SSAE 16/ISAE 3402 (formerly SAS70)	✓	✓
SOC 2	✓	✓
SOC 3*	NA	✓
PCI DSS Level 1	✓	
CSA CCM	✓	
FedRAMP/FISMA	✓	
ITAR		
DIACAP		
HIPAA	✓	
Safe Harbor Certified	✓	✓
UK G-Cloud OFFICIAL	✓	
EU Model Clauses	✓	
FIPS 140-2	✓	
FERPA	✓	

**Figure 114: : Compliance/ Certifications Comparison between Azure & GCP**

**Changes to Terms**

Google may make commercially reasonable changes to the URL Terms (which include the AUP and the SLAs) from time to time without prior notice. In addition, since September 29<sup>th</sup>, 2016, Google can even make material changes to the URL Terms with prior notice. Even though Google provides a process for the customer to keep the original terms for a certain period of time, that process is not available if Google needs to comply with a court order or applicable law.

**Changes to services**

Google may discontinue the service or any portion/feature for any reason at any time without liability to the customer. Google commits to notify customer of any material changes or if it intends to make a Significant Deprecation (defined term). If Google intends to make a Significant Deprecation, it commits to use commercially reasonable efforts to continue to provide the original service for 12 months after the notification unless Google determines in its

'reasonable good faith judgment' that: a) the change is required by law/contract or b) the continuation of the original service would create a security risk/substantial economic burden/technical burden. These exceptions are at Google's discretion and they are quite broad.

**Google Assessment**

Differentiators	Advantages	Disadvantages
<ul style="list-style-type: none"> <li>• They've said that cloud platform prices should follow Moore's Law and have led pricing reductions.</li> <li>• They have innovated with pricing and their automatic discounts are interesting for many customers.</li> </ul>	<ul style="list-style-type: none"> <li>• Like Amazon and Microsoft they have the financial backing and datacenter presence to get a scale advantage.</li> <li>• Like Microsoft they have PaaS and SaaS offerings across this space.</li> <li>• Google has significant leadership in the mobile market which could have an impact long term.</li> </ul>	<ul style="list-style-type: none"> <li>• Like Microsoft, Google initially bet that that the market wanted PaaS and was late with IaaS. Their IaaS offering is relatively new.</li> <li>• Google is still developing enterprise credibility. In the startup space it's a different story, but in enterprise this can have an impact.</li> </ul>

Table 14: Google Assessment

**Salesforce**

**Overview**

Salesforce.com (SFDC) consists of the following core modules:

- **Sales Cloud:** Traditional sales force automation (SFA) functionality including leads, opportunities, forecasting, mobility, and productivity.
- **Service Cloud:** Customer service solution in the cloud including case resolution, solutions, self-service, and agent console. Product options are Service Cloud or Desk.com.
- **Marketing Cloud:** Digital marketing platform with personalized experiences across email, mobile, social, advertising, and the web. Product options are ExactTarget, Pardot, and Social Studio.
- **Community Cloud:** Connect partners, customers, or employees through a self-service community.
- **Analytics Cloud (Wave):** Drill down analysts for answers to collaboration with teams from any device.
- **Salesforce1 Lightning, Force.com, and Heroku:** Cloud development platforms with tools and services to build apps.

**Available today:**

- **Salesforce Files Connect for SharePoint or OneDrive for Business (ODB):** Unlock files from SharePoint or ODB; connect files to the business process.
- **Salesforce1 for Outlook Web Access (OWA):** New mobile/tablet app that will have embedded Salesforce features within email.



- **SalesforceIQ Inbox for Outlook Web Access:** New mobile app with embedded Salesforce features within email. Available for additional subscription fees.
- **Integration with PowerQuery for Excel:** SFDC data and reports will be prebuilt query sources.
- **PowerBI integration with SFDC:** Combine SFDC data and reports with other data sources.
- **SFDC Marketing Cloud Azure:** Integrating Microsoft Azure into the ExactTarget Marketing Cloud, probably for external triggers coming from JourneyBuilder (tool for automated multichannel campaigns).

#### **Key Facts:**

- 6,000-plus front-line sales and pre-sales representatives.
- Spend US\$3.2 billion-plus per year in sales and marketing.
- 20 percent market share versus 7 percent.
- 25 percent growth year over year (YoY).
- Commitments to data centers in Canada and Europe.

#### **Strategy**

##### **Selling Sales Cloud**

The SFDC strategy is to focus on sales rep productivity with less focus on sales operations and sales management. Messages are centered on how SFDC is developing more mobile experiences to give time back to sales reps. Three primary themes include productivity with the focus on mobile, team selling, and closing more deals.

##### **Service Cloud**

The following are four themes to the SFDC Service Cloud strategy:

- Close cases faster
- Personalize customer care
- Provide smarter self-service through Communities
- Deliver support everywhere

Each has embedded knowledge and collaboration on the Salesforce1 platform.

##### **Analytics Cloud/Wave Platform**

- Positioned as “analytics for everyone” with a focus on mobility and easy-to-use visualizations.
- Platform for developers and independent software vendors (ISVs) to build third-party analytics apps.
- Price: US\$75 per user/per machine for users (explorer), US\$150 per user/per machine for report authors (builder), minimum of forty users.

##### **Marketing Cloud**

The emphasis for the Marketing Cloud is ExactTarget and the concept of managing one-to-one customer journeys, web and mobile pages, group messaging, and proximity marketing.

##### **Communities**

Launched as a separate cloud for customers, partners, and employees.

**Salesforce1 Lightning:** A next-generation development platform that introduces a non-programmatic way to drag and drop versus code with an assortment of Salesforce and partner components. Introduces a new mobile first user interface (UI), visual design tool, run-time services, and application programming interfaces (APIs).

## Competitive Situation

### *Salesforce Strengths vs. Microsoft*

- The most recent CRM market share analysis report<sup>38</sup> shows Salesforce as the clear market leader and increasing the distance over the rest of the pack.
- The company is a proven innovator. This strength alone separates Salesforce.com from much of its competition and provides increased payback for customers.
- Salesforce promotes a vibrant user community. The company uses its own Ideas solution to solicit community input, actively monitors social networks and provides online venues for customers to make themselves heard. Too often CRM software companies don't actually practice the Customer Relationship Management they speak of, however, Salesforce.com clearly walks the walk.
- The Salesforce user interface maximizes consumer technologies to deliver a simple and rewarding user experience. This has delivered a profound effect in achieving user adoption.
- Salesforce.com is championing social CRM and delivering the technology for its customers to achieve social CRM business objectives.
- The company's combination of Salesforce1, Force.com, PaaS tools and AppExchange lead the cloud CRM industry in terms of CRM integration, software customization, third party extensibility and ecosystem.

### Microsoft's Differentiated Value Proposition

1. **Unmatched productivity:** Process-driven user interface (UI) with embedded line of business (LoB) processes that are reflective of a company's business.  
 Deep integration across the full range of Office 365 capabilities.  
 Enable employees to remain productive no matter where they are or what device they're using with full offline capabilities.  
 Provide comprehensive service solution, inclusive of self, assisted, and onsite service<sup>1</sup>.
2. **Actionable intelligence:** Intelligently engage customers and manage internal business processes.  
 PowerBI with Dynamics CRM helps to perform operational analyses on business and social data coming from multiple sources, take informed action, and execute "what-if" analyses.  
 Cortana Analytics with Dynamics CRM helps to deliver personalized experiences for their customers while also making better business decisions.  
 Connected Field Service combines the power of Microsoft Azure Internet of Things (IoT) and field service to enable proactive and predictive maintenance.
3. **High value:** Dual use rights available and licensing flexibility with an option to mix and match CRM Online SKUs and true-up/true-down seats used annually.  
 In addition to core CRM, capabilities such as sales intelligence, knowledge article authoring, social engagement, and data encryption are included at no extra cost.  
 Salesforce increased prices 15-20 percent, effective May 1, 2016.  
 Dynamics CRM Online Professional Edition has a list price of US\$65 per user/month versus the comparable Salesforce SKU, Enterprise Edition, at US\$150 per user/month (more than double the cost).

- 4. Platform, security, and data centers:** Unlike SFDC, Dynamics CRM Online (CRMOL) does not have metered usage, paywalls, or multi-tenant governors. The .NET-based Dynamics xRM development platform, along with Microsoft Azure and Office 365, do not use proprietary development languages like Force.com with Apex.

Microsoft owns its global cloud infrastructure (not leased like SFDC), operates transparently, and offers a financially-backed 99.9 percent SLA with monthly measurement periods.

CRMOL has data centers in twice as many regions worldwide as SFDC.

Ability to deploy solution on-premises, online, or hybrid scenarios.

- 5. One Microsoft:** Harness the breadth of Microsoft technologies to deliver exceptional customer experiences.

Dynamics CRM offers a customer engagement solution with immersive Office 365 productivity experiences embedded, including Outlook, Yammer, Skype for Business, Excel, OneNote, SharePoint, Delve, OneDrive, social Insights, and social engagement.

With the 2016 release, embedded Cortana Analytics scenarios for Sales and Service and support for Azure IoT are available.

Enterprise Mobility Suite (EMS) and Intune for mobile device and app security.

Pending the approval and closing of the LinkedIn acquisition, Microsoft expects to launch new user scenarios bringing together Office and LinkedIn to make use of social data to enhance selling capabilities.

<sup>1</sup>Onsite service includes both field service and project service automation.

#### **Win/ Loss Insights**

Microsoft Dynamics CRM has demonstrated success selling licenses to companies where a Microsoft footprint exists, particularly Microsoft SQL Server database software, Microsoft SharePoint Server, Microsoft Office 365, Microsoft Office, Microsoft Dynamics ERP, and custom applications for Microsoft .NET Framework.

#### **Microsoft's strengths vs. Salesforce**

- Effective sales engagement across IT, finance (in switcher scenarios) and line of business with partner or Microsoft Services to position the right line of business/industry solution.
- One Microsoft "Stack" innovation (with Office 365, PowerBI) and Azure for IoT and machine learning (e.g., Ecolab win in US).
- User experience with process-guided, extensible workflow to customize to multiple business processes and rapidly adapt.
- Total Cost of Ownership (TCO) and value of features only offered as expensive add-ons by SFDC: social insights and engagement, analytics, storage, sandbox environments.
- Deployment flexibility (OP, OL, hybrid) with licensing flexibility (dual use rights for cloud, mix and match different SKUs).

#### **Salesforce's Strengths vs. Microsoft**

- **Engagement:** Ineffective and/or late account team (and executive) engagement with

LOB leaders and end-users while over-relying on CIO/IT relationships.

- **References:** Lack of industry/vertical proof points, evidence at scale, and ISV solutions.
- **Platform/ecosystem:** Limited traction with Global Systems Integrators (GSIs) (Accenture, Deloitte who focus on SFDC) and ISVs (who have stated unclear path to build and monetize solutions across Microsoft stack [CRM Online, Office 365, Azure] versus Salesforce [Apps, platform, and AppExchange]).
- **Reality of Market Leadership:** LOB leader SFDC preference based on own previous use, purchase (team or department pilot), or respected industry peer use endorsement.
- **Product capability:** Microsoft has caught up in many areas, although marketing still remains a common gap cited.

#### **EU Model Clauses and DPA**

Salesforce now provides a new DPA with EU Model Clauses or Binding Corporate Rules - depending on the workload. Salesforce's DPA doesn't protect customers who buy via resellers.

#### **Data Retention – Deletion**

Salesforce commits to retain data for 180 days after the subscription expires.

Salesforce commits to delete customer data within 210 days after the subscription expires.

#### **Sub-contractors**

- Salesforce provides a list of subcontractors with their names, countries of location, and the services they perform.
- Salesforce provides prior notice of the appointment of a new subcontractor. However, Salesforce does not specify how many days in advance such notice shall be provided.
- Salesforce provides customer's right to exit the agreement due to a new subcontractor.
- Salesforce allows customers to audit their subcontractors.

#### **Data Location**

Salesforce does not offer a commitment in this regard.

#### **Customer Waiver of IP Rights**

Salesforce does not restrict a customer's right to assert its IP as a condition of using the services, to pursue its claim as part of a class action, or to request a trial by jury.

#### **SLAs**

Salesforce does not offer an SLA commitment.

#### **Suspension from Service**

Salesforce commits to use commercially reasonable efforts to provide notice prior to suspension for violations of the AUP, and for non-payment (unless payment is by credit/debit card and it has been declined). In the non-payment scenario, Salesforce is still draconian compared to Microsoft because it would also accelerate all fee obligations.

**Audits**

Also, Salesforce allows customers to audit their online services and subcontractors. However, there are 2 things worth highlighting:

- Salesforce will not share its certifications with customer’s auditors if the customer is a Salesforce competitor.
- There is no commitment to do the ISO 27001 audits yearly, or within any other time frame for that matter.

**Security Standards**

Salesforce has stated that it complies with ISO 27018; however, Salesforce still does not contractually commit to comply with it.

**Security Incidents**

Salesforce’s commitments with respect to data breaches are very similar to Microsoft’s.

**Limitation of Liability**

Salesforce’s liability (including data breaches) is limited by a cap equal to the amount spent during the 12 months prior to the incident giving rise to liability.

**Use of Customer Data**

Salesforce’s commitments in this matter are essentially equivalent to Microsoft’s. Also, Salesforce has stated that it complies with ISO 27018; however, Salesforce still does not contractually commit to comply with it.

**Law Enforcement Request for Data**

Salesforce does not commit to redirect the entity to the customer and requires the customer to absorb the costs associated with providing the information.

**Compliance with Laws**

Salesforce only agrees to comply with data protection law.

**Changes to the Terms**

Salesforce’s commitments on this issue are essentially equivalent to Microsoft’s.

**Changes to Services**

Salesforce commits not to materially decrease the overall services’ security and functionality, and not to materially change the service’s performance. [Note that while Microsoft does not make these commitments, it does have a fallback that can close the ‘no decrease of overall security’ gap].

**Salesforce Assessment**

Differentiators	Advantages	Disadvantages
<ul style="list-style-type: none"> <li>• Force.com is typically sold as an adjunct to Salesforce CRM. Their identity platform similarly is tied to</li> </ul>	<ul style="list-style-type: none"> <li>• Some apps can be built solely with point-and-click tools. Making development more accessible.</li> </ul>	<ul style="list-style-type: none"> <li>• Customer lock in is total with Force.com. The platform, language and tools are all proprietary.</li> </ul>

<p>CRM (pricing model wise).</p>	<ul style="list-style-type: none"> <li>• Developers can also use Apex, a Salesforce language for more advanced efforts.</li> <li>• Customer self-selection: Since your customer data is in the Salesforce cloud, why not built your apps there too?</li> </ul>	<ul style="list-style-type: none"> <li>• Has no IaaS offerings (different approach). Its storage also focuses on the Non-Relational data stores and its own services.</li> </ul>
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**Table 15: Salesforce Assessment**

**Pricing and Licensing**

**Azure Pricing and Licensing<sup>35</sup>**

Microsoft Azure is a growing collection of integrated cloud services—analytics, computing, database, mobile, networking, storage, and web—for moving faster, achieving more, and saving money. We will review below all the available Azure purchase options<sup>35</sup>.

**Azure in the Enterprise Agreement**

**Enterprise Program General Information**

The following sections describe the overall structure and **offerings** within the Enterprise Programs:

- **Price Protection**  
Customers and channel partners (in the case of indirect channels) are guaranteed to receive prices at or below those indicated in their Customer Price Sheet (CPS) or the price in effect on the effective date of their Azure purchase. This price is referred to as the Baseline price. For services introduced after that purchase, it is the price in effect at the applicable level discount when the service was first introduced. This price protection applies for the duration of the commitment term which can be 1 or 3 years depending upon the Enterprise Program.
- **Price changes**  
Microsoft may drop the current Enterprise Program price for individual Azure services during the term of an enrollment. Microsoft will extend these reduced rates to existing customers while the lower price is in effect. If these rates are subsequently increased later, the enrollment’s price for a service will not increase beyond the customer’s price protection ceiling as defined above but may increase relative to the prior lowered price. In either case, Microsoft will inform customers and indirect channel partners of upcoming price changes by emailing the enterprise and partner administrators associated with the enrollment.
- **Current Effective Pricing**  
Customer and channel partners can view their current pricing for an enrollment by logging into the Azure Enterprise Portal and navigating to the price sheet page for that enrollment. If a customer purchases Azure indirectly through one of Microsoft’s channel partners, he will need to obtain his pricing updates from his channel partner if they have not enabled markup pricing to be displayed for customer’s enrollment.
- **Introduction of new Azure Services**  
Microsoft is continually enhancing Azure and periodically add new services that are priced separately from existing services. Some preview services are automatically available, while others require customer action via in the Azure Account Portal. Note also that as services move from Preview to Generally Available (GA), prices may increase as full performance and reliability SLAs are applied. Lastly, some services

are provided with Promotional pricing in effect when first introduced which may be increased at a future date. Any such increases moving from Preview or Promotional pricing to GA are not constrained by normal Baseline price protection and will apply to usage of those services moving forward. Customers can avoid charges related to these services by electing to not use the new service.

- Introduction of Regional Pricing**  
 In addition to the introduction of new services, services also periodically change from a single Global basis to a more Regional model as regional support for those services is increased. When regionalization of a service is first introduced, price protection applies for those new regions as compared to the prior Global price effective for the enrollment. However, additional regions introduced at a later time for that same service are considered new services and are offered at their own individual rates independent of the baseline price protection.
- Enterprise MSDN Dev/Test<sup>47</sup>**  
 Enterprise Administrators can enable Account Owners to create subscriptions based on the EA MSDN Dev/Test offer. In order for this to function correctly, the Account Owner will need to set up the EA MSDN Dev/Test subscriptions needed for the underlying MSDN subscribers. This enables active MSDN subscribers to run development and testing workloads on Azure at special dev/test rates.

**Enterprise Program Usage Calculation Guidelines**

When calculating service usage, the following Enterprise Program guidelines should be used.

- Enterprise Program Units of Measure**  
 The units of measure for Enterprise Programs are often different than seen in other Microsoft programs such as the Microsoft Online Services Agreement program (MOSA). This means that, for a number of services, the unit of measure is aggregated to provide the normalized pricing. The unit of measure shown within the Usage Summary view of the Enterprise Portal is always the Enterprise measure. A full list of current units of measure and conversions for each service is provided within Friendly Service Names.
- Rounding Rules**  
 Rounding done within the Enterprise Portal uses the IEEE standard Banker Rounding or Gaussian Rounding logic. This rounds to the nearest even digit for half digit values where the more typical Half Round Up rounding functions always round half digits up to the next highest digit. This method actually provides a more accurate total sum over the group when compared to the standard Excel logic. The example below shows the difference between these two methods.

	Initial Value	Banker Logic	Standard Excel Logic
	0.5	0	1
	1.5	2	2
<b>Sum</b>	2	2	3

Figure 115: Banker Logic vs. Standard Excel Logic

For reference, when using Excel to model the rounding and conversion rules used within the Enterprise Portal, the MROUND formulas should be used as shown below.

Scenario	Banker Logic Formula
Rounding Usage	=MROUND({source}, 0.0002)
Rounding Pricing (2 decimals)	=MROUND({source}, 0.02)
Rounding Pricing (0 decimals)	=MROUND({source}, 2)

Figure 116: Cloud Service and Virtual Machine Hours Conversion

- Conversion between Download Usage File and Usage Summary Portal View**  
 Raw resource utilization data is reported up to a maximum of 6 decimal places as can be seen in the download usage data report. However, the Azure Enterprise Portal rounds usage to 4 decimal places for commitment units and truncates to 0 decimals for overage units. In addition, conversion to the Enterprise unit of measure must first be applied to the reported usage after which the result is subsequently rounded or truncated. Note that the actual consumed hours before conversion is shown only in the download usage report and not within the UI itself. As an example, assume 694.533404 actual SQL Server hours are reported in the Download Usage Report as shown below.

Service	ServiceType	ServiceRegion	ServiceResource	ResourceQtyConsumed
Virtual Machines	SQL Server Standard	All	Compute Hours	694.533404

Figure 117: Download Usage Data Example

These units are then converted to 6.94533404 units of 100 Compute Hours which is then rounded to 6.9453 to be displayed in the Enterprise portal as shown below.

November Usage Summary					
Account Owner: All Accounts				Subscription: All S	
Service Name	Resource Consumed	Included Units	Billable Units	Unit Of Measure	Commitment Units Applied
SQL Server Standard	6.9453	0	6.9453	100.000 Hours	6.9453

Figure 118: Enterprise Portal Usage Example

These units are then simply multiplied by the Commitment Unit Price, and the result is truncated to two decimals to determine the extended billing amount. For this same example in overage, the billable units would simply be truncated to 6 and then multiplied by the Overage Unit Price to determine the extended billing amount. For Managed Service Provider (MSP) billing, all usage associated to a Department marked as MSP is truncated to zero decimals after conversion to the EA unit of measure as is done for overage reporting. As a result, the sum of this usage could be lower than the sum total of all usage reported in the UI depending on if the MSP is still within their monetary commitment balance or is already in overage.

- Graduated Pricing**  
 Enterprise Program pricing does not currently include graduated pricing (where pricing per unit decreases as utilization increases). When moving from a MOSA program with graduated pricing to an Enterprise Program, the pricing is generally set commensurate with the base tier for that service, after adjusting for Enterprise Program discounts, if applicable.



- Partial Hour Billing**  
 All usage is billed based on minutes converted to partial hours in lieu of whole hour increments. Enterprise rates listed as hourly are simply applied to the total hours including any partial hours.
- Average Daily Consumption**  
 When a service is priced on a monthly basis but usage is reported on daily basis, this usage is actually evaluated once per day, divided by 31 and summed across the number of days in that billing month. This results in rates that are never higher than expected for any month and are actually slightly lower for those months with less than 31 days.
- Compute Hours Conversion**  
 Cloud Services, Azure Virtual Machines, and Web Sites hours are all converted to small instance hours within each service category for billing based on a common doubling of billed hours per tier above the Small instance size. The tables below provide specific guidance:

Cloud and Virtual Machine Compute Instance Size	Small Instance Hours Conversion Factor
<b>Extra Small</b>	Cloud Services – 1/4x Windows VM – 2/9x Linux VM – 1/3x
<b>Small</b>	1x
<b>Medium</b>	2x
<b>Large</b>	4x
<b>Extra Large</b>	8x

Figure 119: Cloud Service and Virtual Machine Hours Conversion

Websites Reserved Instance Size	Small Instance Hours Conversion Factor
<b>Small</b>	1x
<b>Medium</b>	2x
<b>Large</b>	4x

Figure 120: Web Sites Hours Conversion

- Regions**  
 For those services where zone and region affect pricing, the following table shows the mapping for geographies and regions:

Geo	Data Transfer Regions	CDN Regions
<b>Zone 1</b>	Europe North Europe West US West US East US North Central US South Central US East 2 US Central	North America Europe
<b>Zone 2</b>	Asia Pacific East Asia Pacific Southeast Japan East Japan West Australia East Australia Southeast	Asia Pacific Japan Latin America Middle East / Africa Australia East Australia Southeast
<b>Zone 3</b>	Brazil South	

**Figure 121: Mapping for geographies and regions**

Note that there are no charges for data egress between services (e.g. O365 and Azure) housed within the same data center.

- **Third Party Products**

Products and services provided from third party sources are not eligible for Microsoft’s volume licensing discounts and do not consume Azure monetary commitment balances. Instead, these items will be billed separately each quarter for all usage. Affected products include:

- Azure Marketplace (third party products only)
- Java Development Environment
- Linux Support Plan
- Oracle Software on Azure

- **Azure Marketplace**

For Direct customers, Marketplace charges are visible on the Enterprise Portal. Note that all Marketplace purchases and consumption will be billed outside of Monetary Commitment and is billed quarterly and in arrears.

Indirect customers can find their Azure Marketplace subscriptions on the ‘Manage Subscriptions’ page of the Enterprise Portal, but pricing will be hidden. Customers should contact their License Solution Partner (LSP) for information on Marketplace charges.

**Benefits**

The EA offers enterprise customers four distinct **benefits** as they invest in Microsoft Azure.

**Great EA Pricing**

Through their EA commitment to Microsoft, enterprise customers will get the best Azure prices based on their infrastructure spend—regardless of their upfront Microsoft Azure commitment. These discounts are provided on top of per meter prices that for commodity services like compute, storage and bandwidth Microsoft committed to beat Amazon’s prices (Microsoft made a commitment to match AWS prices for commodity services such as Compute, Storage and Bandwidth when comparable in service offering type and purchase model. Published October 11, 2014.)

### Purchase simplicity

Microsoft has also extended those same great rates to unplanned growth customers have on Windows Azure, so they are free to grow as their organizations' need.

### Annual Payment

Customers can now pay Microsoft at the end of the year for that unplanned growth, as long as that extended use is within certain thresholds (more below).

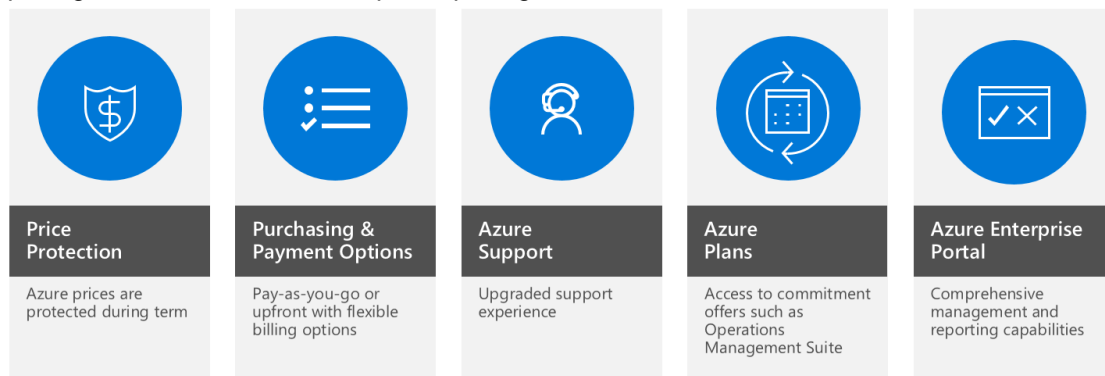
### Enterprise portal

Microsoft Azure via the EA also gives customers access to the Enterprise Portal, a great resource for customers managing multiple accounts or subscriptions.

The Microsoft Azure Enterprise Portal (MAEP) is a management and reporting tool, giving enterprise customers the ability to view usage and cost information across all accounts and subscriptions within their organization.

Below will be provided details on how usage is calculated and more info regarding pricing for various Azure services in Enterprise Programs where the calculations are more complex. Basic information regarding each service can be found at Microsoft's Azure Services page while standard pricing information grouped by service area can be found at Azure Pricing page.

Please note that pricing shown on any of the Microsoft Azure pages is not Enterprise Program pricing, but is instead standard public pricing.



**Figure 122: Azure benefits for EA customers**

### How it works

Any EA customer can add Windows Azure to their EA by making an upfront monetary commitment to Windows Azure.

That commitment is consumed throughout the year by using any combination of the wide variety of cloud services Windows Azure offers from its global datacenters. If a customer's usage exceeds their commitment, they will be billed in arrears for that usage, either quarterly or annually depending on whether that additional use is more than 50% beyond their original commitment.

Windows Azure can be added to an EA agreement at any time, although the anniversary or expiration of an existing EA commitment is a great time to evaluate how you can take advantage of the tremendous cloud value Windows Azure offers for enterprises.



Figure 123: Pay for added usage at same great EA rates

	EA Additional Product	Full Server & Cloud Enrollment (SCE)	Azure-only EA (SCE or EWA)
<b>Required</b>	Azure purchase in existing EA	Installed Base SCE (SQL, CIS or VS)	Azure purchase in new EA
<b>Discounts</b>			
<b>Term</b>	EA	EA + SCE	EA
<b>Discount Criteria</b>	3 Years/Co-term with option to reduce service at anniversary		
	Enterprise Products (Core CAL/ECAL)	Broader SCE commitment	Qualifying Enrollment Level

Figure 124: Azure in EA commitment options

Program	Pay As You Go	Monetary Commitment	Azure Plans
Cloud Solution Provider (CSP)	✓		
Enterprise Agreement (EA) / (EAS)	✓	✓	✓
Server and Cloud Enrollment	✓	✓	✓
Enrollment for Education Solutions (EES)	✓	✓	✓
Microsoft Online Services Program (MOSP)	✓		
Open Programs		✓*	✓**

\*Token/ Product Key

\*\*Available in some plans

**Figure 125: Azure availability by program**

**Choosing the ideal purchase option<sup>76</sup>**

When it comes to the decision of which Azure purchase option to choose, Microsoft suggest the following:

- Prefer **CSP** for Azure-only purchases with partner-managed value-added services.
- Consider the **Enterprise Agreement** (including Server and Cloud Enrollment) for Azure purchases as part of an organization-wide commitment, or when terms and conditions not yet addressed by other programs are required.
- Consider **MOSP** for a self-service way to buy Azure where no partner or licensing program benefits are required.

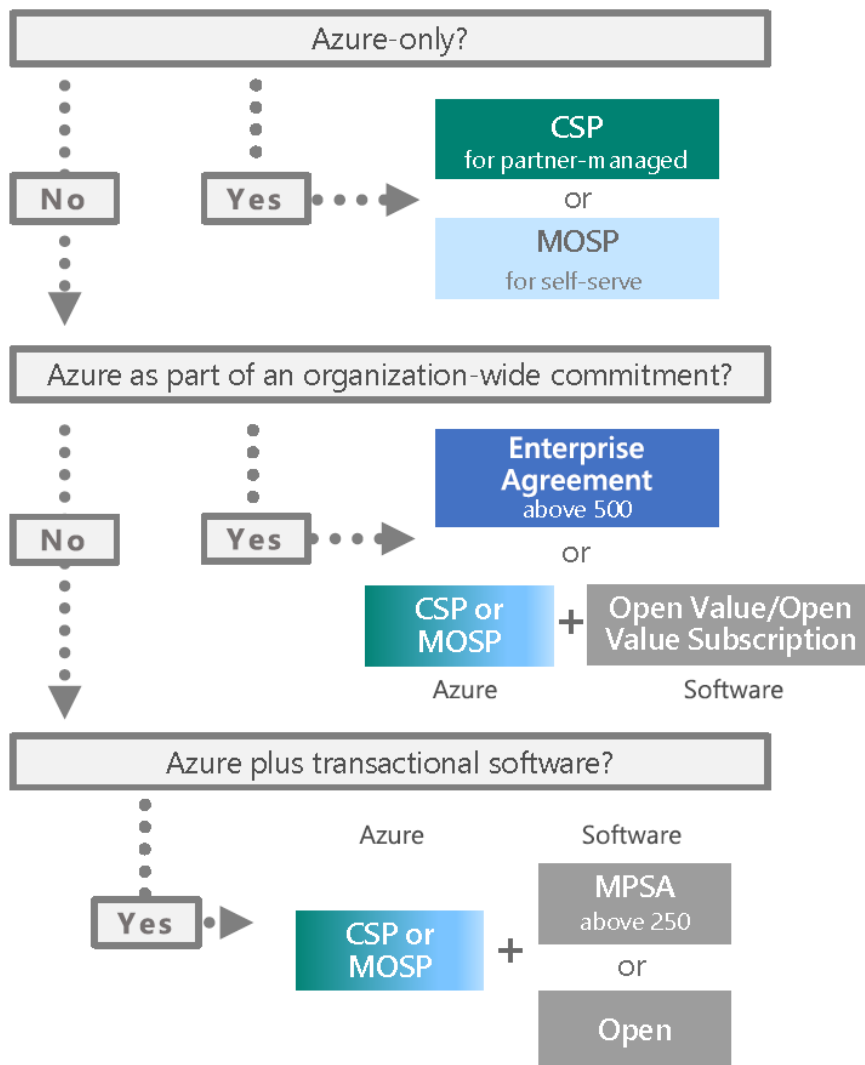


Figure 126: What customer wants - Choosing the ideal purchase option

**Monetary Commitment – examples**

**Example 1:**

Cerise Estate Management have a Monetary Commitment of \$60,000 for Azure Services on their EA. After the first quarter they want to increase the Monetary Commitment so that they don't go to quarterly billing.

Cerise Estate Management started with an initial Monetary Commitment of \$60,000 and then added \$90,000 later in month 4.

**Terms:** Monetary Commitments are allocated proportionally through the Enrollment term. Customers may increase their Monetary Commitment at the time by placing additional orders. When an additional order is placed, Allocated Annual Commitment will be increased for that year by the amount of the order. For each subsequent year remaining in the Enrollment term, Allocated Annual Commitments will be increased by the amount of the additional order, multiplied by the twelve, divided by the number of the full months between when the additional order was placed and the anniversary date following the additional order.

**Calculating Monetary Commitment Payments:**

- How many complete months are there left? 8
- What is the per month added amount?  $\$90,000 / 8 = \$11,250$

- What is that per year?  $\$11,250 \times 12 = \$135,000$
- New Monetary Commitment = Original + Calculated Yearly Addition  
 $\$60,000 + \$135,000 = \$195,000$

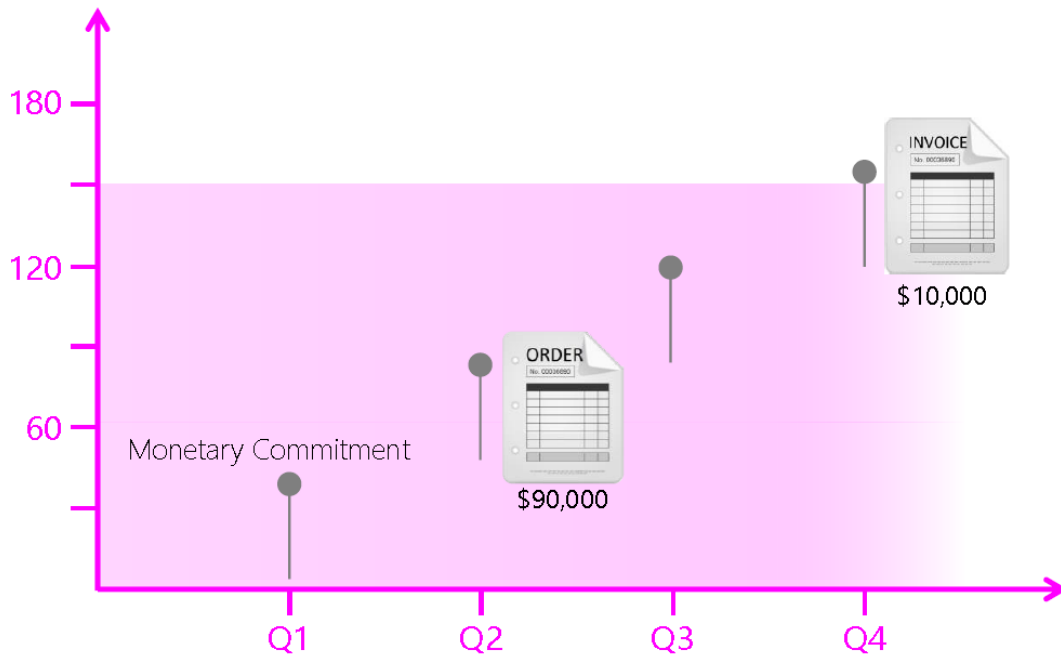


Figure 127: Azure Monetary Commitment – example 1

**Example 2:**

Tangerine Truckers have an existing on-premises server farm and now intend to extend it to Azure.

The IT Manager plans to use 2 Windows Virtual Machines and 1 Linux Virtual Machine. They want to know how much this is likely to cost them each month.

**Calculating Monetary Commitment Payments:**

Estimated Monthly cost: \$2266,22

Divide the monthly spend estimate by the monthly SKU value:

$$\$2266,22 / \$100 = 22,6622$$

Initial Order:

Unit Quantity: 12; License Quantity: 22

Annual Monetary Commitment:

$$22 \times 12 \times \$100 = \$26400$$

**AWS Pricing and Licensing**

Certain recent amendments by Amazon to its main contract had as a consequence the following changes:

- **Use of Customer Data:** Amazon has removed ambiguity regarding the terms that apply to Customer Data. It is now clear that the Privacy Policy only applies to account information and not to Customer Data.
- **Security Incidents:** Amazon makes commitments to provide notice and mitigate the effects of a security incident in its DPA.

- **Customer Indemnity of Claims:** Amazon now mandates arbitration for everything other than small claims. In addition, customer must agree not to pursue its claim as a class action and to waive a jury trial in the event a claim proceeds in a court.

**Discounting with AWS**

Some kind of commitment is required to get discount from AWS:

- Reservation Model is a commitment & most commonly used discount model.
- Volume discount on services that have usage based model if usage is beyond highest tier.
- Discount if customer agree to minimum spend & pre-paid for at least a year (mostly on spend of \$250K of higher every month).

Discounts are typically not more than 15% and may get applied on specific item or one-time purchase.

**Azure VMs vs. AWS Elastic Cloud Compute (EC2)**

Comparing AWS EC2 instances with equivalent Azure capabilities:

- AWS price matching applies only to Azure Basic tier VMs (A1 – A4)
- Regional pricing for compute - US S Central and US East 2 are lowest priced regions
- Azure Standard instances include load balancing and autoscaling

Amazon	Azure Category	Azure	Scenarios	Guidance	Azure Price
T2.micro	Current Gen - General Purpose Instances	Basic A0	Development environments, build servers, code repositories, low-traffic web applications, early product experiments, small databases.	Azure instances are considerably different from t2 – Microsoft provides more consistent CPU performance desired by most workloads, local hard disks included in the price of the VM, and different memory configurations. For example, for web servers, Azure provides a fully managed service WebSites with multiple tiers, which provides a simplified and cost-effective way to run web servers.	Higher
T2.small					
T2.medium					
M1.small		Basic A1	<i>[previous generation instance]</i>	Azure has equivalent VMs to support the same scenarios.	Match
M1.medium		Basic A2	Small and mid-size databases, data processing tasks that		



M1.large		Basic A3	require additional memory, caching fleets, and for running backend servers for SAP, Microsoft SharePoint and other enterprise applications.		
M1.xlarge		Basic A4			

**Table 16: Azure VMs (A0-A4) vs. AWS Elastic Cloud Compute (EC2)**

- D series VMS are launched with Standard instances. When the Basic tier launches there will be price matching with AWS equivalents.
- Basic instances for current gen memory intensive instances (A5 to A7) are not currently available.

Amazon	Azure Category	Azure	Scenarios	Guidance	Azure Price
M2.xlarge	Current Gen - Memory Intensive Instances	Std. A5	[previous generation of memory-optimized instances - for high performance databases, distributed memory caches, in-memory analytics, genome assembly and analysis, larger deployments of SAP, Microsoft SharePoint, and other enterprise applications.]	A5 – A7 VMs are memory-intensive instances that provide larger amounts of memory optimal for running high-throughput applications, such as databases or SharePoint server farms. Detailed configurations of these instances are available here.	Std is lower
M2.2xlarge		Std. A6			
M2.4xlarge		Std. A7			
M3.medium	New Gen – General Purpose instances	Std. D1	Small and mid-size databases, data processing tasks that require additional memory, caching fleets, and for running backend servers for SAP, Microsoft SharePoint, and other enterprise applications.	New Azure SSD-based VM instances will be released soon. We will share more details as they become available.	Plan is to match with Basic
M3.large		Std. D2			
M3.xlarge		Std. D3			
M3.2xlarge		Std. D4			

**Table 17: Azure VMs (A5-D4) vs. AWS Elastic Cloud Compute (EC2)**

- D series VMS are expected to launch with Standard instances first in Q1 FY15. When the Basic tier launches there will be price matching with AWS equivalents.
- AWS price matching applies only to Azure Basic tier VMs (D11 to D14).
- Compute intensive instances do not have a Basic tier.

Amazon	Azure Category	Azure	Scenarios	Guidance	Azure Price
R3.large	New Gen – Memory Intensive instances	Std. D11	Memory-optimized instances for high performance databases, distributed memory caches, in-memory analytics, genome assembly and analysis, larger deployments of SAP, Microsoft SharePoint, and other enterprise applications.	New Azure SSD-based VM instances will be released soon. We will share more details as they become available.	Plan is to match with Basic
R3.xlarge		Std. D12			
R3.2xlarge		Std. D13			
R3.4xlarge		Std. D14			
R3.8xlarge		N/A			N/A
CR1.8xlarge	Current Gen - Compute Intensive instances	Std. A8, A9	[previous generation instance - same as R3 above]	A8 and A9 instances provide faster processors, faster interconnect, more virtual cores for higher compute power, larger amounts of memory. Differentiators include an additional 40Gbit/s InfiniBand network that provides remote direct memory access (RDMA) technology for maximum efficiency of parallel MPI applications.	Higher

**Table 18: Azure VMs (D11-D14 & A8, A9) vs. AWS Elastic Cloud Compute (EC2)**

There are some AWS offerings for which Azure does not have a comparable solution to compete with.

Amazon	Scenarios	Azure	Guidance
Compute Optimized C3 (large, xlarge, 2xlarge, 4xlarge, 8xlarge)	High performance front-end fleets, web-servers, on-demand batch processing, distributed analytics, high performance science and engineering applications, ad serving, batch processing, MMO gaming, video encoding, and distributed analytics	N/A	Microsoft offers solutions such as HPC pack for large scale compute-intensive applications. Customers can also make use of A8 and A9 instances in Azure HPC clusters.
Compute Optimized C4	Compute optimized instances with Intel Xeon E5-V3	G series	.G-series offers up to 32 vCPUs using the latest Intel® Xeon® processor E5 v3 family, 448GB of memory, and 6.59 TB of local Solid State Drive (SSD) space.
GPU G2 (2xlarge)	Game streaming, video encoding, 3D application streaming, and other server-side graphics workloads.	N/A	We are exploring GPU instances in Azure and will share more details as they become available.

Storage Optimized I2 (xlarge, 2xlarge, 4xlarge, 8xlarge)	NoSQL databases like Cassandra and MongoDB, scale out transactional databases, data warehousing, Hadoop, and cluster file systems.	N/A	G Series - instances with 32 vCores, ~450GB RAM to support workloads that require high IOPS.
Storage Optimized HS1 (8xlarge)	Data warehousing, Hadoop/MapReduce, Parallel file systems	N/A	HDInsight is our PaaS offering for running Hadoop clusters providing big data capabilities. For data warehousing, we have no information to share at this time.

**Table 19: AWS offerings for which Azure does not have a comparable solution to compete with.**

**Azure EA benefit over AWS Reserved Instance**

Customers procure through EA to get the best price. Azure EA not only provides customers Microsoft’s best price but also offers value that customers will not find in the competitor procurement model.

- Unlike AWS, Azure monetary commitment is consumed throughout the year by using any combination of the wide variety of cloud services.
- Discount customers get applies on most of Azure Services. These discounts are provided on top of per meter prices that for commodity services like compute, storage and bandwidth Microsoft has already committed won’t be beaten by Amazon. Thus, consuming Azure services across the broad is more cost effective.
- Microsoft doesn’t lock customers in a region and price. When Microsoft reduces the Pay-As-You-Go price, the same price drop applies to monetary commitment.
- Customers pay the same EA rate when they exceed their commitment. There is no overage penalty. They also have the ability to step down at anniversary. That means customers can start small if that is what they prefer and grow from there.
- Microsoft offers per minute billing for Azure compute resources. So, if a customer runs a VM (or Cloud Service, or Web Site, or Mobile Service) for only 6 minutes in an hour, Microsoft only charges him for the actual 6 minutes of compute usage.
- Software Assurance customers can deploy owned licenses on the cloud. Many Azure images including SQL Server Enterprise Edition and Oracle Database are available via direct hourly rate.
- Microsoft offers license portability of the software licensed under MSDN on Azure Virtual Machines, providing greater flexibility for developing and testing their applications. This cloud use right applies to all software included in the MSDN subscription except Windows client and Windows Server.
- Customers can make use of Azure EA offers which offer Azure credits & deployment funding along with Azure MSDN offer.

**AWS Reserved vs. Azure in Enterprise Agreement**

**AWS Reserved Instance Pricing:**

- The effective rate depends on utilization
- Precise capacity planning/predication required
- Lock your rate, no benefit of price drops
- Only for compute instances

**Azure in EA:**

- Discount you get applies to most of your Azure services
- When we reduce the Pay-As-You-Go price, the same price drop applies to monetary commitment

- No penalties for overuse
- Cover additional incremental usage with quarterly or annual payments

#### **Google Pricing and Licensing**

Google claims to have a customer friendly pricing with the following characteristics:

- **No upfront costs**  
Customers don't need to make commitments to get great prices. Google Cloud Platform is on average 60% less for many compute workloads than other clouds.
- **Pay as you Go**  
By paying for services on an as-needed basis for resource allocation, customers are able to save money and direct more focus to innovation.
- **No termination fees**  
The second customers turn off services is the second they stop paying for that service.

#### **Pricing Innovation<sup>83</sup>**

- **Sustained Use Discounts**  
Automatically calculated and reflected up to 30%-off workloads that run for a significant portion of the billing month on Compute Engine and Cloud SQL.
- **Per second billing**  
You pay per-second, which is extremely fair.
- **Custom Machine Types**  
Customers can pick any configuration of CPU and memory to save up to 50% compared to fixed machine types from other clouds. Custom Machine Types allow the user to define how much CPU-power and how much RAM is needed on a VM.
- **Rightsizing Recommendations**  
Customers can take advantage of compute sizing recommendations based on usage, so they consume less and save time on management.
- **Preemptible VM instances**  
Up to 80%-off workloads that can be interrupted, like data mining and data processing.
- **Coldline**  
Archival storage at the cost of tape at the speed of disk
- **Committed Use discount**  
Savings of up to 57% without upfront fees or instance-type lockin.

#### **Basic Pricing Pillars**

- **Compute**  
Custom machine types provide exactly what customers need for their specific workloads. Google's machines roll up in minutes and automatically scale as customers' needs change, helping them avoid over allocating resources. And the more they use, the more they save with sustained use discounts.
- **Storage**  
From managed storage solutions to roll-your-own databases, GCP is designed to keep customers' data secure and highly accessible. Google offers best-in-class IOPS, automatic replication, and live disk resizes (all at no cost premium). Blob storage starts at \$0.007 (in US regions) with millisecond response times.
- **Network**  
Customers can access to Google's global network, with pricing that works for them. Competitive egress pricing compared to other clouds and thus customers don't have

to worry about additional operational expenses, like they do with non-cloud infrastructure.

Google updated its US G Suite (Online) Agreement and Data Processing Agreement and as a result:

- **Data Retention:** Google no longer commits to data retention after the expiration of the agreement.
- **Data Deletion:** Google has limited its data deletion commitment after the expiration of the contract to data the customer previously deleted.
- **Sub-Contractors:** Google now allows customers to exit the agreement if they object to a new sub-contractor.
- **Suspension from Service:** In the US, Google may now at its sole discretion suspend the provision of the service at any time if required to comply with any applicable law.
- **Audits:** Google now commits to provide full audit reports.
- **Security Standards - Use of Customer Data:** Google now contractually commits to ISO 27018.
- **Security Incidents:** Google's definition of Data Incident no longer covers accidental losses. Also, Google no longer commits to work with customers to address the breach.
- **Limitation of Liability:** In the US, Google now states that its liability (including data breaches) is limited by a cap equal to the amount spent during the 12 months prior to the incident giving rise to liability.
- **Law Enforcement Requests:** Google will now release customer data to third parties if the request is related to exceptional circumstances involving danger of death or serious physical injury to any person.
- **Changes to Terms:** In the US, Google can now make material changes to the URL Terms (AUP and SLA) with prior notice. Even though Google provides a process for the customer to keep the original terms for a certain period of time, that process is now not available if Google needs to comply with a court order or applicable law.
- **Changes to the Services:** In the US, Google may now discontinue the service or any portion/feature for any reason at any time without liability to the customer. Google now commits to notify customer of any material changes or if it intends to make a Significant Deprecation. If Google intends to make a Significant Deprecation, it now commits to use commercially reasonable efforts to continue to provide the original service for 12 months after the notification with some broad exceptions.

### **Salesforce Pricing and Licensing**

#### **Salesforce License Cost**

- **Professional Edition** – list price is \$65 user/month
- **Enterprise Edition** – list price is \$125 user/month
- **Platform Edition** – Enterprise App list price \$25 user/month

It is important to note that customers can't mix Salesforce Licenses between Professional and Enterprise but they can mix these two with Platform Edition. They also can add on a special Salesforce License type called Chatter Paid which is listed at \$15 /user/month. Salesforce License allows customers to have different functionality and features.

Professional and Enterprise editions both come with the core standard objects (Leads, Accounts, Contacts, Campaign, Cases and Opportunities). What customers have to determine is

who within their organization needs access to CRM and what the roles are. Identifying roles will directly impact Salesforce License cost.

Roles that need read + write access to core objects (outside of Accounts and Contacts) will always require a full CRM core Salesforce License. If a role only needs read access to Accounts and Contacts but will work in other non-core objects (custom) then these Salesforce License users should use Chatter Paid or even Platform. The advantage and difference with Platform is that customers have read + write access to Accounts and Contacts. Also known as CRUD (Create, Read, Update & Delete). Platform is designed to give customers the foundation of Salesforce without the CRM core objects so they can build their own apps or business processes.

Salesforce now offers a new Data Processing Agreement with Binding Corporate Rules.

- **Compliance with EU Law:** Salesforce now offers Binding Corporate Rules for its main workloads (Sales Cloud, Service Cloud, Chatter, Communities, and Force.com) as part of a Data Processing Addendum. For other services, Salesforce offers the EU MC's as part of a new Data Processing Addendum.
- **Security Standards:** Salesforce now has the ISO 27018 certification but it still does not commit to it contractually.
- **Audits:** Salesforce's commitments regarding audits are now the best amongst major cloud providers, and they extend to their subcontractors.

**Channel Incentives Compete**

Dan Hawtof, VP at Parago<sup>1</sup> shared the following results of a recent IT vendor survey (Survey pool: 52% small vendors (<\$100M), 22% mid-size vendors(\$100M-\$1B), 26% large vendors(>\$1B)) through their 2014 Channel Strategy webinar.

The survey reported that:

- 90% of large vendors will add new partner enablement tools
- 60% of all vendors will increase partner incentives.

Provider/ Vendor	Sales Method	Incentive Elements	Key Differentiator
Google Apps <sup>59</sup>	Direct and indirect (through resellers), pushing co-selling	20% discount	Retention requirement on seats to maintain SMB Premier status, localized partner requirements <sup>60</sup>
Salesforce	80% direct, 20% indirect	10-20% referral fee	Different rates for different markets
Microsoft	95% revenue through partners	Enterprise, Cloud, Solution, SMB, Software Asset Management (SAM) incentives	Large partner network

<b>AWS</b>	Direct (to large enterprises) and indirect (to SMB through distributors/resellers)	30% margin through consolidated billing	Low margin long reach, customer centric
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**Table 20: Sales and Channel Incentives Compete**

No vendor rated their own partner incentive programs as very easy (discounts were perceived as easiest). Over 75% of vendors maintained or increased their partner incentive participation in 2013.

43% of large vendors mentioned transitioning recurring as the greatest challenge while 30% answered reporting, 18% partner participation, and 9% budget. 15% of large vendors said they have complete insights on measuring the impact of incentive investment, while 80% have limited insight and 5% have no insight. 80% of channel incentive management is done internally and manually, with vendors using spreadsheets and other systems not robust enough to support long-term partner engagement. 74% of the vendors said they want to implement more complex incentive beyond rewarding sales, but do not have the bandwidth or the tools to do so. Only 10% of vendors incent on partner behaviors aside from sales and only 39% of vendors have implemented a recurring revenue model for partners. Only 52% of the vendors pay partner sales representatives directly and many split the incentive between the partner firm and the sales representative. 89% of vendors also incent partner sales engineers or partner marketing along with the partner sales representatives.

In February 2014, PartnerPath, a partnering development firm based in Mountain View, released the results of their 2014 State of Partnering study<sup>113</sup> where they surveyed 187 vendors and 175 solution providers in North America. Solution providers believe that market demand (vendor brand recognition, product strength, installed base) is more important to their profitability than financial rewards from a vendor (margin, rebates). Vendors on the other hand believe that financial rewards are more important to solution provider profitability than the product/brand strength which leads to increased market demand. Compared to 2013, IT vendors are focusing more on getting partners to invest more in their services capabilities and managing channel conflict. When solution providers were asked what program features and benefits are most important in a vendor's partner program besides margin, the number 1 answer changed from "Qualified leads and referrals" in 2013 to "Pre-Sales support" in 2014. The average rates IT vendors offer partners as financial rewards were 20% for discounts, 10% for deal registration, 8% for MDFs, 5% for rebates, and 5% for agent fees. Compared to 2013, deal registration, agent fees and MDF spend is on the rise in 2014.

**Google Apps**

Google Apps Resellers mentioned that they do not select a vendor based on discounts or channel incentives but rely on the recurring revenue coming from value-added services, estimating 50-95% of revenue coming from value-added services. There was wide partner consensus that Microsoft has the broadest platform opportunity, but it is more difficult to get noticed in MPN compared to GPN. Partners mentioned complex channel incentive programs and changing competency requirements as pain points when working with Microsoft.

Google is also providing premier resellers up to \$20k in partner funds for marketing - the partner and Google together set up several Google Apps events. Depending on the customer's roster, there would be several Google Sales Representatives and Engineers available with the partner to engage with the customer, evangelize the cloud. There were incentives for partners who transitioned customers to Google Apps and built line of business applications on the Google Cloud Platform or introduced Chromebooks, and contests for partners to build LOB apps on AppEngine. In March 2014 Google launched a Referral Program<sup>85</sup> that's gives a \$15 per seat (up to 100 seats) award to current Google Apps customers who refer other businesses to Google Apps. Partners are not involved in this customer to customer referral promotion.

In March 2014, Google Apps introduced the Technology Partner Track. There are two tiers, Authorized and Premier. A company can be both a Technology Partner and a Services Partner. While the 20% margin that is available to the Services Partners is not offered to the Technology Partners, these partners have access to training, marketing collateral and tools. The Premier Partner is assigned a partner manager and has an opportunity to qualify for Partner Marketing Incentive Funds for partner-driven lead generation efforts. A full list of requirements and benefits for both the Services Partner and the Technology Partner can be found [here](#). A number of cloud providers have achieved the Premier partner program level, including CloudLock, BetterCloud, UberConference and Zoho. According to Zoho, being a Google Apps Premier Technology Partner means providing customers with more integration between their services and Google Apps in a more seamless experience.

In March 2014 Google expanded its Cloud Platform (Google Compute Engine, App Engine) Partner Program to segment its existing 161 Cloud Platform Partners into three tiers. Registered partners (3 unique customers served with validated Google Cloud Platform projects) have access to online resources and training. Authorized partners (\$12K annual revenue and 2 trained technical professionals and 2 trained sales professionals) have branding and relationship management. Premier partners (\$120K annual revenue and 5 trained technical professionals and 5 trained sales professionals) will have access to premier level services. Google launched its cloud platform channel program<sup>65</sup> in 2012, opening its infrastructure as a development stage for partners and resellers. Until March 2014, the program had two tiers, technology and service providers, which segmented the channel between those leveraging the platform to host their services and those that provided technical support for companies looking for a hosted platform. Under the new structure, Google is providing human technical and sales support to its Premier partners. No financial incentive or margin has been announced as a benefit to these partners.

#### **Salesforce**

Salesforce's solutions are highly priced than Dynamics. While Salesforce has been successful with ISVs, the value proposition to traditional IT service providers has been less compelling and the majority of revenue has come from direct sales efforts. The company recently shifted focus to large global SIs as they recognize that these SIs are capable of playing as both a service provider and an ISV.

Salesforce provides referral incentives to partners that generates leads and customer referrals with the intent of closing business through Salesforce.com's direct sales organization. Lead must result in a direct Salesforce.com order from the customer. Public sector and non-profit orders are not eligible. In addition to the existing Silver, Gold, and Platinum tiers, the company added the Global Strategic tier (Accenture, Deloitte, Capgemini, PWC, bluewolf, Appirio, Saaspoint, Vivnes CRM). The referral incentive has been updated per below, the biggest changes being that the Developing Market has been integrated to Mature, the rate for Emerging dropped from 30% to 20%, and max cap and minimum threshold has been introduced for all regions.



	Before (Aug 1 <sup>st</sup> 2013 ver)	After (May 13 <sup>th</sup> 2014 ver)
Eligible tier	Platinum tier not eligible	Platinum and Global Strategic tier not eligible
Eligible regions	All regions	United State and Canada businesses not eligible
Lead submission timeframe	Deal must close within 6 months of lead submission	Lead must be submitted prior to opportunity close
Invitation	Access to incentive by invitation in some countries	Invitation criteria removed for all countries
Incentive Rates (based on 1 <sup>st</sup> year annual contract value)	Mature 10%, Developing 20%, Emerging 30%	Mature 10%, Emerging 20%
Max payout cap	No cap for emerging	\$150,000 for emerging
Minimum payout threshold	\$100 for Americas, none for others	\$200/month (EMEA), \$200/quarter (other regions)

**Figure 128: Salesforce's Referral Incentive changes**

In April 2013 the company announced a new product suite called Government Cloud<sup>130</sup> with enhanced security features. To target the education and non-profit sector, Salesforce.com Foundation provide the "Power of Us" program<sup>84</sup> that offers 10 donated Enterprise edition licenses and deep discounts on licenses, products, training, events and apps.

#### **Amazon Web Services**

AWS revamped their partner program in 2012 and as of 2014 they have 8,000+ partners worldwide.

The main advantage for Consulting Partners on Standard or higher tiers is the option to become a Channel Reseller (\$25k/month revenue requirement, 220 worldwide as of June 25, 2014). These resellers can combine bills from multiple smaller customers into one aggregated bill to buy in bulk from AWS and get volume discounts (on average 30-40%). AWS has partnered with CloudCheckr to provide additional services for consolidated billing such as tagging, cost allocation reporting and optimization (starts at \$49/mo). AWS works with distributors for smaller resellers that do not meet these requirements. Amazon assigned Ingram<sup>7</sup> as their first distributor in June 2012 and have added Avnet, Techdata, Compusoluciones, and Westcon Group totaling five distributors. Each distributor contract with AWS is customized and the margin for the distributor is on average 30% of which 6-20% is passed down to the small reseller. These resellers can use their existing credit line with distributors and the distributor performs partner account management activities. Distributors have greater account (reseller) control and can move away from one-time transactions into recurring revenue without additional acquisition costs.

During the APN Summit in November 2013, AWS announced that they will be launching "APN Partner Leads," a new pilot program that will provide leads and opportunities to a select number of APN's top consulting partners, "APN Business Development Training Series," and "Market Development Funds" to select premier technology and consulting partners. APN Summit was attended by over 2000 partners. To enhance value prop for ISVs and developers, Amazon also launched the "Developer Select Program" through which qualifying apps will receive 500,000 free mobile ad impressions across the Amazon Mobile Ad Network, consumers purchasing the developer's app or in-app items will receive up to 30% of

the purchase price back in Amazon Coins<sup>129</sup>, and the developer will earn 25% credit (\$500/year max) back on qualifying purchases of AWS products.

### Solution Approaches – Examples

#### Microsoft Solution Approach for Financial Sector – example 1

##### Business Case:

Financial firms are dependent on risk modeling software to remain competitive. Large firms often have internal computing grid capacity set aside, requiring significant capital to upgrade and maintain but, often need additional computational capacity required by internal users.

##### Solution:

Using the vast computing and storage capacity in Windows Azure and High Performance computing, Financial Service firms<sup>29</sup> can enhance the scalability of their risk management applications, deploying large numbers of processing instances only when necessary. They can respond to demand as it comes, provisioning more instances of Windows Azure as required and reducing the number of instances as demand declines. Customers can run their risk environments entirely within Windows Azure using HPC applications or perform “burst” calculations from their on-premise HPC systems to Windows Azure; using software that is internally developed, ISV provided and/or excel based.

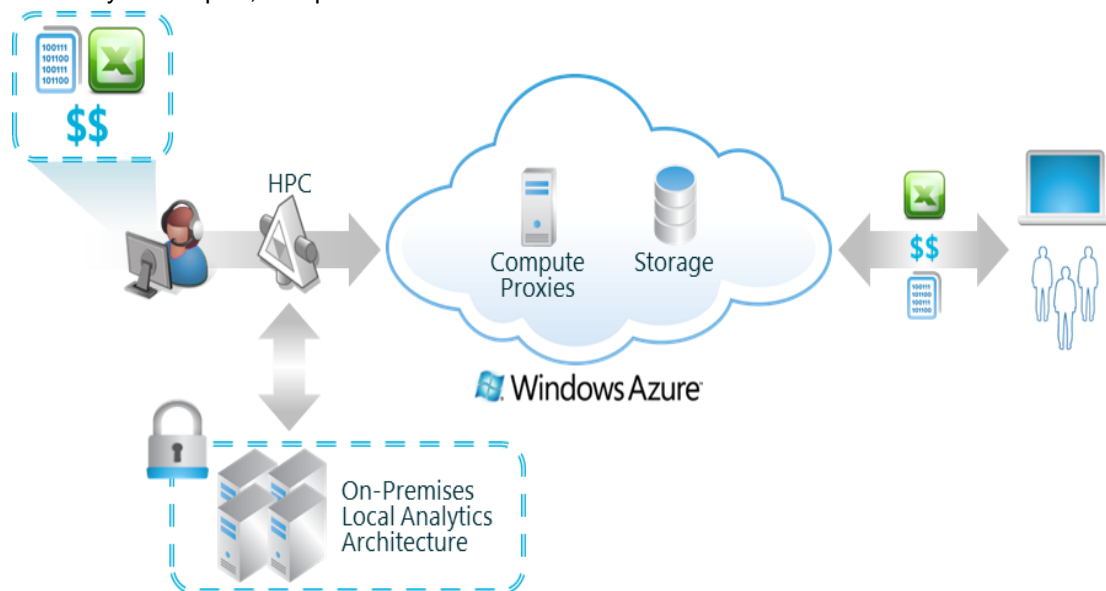


Figure 129: Microsoft Example solution for Financial Sector (graphic)

#### Microsoft Solution Approach for Financial Sector – example 2

##### Assumptions / Projections:

- Risk modeling & analytics calculation volumes are projected to accelerate 10x in the next 3 years.
- Nearly two thirds of European and North American banking and capital markets firms expect to significantly increase their spending on compliance risk management over the next couple of years, according to research from Accenture.

##### Customer Requirements:

- Lower the cost of technology and operations.
- Simplify the complexity of integration.
- Lower the time to market for new channels and products (eg: online and mobile).
- Reduce points of failure and improve operational reliability.

### Scenario Target Audience/ Stakeholders:

- **BU Sponsor:**
  - **Time to Market:** Increased focus on products well-matched to the customer's needs while being efficient in terms of their use of economic capital.
  - **Regulation:** Analyses required more frequently, models are more complex.
  - **Risk:** Calculation volume could easily be 1,000,000 times greater in the next 1-5 years.
- **BUIT/ Developers:**
  - **Cost:** internal IT cross-charges are very high, and they don't want to ask for more capacity.
  - **Time to market:** scheduling time to run these models is getting more difficult.
  - **Risk:** operations cannot give them the needed capacity and they won't meet their deadlines.
- **Central IT/ Infrastructure Ops:**
  - **Cost:** It is hard to set DC resource priorities for competing project requests; They don't want to set aside infrastructure for unpredictable needs.
  - **Time to market:** They don't understand fully what the business needs.

### Customer Needs:

- Avoid CAPEX (e.g. purchasing additional Data Center)
- Reducing time to delivery
- Meet expansion demands
- Align costs to business strategy

### Microsoft Solution:

- Bursting Scenario using HPC in the cloud.
- Move more cores per day to the cloud.
- Use in concert with On-premise datacenters allowing maximum flexibility.
- Hyper-V & Windows Azure lowers TCO.
- Vertical solution integration from a Microsoft core enables business agility and lower time to market.
- Easy integration with other providers to enable and enterprise deployment.

### Benefits Realized:

- Proven burst Scenario model
- Cloud Economics (elasticity key in this scenario)
- Turn-key Hybrid cloud proposition

### Economic analysis & Sizing - Examples

#### Forrester "Total Economic Impact" - Customer Example of Transition to Cloud

A Forrester "Total Economic Impact" study examined the potential Return on Investment that enterprises may realize by deploying a "Software as a Service" (SaaS) Cloud solution. The selected SaaS Cloud solution was **O365**.

**Customer dynamic:** Light manufacturing, distribution and sales company with 6,000 employees, 300 road warriors, and 8 sales offices across US & Canada and manufacturing operations in Europe & Asia.

#### Summary of Impact:

- Cloud Investments of **\$3.2m** over 3 years
- Economic Benefit of **\$8.8m** over 3 years

- **\$5.6M** in risk-adjusted NPV over three years

**Costs:**

- Implementation Labor ~\$400k
- Professional Services ~\$420k
- Training ~\$910k
- System Admins ~\$1.1m
- Incremental SaaS licenses ~\$240k
- Additional Bandwidth ~\$100k

**TOTAL COSTS: +\$3.2m**

**Benefits:**

- Hardware/Software avoidance ~\$670k
- Less Implementation ~\$270k
- Ongoing Labor Costs ~\$1.42m
- Mobility Productivity ~\$2.81m
- Software Productivity ~\$3.25m
- 3<sup>rd</sup> party software ~\$250k

**TOTAL BENEFITS: +\$8.8m**

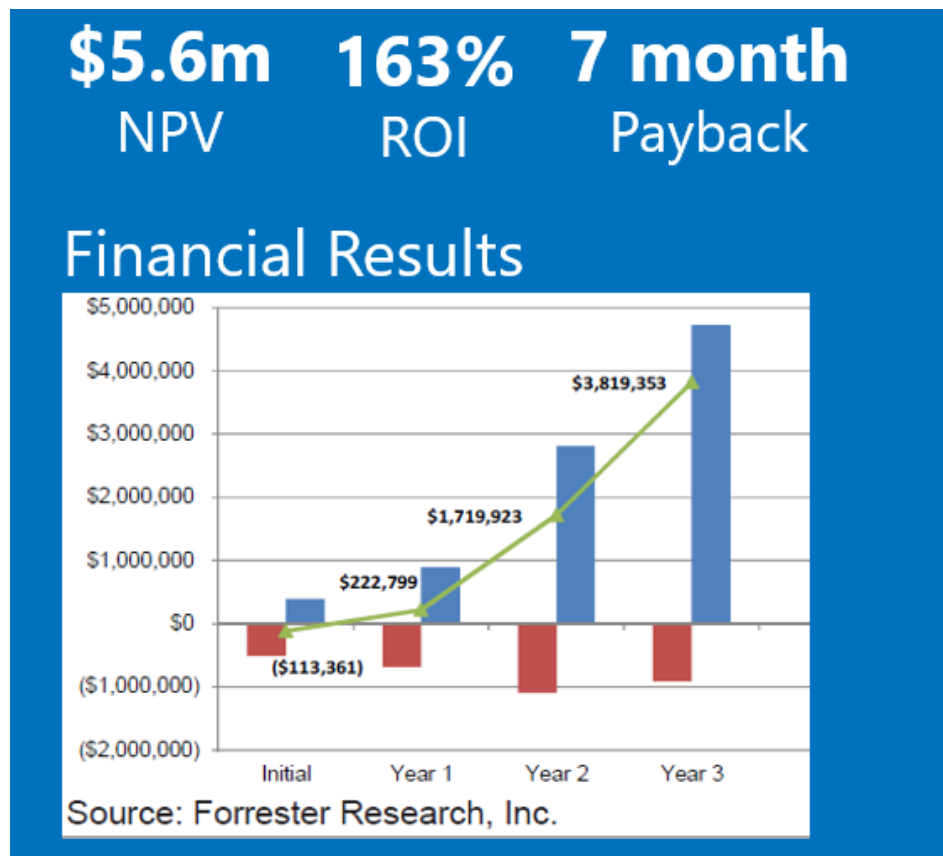


Figure 130: Financial Results of Customer Example: Transition to Cloud

**Bringing SharePoint to Azure – example**

- Azure offers popular SharePoint configurations through single, one-click deployments; each configuration is completely customizable to customers' particular

requirements, including selection of Standard or Premium storage options for customers' most demanding workloads.

- Azure has the best hybrid connectivity story between customers' SharePoint farms deployed with Azure Virtual Machines, their O365 applications<sup>133</sup>, and their on-premises deployments with ExpressRoute capabilities that ensure high performance.
- 20-30x faster infrastructure provisioning on Microsoft Azure with provisioning time reduced from days to minutes.

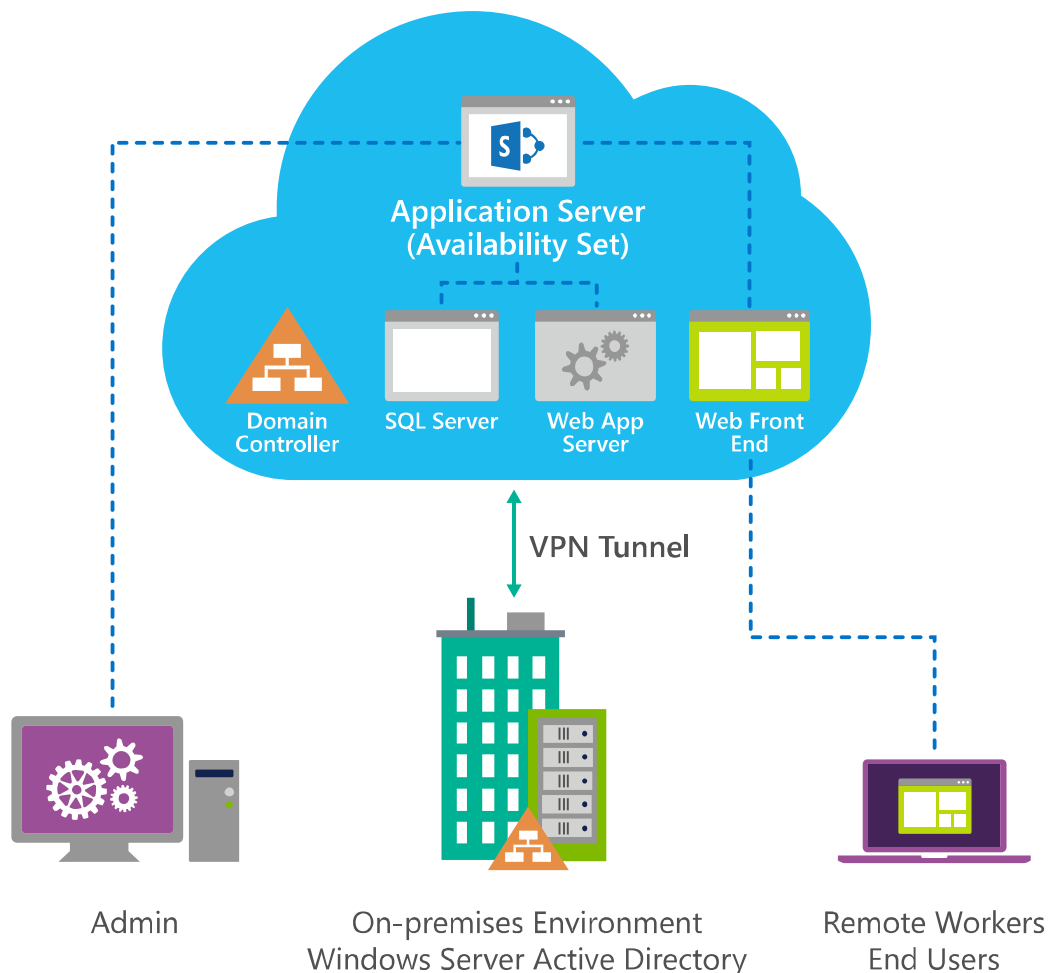
**Typical TCO savings:**

55 VMs: 20 medium, 22 extra large, 13 A7

35 TB LR storage

35 TB zone 1 egress, 5 VPN connections

The savings quoted in the slides are actually quite conservative (e.g., we assume on-premises infrastructure is 100% utilized, assume a very power-efficient on-premises data center). Also, we are using EA Level A pricing to arrive at these numbers.



**Figure 131: Bringing SharePoint to Azure**

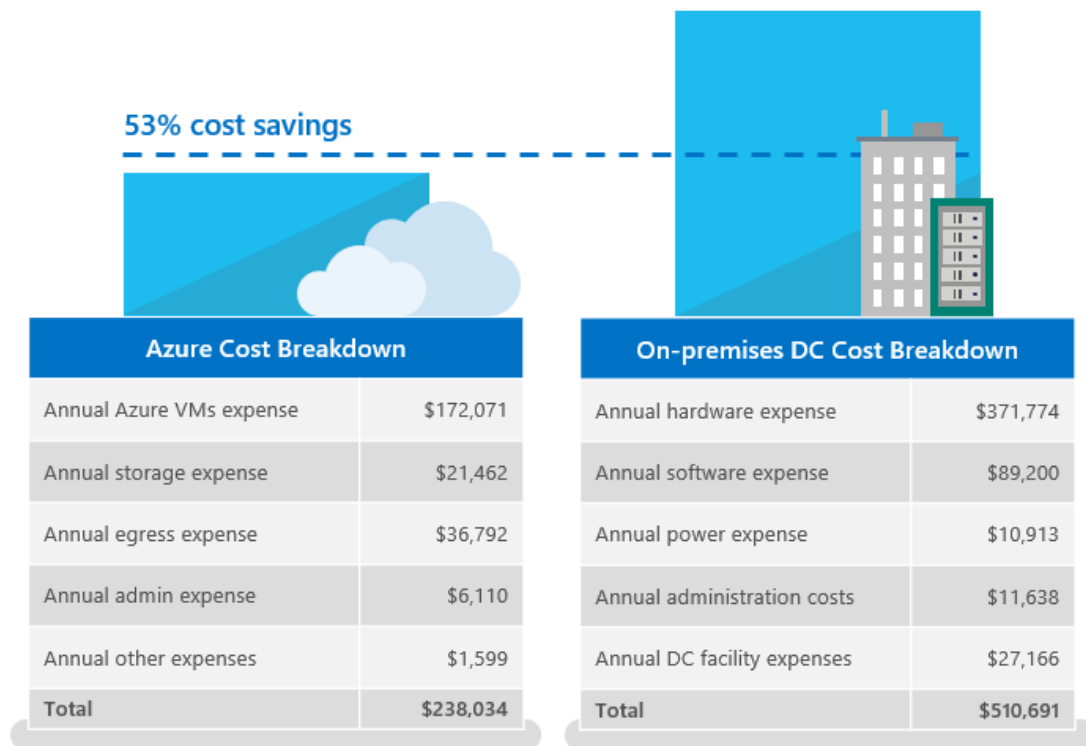


Figure 132: Bringing SharePoint to Azure - cost savings

**Sizing the same scenario through Online, EA & CSP**

**Web (Microsoft Site)**

Service type	Custom name	Region	Description	Estimated Cost
Virtual Machines	Virtual Machines	West Europe	2 Standard virtual machine(s) Windows type, A1 (undefined, 1 cores, 1.75 GB RAM, 70 GB disk, \$0.090/hr) size, 744 hours	\$133,92
Virtual Machines	Virtual Machines	West Europe	10 Standard virtual machine(s) Windows type, A2 (undefined, 2 cores, 3.5 GB RAM, 135 GB disk, \$0.180/hr) size, 744 hours	\$1.339,20
Virtual Machines	Virtual Machines	West Europe	1 Basic virtual machine(s) Windows type, A3 (undefined,	\$241,06

			4 cores, 7 GB RAM, 120 GB disk, \$0.324/hr size, 744 hours	
Virtual Machines	Virtual Machines	West Europe	3 Standard virtual machine(s) Windows type, A3 (undefined, 4 cores, 7 GB RAM, 285 GB disk, \$0.360/hr) size, 744 hours	\$803,52
Virtual Machines	Virtual Machines	West US	2 Standard virtual machine(s) Windows type, D3 (undefined, 4 cores, 14 GB RAM, 200 GB disk, \$0.560/hr) size, 744 hours	\$833,28
Storage	Storage	West Europe	28 TB storage Page Blob and Disk type. Basic tier, GRS redundancy, 1 x100,000 transactions	\$2.309,12
Storage	Storage	West Europe	23 TB storage Page Blob and Disk type. Basic tier, LRS redundancy, 1 x100,000 transactions	\$1.177,60
Support			Support	\$0,00
			Monthly Total	\$6.837,70
			Annual Total	\$82.052,44
<p><b>Disclaimer:</b>  <i>All prices shown are in US Dollars (\$). This is a summary estimate, not a quote. For up to date pricing information please visit <a href="https://azure.microsoft.com/pricing/calculator/">https://azure.microsoft.com/pricing/calculator/</a></i></p>				

Figure 133: Sizing Example - Azure through Online

**Enterprise Agreement (EA)**

Service type	Custom name	Region	Description	SKU	Estimated Cost
Virtual Machines	Virtual Machines	West Europe	2 Standard virtual machine(s) Windows type, A1 (undefined, 1 cores, 1.75 GB RAM, 70 GB disk, \$0.066/hr) size, 744 hours	N7H-00354	\$97,76

Virtual Machines	Virtual Machines	West Europe	10 Standard virtual machine(s) Windows type, A2 (undefined, 2 cores, 3.5 GB RAM, 135 GB disk, \$0.131/hr) size, 744 hours	N7H-02507	\$977,62
Virtual Machines	Virtual Machines	West Europe	1 Basic virtual machine(s) Windows type, A3 (undefined, 4 cores, 7 GB RAM, 120 GB disk, \$0.237/hr) size, 744 hours	N7H-02249	\$175,96
Virtual Machines	Virtual Machines	West Europe	3 Standard virtual machine(s) Windows type, A3 (undefined, 4 cores, 7 GB RAM, 285 GB disk, \$0.263/hr) size, 744 hours	N7H-02407	\$586,57
Virtual Machines	Virtual Machines	West US	2 Standard virtual machine(s) Windows type, D3 (undefined, 4 cores, 14 GB RAM, 200 GB disk, \$0.543/hr) size, 744 hours	997-01370	\$808,28
Storage	Storage	West Europe	28 TB storage Page Blob and Disk type. Basic tier, GRS redundancy, 1 x100,000 transactions	N9H-00092, N9H-00803	\$1.720,32
Storage	Storage	West Europe	23 TB storage Page Blob and Disk type. Basic tier, LRS redundancy, 1 x100,000 transactions	N9H-00090, N9H-00803	\$1.059,84
Support			Free level	<b>Support</b>	\$0,00
				<b>Monthly Total</b>	<b>\$5.426,35</b>
				<b>Annual Total</b>	<b>\$65.116,22</b>
<b>Disclaimer:</b>					
<i>All prices shown are in Euro (€). This is a summary estimate, not a quote. For up to date pricing information please visit <a href="https://azure.microsoft.com/pricing/calculator/">https://azure.microsoft.com/pricing/calculator/</a></i>					

**Figure 134: Sizing Example - Azure through Enterprise Agreement**

**CSP**

Service type	Custom name	Region	Description	Estimated Cost
Virtual Machines	Virtual Machines	West Europe	2 Standard virtual machine(s) Windows type, A1 (undefined, 1 cores, 1.75 GB RAM, 70 GB disk, \$0.077/hr) size, 744 hours	\$113,83
Virtual Machines	Virtual Machines	West Europe	10 Standard virtual machine(s) Windows type, A2 (undefined, 2 cores, 3.5 GB RAM, 135 GB disk, \$0.153/hr) size, 744 hours	\$1.138,32



Virtual Machines	Virtual Machines	West Europe	1 Basic virtual machine(s) Windows type, A3 (undefined, 4 cores, 7 GB RAM, 120 GB disk, \$0.275/hr) size, 744 hours	\$204,90
Virtual Machines	Virtual Machines	West Europe	3 Standard virtual machine(s) Windows type, A3 (undefined, 4 cores, 7 GB RAM, 285 GB disk, \$0.306/hr) size, 744 hours	\$682,99
Virtual Machines	Virtual Machines	West US	2 Standard virtual machine(s) Windows type, D3 (undefined, 4 cores, 14 GB RAM, 200 GB disk, \$0.476/hr) size, 744 hours	\$708,29
Storage	Storage	West Europe	28 TB storage Page Blob and Disk type. Basic tier, GRS redundancy, 1 x100,000 transactions	\$1.962,81
Storage	Storage	West Europe	23 TB storage Page Blob and Disk type. Basic tier, LRS redundancy, 1 x100,000 transactions	\$1.000,96
Support			<b>Support</b>	\$0,00
			<b>Monthly Total</b>	<b>\$5.812,10</b>
			<b>Annual Total</b>	<b>\$69.745,19</b>
<p><b>Disclaimer:</b>  <i>All prices shown are in Euro (€). This is a summary estimate, not a quote. For up to date pricing information please visit <a href="https://azure.microsoft.com/pricing/calculator/">https://azure.microsoft.com/pricing/calculator/</a></i></p>				

Figure 135: Sizing Example - Azure through CSP

**Sizing Navision (NAV) on Azure - example**

Service type	Region	Description	Estimated Cost
Virtual Machines	West Europe	1 Standard virtual machine(s), D2 v2 (2 cores, 7 GB RAM, 100 GB disk) size: 744 hours	€168,77
Storage	West Europe	1 disks P10 (128 GB, 500 IOPS, 100 MB/sec, \$21.68/mo), Page Blob and Disk type, Premium (SSD) tier	€18,28
Virtual Machines	West Europe	1 Standard virtual machine(s), F8 (8 cores, 16 GB RAM, 128 GB disk) size: 744 hours	€515,74
Storage	West Europe	1 disks P20 (512 GB, 2300 IOPS, 150 MB/sec, \$80.54/mo), Page Blob and Disk type, Premium (SSD) tier	€67,92
Support		<b>Support</b>	€0,00
		<b>Monthly Total</b>	<b>€770,71</b>
		<b>Annual Total</b>	<b>€9.248,55</b>

**Disclaimer:**  
 All prices shown are in Euro (€). This is a summary estimate, not a quote. For up to date pricing information please visit <https://azure.microsoft.com/pricing/calculator/>

**Figure 136: Sizing Navision (NAV) on Azure - example**

**Sizing Data Factory on Azure – example**

Service type	Region	Description	Estimated Cost
Virtual Machines	West Europe	1 Standard virtual machine(s), D3 (4 cores, 14 GB RAM, 200 GB disk) size: 744 hours	€372,06
Power BI Embedded	West Europe	5000 sessions in the europe-west region.	€206,61
Storage	West Europe	1 disks P20 (512 GB, 2300 IOPS, 150 MB/sec, \$67.92/mo), Page Blob and Disk type, Premium (SSD) tier	€67,92
Data Transfers	West Europe	50 GB/Month Zone 1 (North America, Europe)	€3,30
SQL Database	West Europe	1 standard database(s) x 744 hours, size: s1	€25,28
Support		<b>Support</b>	€0,00
		<b>Monthly Total</b>	<b>€675,17</b>
		<b>Annual Total</b>	<b>€8,102,06</b>

**Figure 137: Sizing Data Factory on Azure – example**

**Disclaimer:**  
 All prices shown are in Euro (€). This is a summary estimate, not a quote. For up to date pricing information please visit <https://azure.microsoft.com/pricing/calculator/>

**Sizing a Large Application on Azure - example**

Service type	Custom name	Region	Description	Estimated Cost
Virtual Machines	Virtual Machines	North Europe	3 Standard virtual machine(s), D12 (4 cores, 28 GB RAM, 200 GB disk) size: 744 hours , Managed disks: standard-s10 Disk type with 3 disks	€1.136,80
Virtual Machines	Virtual Machines	North Europe	1 Standard virtual machine(s), D14 (16 cores, 112 GB RAM, 800 GB disk) size: 744 hours , Managed disks: premium-p20 Disk type with 4 disks	€1.466,68
Data Transfers	Bandwidth	North Europe	1 TB/Month Zone 1: North America, Europe (North America, Europe)	€74,76
VPN Gateway	VPN Gateway	North Europe	standard tier, 744 gateway hour(s), 1 TB outbound internet	€149,43
VPN Gateway	VPN Gateway	North Europe	standard tier, 744 gateway hour(s), 1 TB outbound vpn	€193,97
Virtual Machines	Virtual Machines	North Europe	2 Standard virtual machine(s), A4 v2 (4 cores, 8 GB RAM, 40 GB disk) size: 744 hours	€343,82
Traffic Manager	Traffic Manager	North Europe	10 million(s)/mo queries, 2 Azure endpoints, 2 external endpoints	€6,07
Storage	Storage	North Europe	standard-s10 Disk type with 1 Managed disks	€2,48
Support			<b>Support</b>	€252,99
			<b>Monthly Total</b>	<b>€3.627,01</b>
			<b>Annual Total</b>	<b>€43.524,10</b>
<p><b>Disclaimer:</b>  All prices shown are in Euro (€). This is a summary estimate, not a quote. For up to date pricing information please visit <a href="https://azure.microsoft.com/pricing/calculator/">https://azure.microsoft.com/pricing/calculator/</a></p>				

Figure 138: Sizing a Large Application on Azure - example

**Sizing VMs and VPNs - example**

Service type	Custom name	Region	Description	Estimated Cost
Virtual Machines	Virtual Machines	North Europe	1 Standard virtual machine(s) Windows type, A7 (HDD, 8 cores, 56 GB RAM, 605 GB disk, \$1.012/hr) size, 31 days	€752,90
VPN Gateway	VPN Gateway	North Europe	staticdynamic tier, 744 gateway hour(s), 0 GB outbound intervnet	€22,59
Support			<b>Support</b>	€0,00
			<b>Monthly Total</b>	<b>€775,49</b>
			<b>Annual Total</b>	<b>€9.305,82</b>
<b>Disclaimer:</b> All prices shown are in Euro (€). This is a summary estimate, not a quote. For up to date pricing information please visit <a href="https://azure.microsoft.com/pricing/calculator/">https://azure.microsoft.com/pricing/calculator/</a>				

**Figure 139: Sizing VMs and VPNs - example**

**Sizing SQL on Azure - example**

Customer wants to have the following:

Azure VM A2 Instance

Azure VM A2 Instance, SQL Database

Azure VM A2 Instance, SQL Database, Storage

Azure VM D2 Instance, SQL Database, Storage

Estimations: SQL Standard through Azure, All VMs in West EU, Storage & Bandwidth excluded as there are no data

Service type	Custom name	Region	Description	Estimated Cost
Virtual Machines	Virtual Machines	West Europe	1 standard virtual machine(s) windows type, a2 size, 744 hours	€112,93
Virtual Machines	Virtual Machines	West Europe	7 standard virtual machine(s) sql type, a2 size, 744 hours, sql-standard license	€2.547,31
Support			Free level	€0,00
			<b>Monthly Total</b>	<b>€2.660,24</b>
			<b>Annual Total</b>	<b>€31.922,88</b>
<b>Disclaimer:</b> All prices shown are in Euro (€). This is a summary estimate, not a quote. For up to date pricing information please visit <a href="https://azure.microsoft.com/pricing/calculator/">https://azure.microsoft.com/pricing/calculator/</a>				

**Figure 140: Sizing SQL on Azure - example**

## Demo

For the purpose of this postgraduate dissertation there was created an excel file that can be used as a rough estimator of whether a company or an organization should invest on Azure instead of making a new or keeping an already acquired on-premise installation.

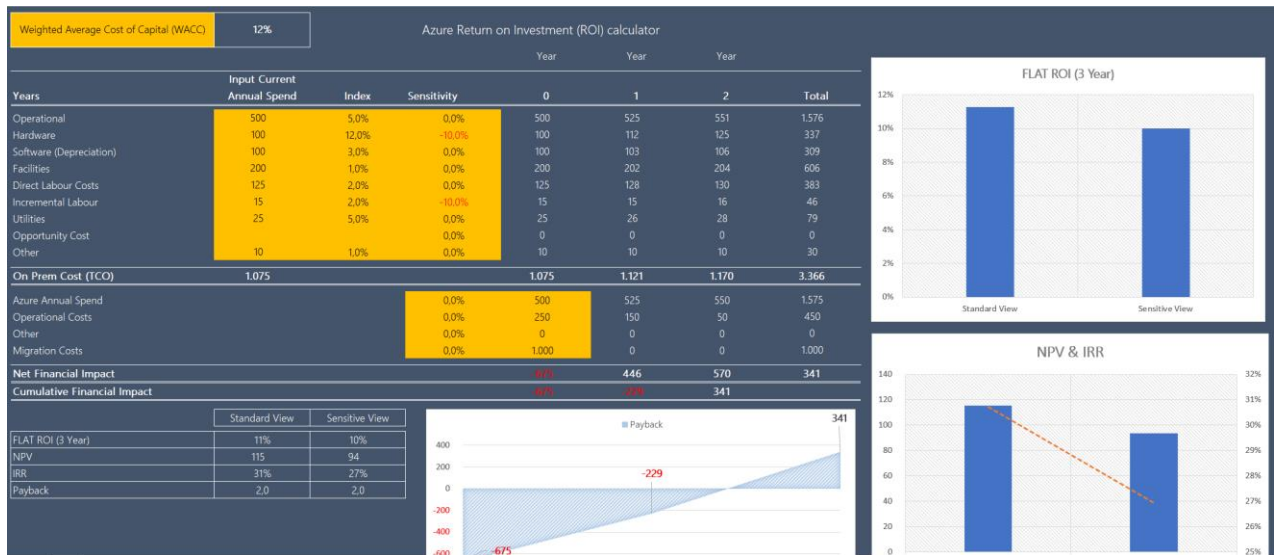


Figure 141: Azure ROI Demo Calculator

### Definitions used:

- WACC: Weighted Average Cost of Capital. Blended % cost, is the required return rate for a company.
- ROI %: Revenue - Costs / Costs = % Return
- IRR: Internal Rate of Return. A Measure for evaluating whether to proceed with a project which normally has to beat a pre-determined threshold (e.g. WACC).
- NPV: Using the company's cost of capital (WACC) the Net Present Value (NPV) is the sum of the discounted cash flows minus the original investment.

This demo calculator aims to address the following common obstacles that customers face during the cloud adopting decision process:

- Difficulty projecting service usage ramp over time
- Conversion of on-prem hardware needs to cloud utilization
- Impact of timing for opex vs capital investments

It provides:

- A clear picture of a customer's current costs versus cost in Azure
- Split of costs by category with ability for constant changes
- Standard industry outputs

## Outlook

Companies are expected to continue to shift their strategies away from on-premise investments to the cloud. Gartner has said that cloud computing will be one of the "most disruptive forces of IT spending since the early days of the digital age" and predicts more than

\$1 trillion<sup>108</sup> in spending will be directly or indirectly impacted by the shift to cloud over the next five years. IDC's CloudView Survey found that more than 43% of organizations expect that within five years, the majority of their IT capability will be delivered through public cloud services, and that within three years they will access 78% of IT resources through some form of cloud.

There is a number of key cloud computing trends to watch in the near and long term. Over the next two years, enterprise app migrations, microservice-based app designs, and containers will create further disruption and fuel innovation in public cloud platforms, according to Forrester. IDC says that open source is becoming a mandatory cloud evaluation criterion, and over 60% of enterprises will embrace open source and open APIs as the underpinning for cloud integration strategies by 2017. Hybrid cloud infrastructure is now a common pattern and is expected to continue to dominate enterprise cloud strategies, however IDC predicts that by the end of 2017, over 80% of enterprise IT organizations will commit to hybrid cloud architectures encompassing multiple public cloud services, as well as private clouds, community clouds, hosted clouds, and/or non-cloud infrastructure resources. During the next three to five years, Forrester anticipates competition at the more mature IaaS/PaaS levels (based on price, breadth, and scale) to intensify.

Forrester believes the hypergrowth phase of this industry-altering market will continue and accelerate for the next four years in all public cloud services categories. IDC expects to see the highest percentage growth rates (CAGR of 41.2%) for public cloud IaaS over the next two years, driven by enterprise IT organizations' adoption. Digital transformation initiatives are also driving greater internal and external use of PaaS. By 2020, organizations' spending on cloud services, the hardware and software to support cloud services, and services for implementing and managing cloud services will exceed \$500 billion – over three times what it is today. A majority of hardware, and a larger majority of software, that IT vendors make and sell will be "cloud first." Enterprises buying "non-cloud" infrastructure or software will be in a rapidly shrinking minority. By 2019, "cloud" will be a ubiquitous term like "network" as business solutions assume use of public cloud as a common asset, according to Gartner.

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