January 13, 2015

Cloud Platforms – Volume 1

Riding the Cloud Computing Wave; RHT down to Sell

Goldman Sachs

Equity Research

Deep dive on the opportunity, key players and disruption

The next frontier in enterprise computing is accelerating

We believe the fast-growing adoption of enterprise cloud platforms (IaaS and PaaS) will lead to unprecedented change for the infrastructure software and data center industries. This includes the types of software consumed and the way it is procured, deployed, and managed. The re-architecting of enterprise data centers is in the early stages of a long journey as data residency and security concerns become addressed. While only 4% of workloads are run in public clouds today, we believe this figure will easily move closer to 10% by the end of 2017 (with a high degree of confidence of upside) and continue to march higher – upending the current distribution of over $300bn in IT spend annually today (Gartner).

Amazon has taken an early lead, but the Battle of the Titans has just begun (AMZN, MSFT, GOOG, and CRM)

Amazon Web Services (AWS) has been the clear leader to date by revenue (we forecast $4bn LTM revenue, 26% IaaS and PaaS market), a pioneer that has helped create the industry as we know it. However, our field work suggests AWS, Microsoft Azure, Google's Cloud Platform, and salesforce.com's Salesforce1 are being increasingly evaluated in deals. We believe cloud platform products add net new revenue for Amazon, Google, and salesforce.com, and to a lesser extent Microsoft. However, on a gross margin basis, IaaS is gross margin dilutive on a fully costed basis for all vendors, while PaaS would be gross margin additive for Amazon and a headwind for Google, Microsoft, and salesforce.com.

What lies ahead for existing infrastructure software providers (CTXS, RHT, VMW)

Increasing penetration of public cloud workloads represents a headwind to traditional software companies, in our view. Certainly revenue growth rates will continue to slow (even on a constant currency basis), but in our view it is the slope of the line that remains the biggest variable going forward. We are downgrading RHT to Sell (more detail on pages 9 and 36) and revising our price target for VMW.

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Portfolio manager summary

This report is the first in a multi-part series designed to educate investors about cloud computing platforms

Cloud platforms: The next frontier in enterprise computing

Background – In our view, we are now 6-7 years into a 20+ year cloud computing cycle that will upend the current distribution of wallet share. We have already seen two major movements within this cycle, the first was server virtualization (74% of x86 servers are virtualized in 2014, Gartner January 2014), and the second was software as a service (SaaS, used by 79% of organizations surveyed for mission critical and production applications, Gartner October 2014). Today, we believe we are in the midst of the third phase, cloud platforms for enterprise computing.

The notion of cloud platform services was pioneered by Amazon Web Services (AWS) with the introduction of its Simple Storage Service in 2006 and also salesforce.com in 2007 with what is now its Salesforce1 platform. Prior to the emergence of cloud computing services, if someone wanted to host or write an application, they would need months and thousands (and sometimes millions) of dollars upfront to find and procure data center space, hire consultants to help architect this complex system, and pay for infrastructure software and hardware. For example, paying EMC for servers and storage, Oracle for databases, IBM for middleware, Microsoft for operating systems and so on. Plus enterprises would have to hire staff to implement and manage the infrastructure. Today, a company can essentially "rent" this infrastructure in minutes with a credit card.

Today, most enterprises are using the public cloud for net new applications and not yet migrating legacy applications, as Gartner expects 90-95% of applications hosted on AWS are for what it calls systems of innovation or new idea development (September 2014). However, we believe a broader shift to cloud platforms will be a matter of when, not if, as enterprises become more comfortable with compliance and security of cloud platforms, and the idea of trusting their data in the hands of a third party. While the market is still early, we have seen a number of companies already aggressively decide to embrace cloud platforms, for example:

General Electric is planning to shut down 90% of their 32 data centers over the next five years *– GigaOM, June 2014*

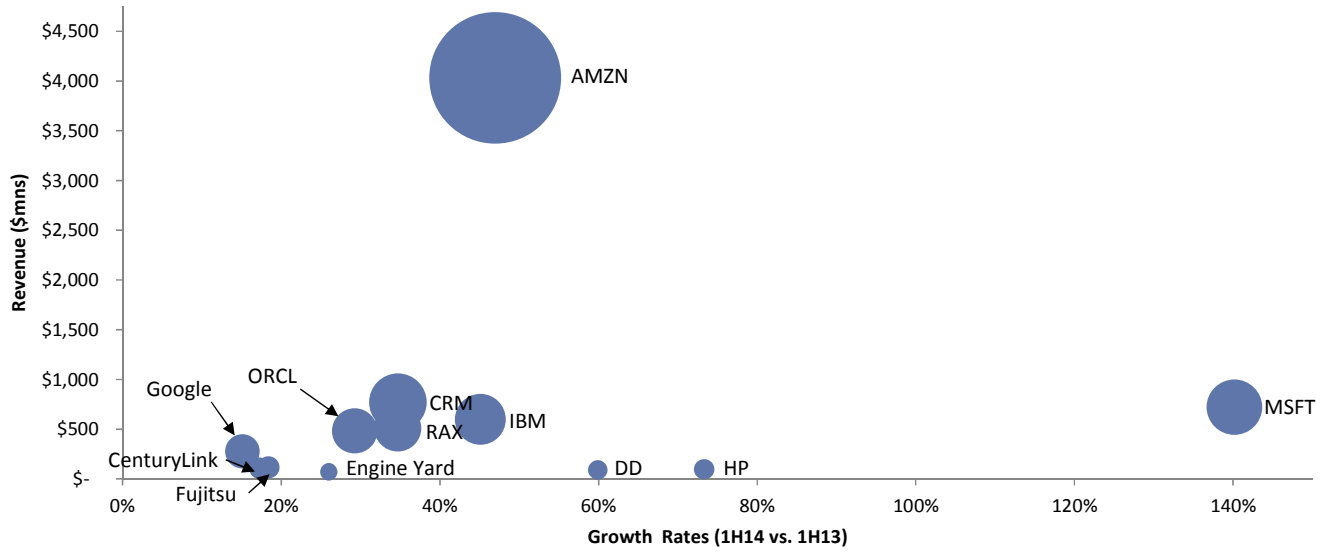
"No company that we [Andreessen Horowitz] invest in anymore actually ever buys any hardware" *– Marc Andreessen, TechCrunch, January 2013*

Dow Jones plans to migrate 3,000 applications to AWS by January 2015, decreasing their 40 data centers down to 6 *– Amazon AWS re:Invent, November 2013*

Battle of the Titans: Amazon has taken an early lead, but the battle has just begun. We believe Amazon has taken a clear lead in the market thus far, as it helped pioneer this cloud platform market. Amazon had a running start launching its cloud platform (AWS) in 2006, ahead of salesforce.com in 2007, Google in 2008, and Microsoft in 2009 as well as more recent entrants VMware, Oracle and IBM (with its acquisition of SoftLayer). AWS has kept its lead, demonstrated by its revenue, usage compared to other platforms, and product and service offerings:

- At roughly $4bn in LTM revenue (estimate from GS analyst Heath Terry), AWS equates to 26% of Gartner's 2014E total cloud platform TAM (Gartner estimate as of December 2014).
- Gartner reported that AWS "has more than five times the cloud IaaS compute capacity in use than the aggregate total of all other public cloud IaaS offerings combined" (September 2014).
- Synergy Research Group states "I do not think that Amazon is resting on its laurels – quite the opposite actually…it is continuing to innovate and introduce new service offerings, [and] is looking and feeling like a company that intends to maintain its leadership position" (CloudTech article, July 2014).

Exhibit 1: Leading public cloud platform vendors revenue and growth estimates

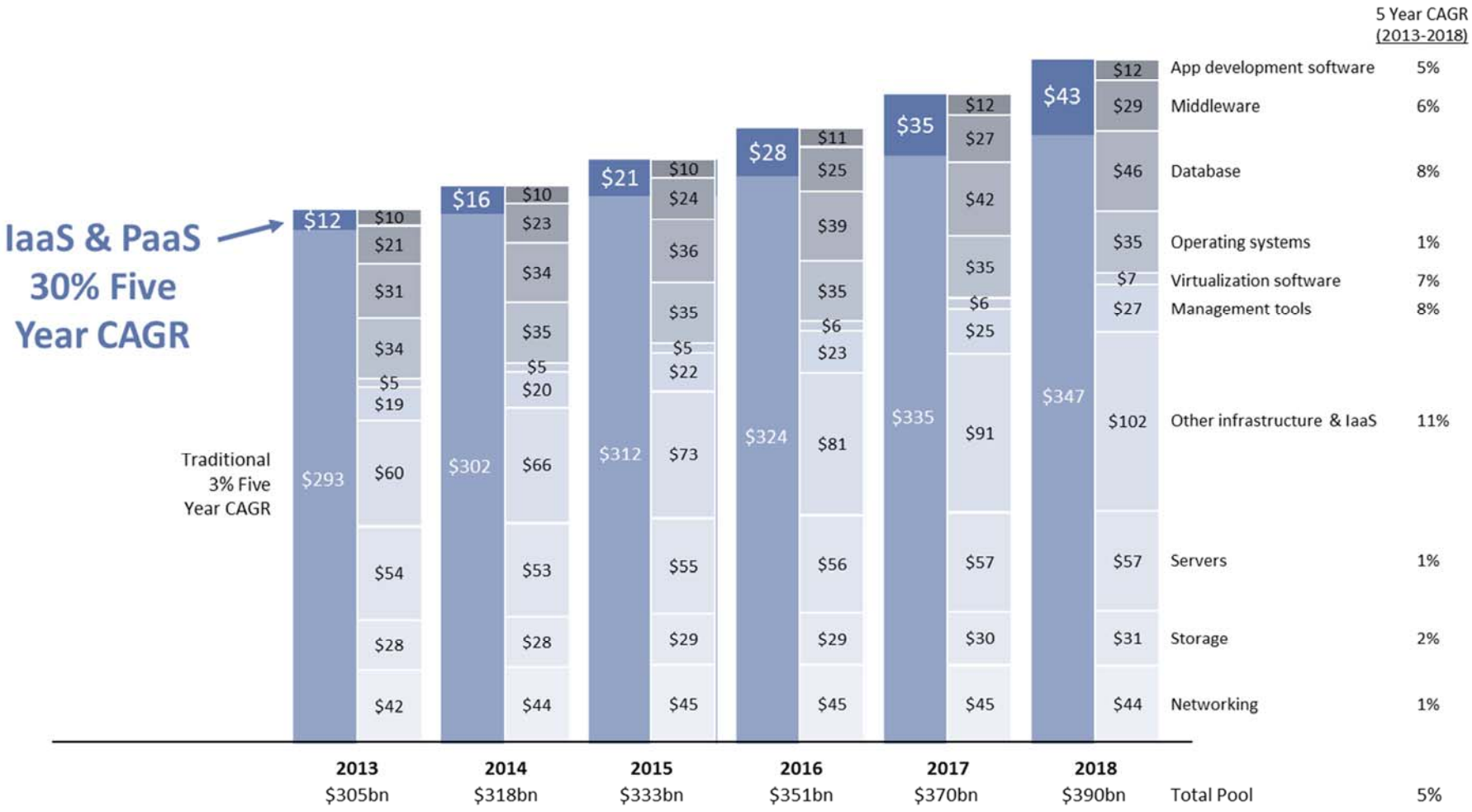


Source: AMZN, MSFT and RAX reflects LTM public cloud revenue. CRM cloud revenue reflects a run rate of October quarter's Salesforce1 and Other line. Oracle reflects LTM IaaS revenue only. The rest reflects IDC's IaaS and PaaS combined estimates pulled as of November 2014 and Goldman Sachs Investment Research. DD = Dimension Data.

Our CIO contacts underscore that we are seeing positive cloud momentum from large caps Google and Microsoft and salesforce.com. While Amazon was the first, CIO conversations would suggest that a significant number of proof of concepts have been done which now include Google Compute Platform and Microsoft Azure in addition to AWS. In PaaS, salesforce.com continues to be a strong contender. Currently underestimated by the market compared to AWS, Microsoft, Google and salesforce.com have been rapidly ratcheting up their capabilities and are seeing traction amongst enterprises.

Recent wins include Netflix adding Google, Sigma Systems migrating to Azure from AWS, and Philips working with salesforce.com to build a cloud-based healthcare platform. Netflix, one of AWS's largest customers, started to use Google's Cloud Platform for storage in 2013 but continues to primarily use AWS (Wall Street Journal, November 2014). Sigma Systems Canada Inc., a telecom services company, was using both AWS and Azure. In 2013, it consolidated onto one provider, and chose Azure because "it was cheaper" and Azure had more global facilities, claiming "technically, there's very little difference between AWS and other providers now" (Bloomberg, November 2014).

Exhibit 2: Cloud platform TAM and total "pool" of enterprise spend cloud platform vendors can potentially disrupt ($bns)



Source: Gartner 4Q14 and December 2014 forecast, Goldman Sachs Investment Research. Traditional includes infrastructure software and data center spend (excluding enterprise communications applications). Note: "Other infrastructure software" includes data integration and data quality tools, security, storage management and IaaS.

Cloud platforms have the potential to disrupt a $300bn+ revenue pool, causing a mix shift in spend – We believe public cloud platforms have the potential to disrupt this pool of IT spend that infrastructure software and data center suppliers have drawn from since the 1980s. The two main components of public cloud platforms are Infrastructure as a Service (IaaS) and Platform as a Service (PaaS). IaaS is the base layer that includes compute, storage, networking, and virtualization. IaaS has the potential to disrupt $169bn of the total pool by 2018 (43%). Above that is the PaaS layer, which accounts for the operating system, database, middleware, management tools and more. PaaS has the potential to disrupt $221bn of the total pool (57%). In addition, cloud platforms impact the use of power, real estate for data centers, services to host and manage data centers, colocation, consultants to help architect the system and more, as enterprises have the ability to use third parties instead of building out their own data centers.

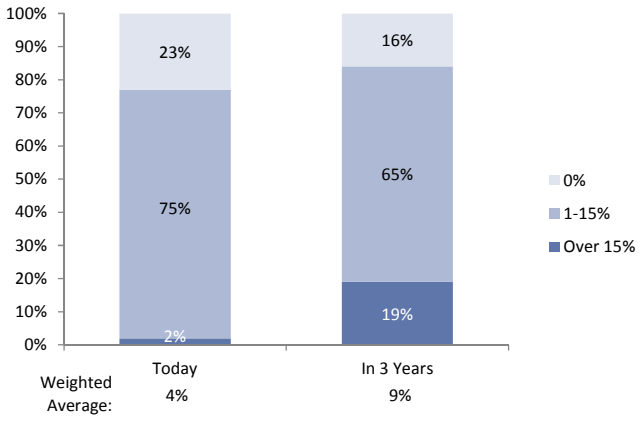
Ultimately, we believe that there will be a mix shift in how enterprises spend their IT budgets, as Gartner and IDC estimate the total addressable market (TAM) for public cloud platforms will grow at a significantly faster pace, a roughly 30% CAGR from 2013-2018, compared to the total pool at a 5% CAGR. The public IaaS and PaaS market is still in early stages, at $12-13bn in 2013, and is expected to grow to $43-45bn in 2018. This compares to SaaS, which had a $22bn TAM in 2013 and is expected to grow to $54bn in 2018. Some argue that, over time, the market for cloud platforms (IaaS and PaaS) could ultimately be larger than SaaS, including Oracle, who stated "the PaaS opportunity is big, given the size of our install base and you might argue it's big or bigger than the SaaS opportunity" on its F2Q15 earnings call.

Not just for test and development anymore. While public cloud adoption started out primarily as a sandbox for test and development workloads, this has quickly been changing. With more large enterprises getting comfortable with security requirements and cloud vendors responding to recent events with more visible data residency offerings, adoption could ramp faster than expected. We see capacity that is required for burst capacity workloads as an easy migration to public cloud providers. Before the public cloud, companies would have to build their data centers to handle peak capacity, even when it was not being utilized 90% of the time. Now enterprises can use the public cloud to absorb those spikes, while seeing significant savings from only having to build out what they need on a normal basis. An example of cost savings from migrating data centers is News Corp (parent company of Dow Jones). It expects to save $100mn by migrating 75% of its data centers to AWS (AWS re:Invent, November 2013). At the same time, we expect many existing workloads to migrate and for the vast majority of new workload growth to occur on these types of platforms, especially if leading cloud vendors continue to ratchet pricing downward. **While each public cloud use case is unique, we estimate public cloud is roughly one third the cost for a continuous use application as is detailed starting on page 17.**

Investment implications for public cloud platform stocks

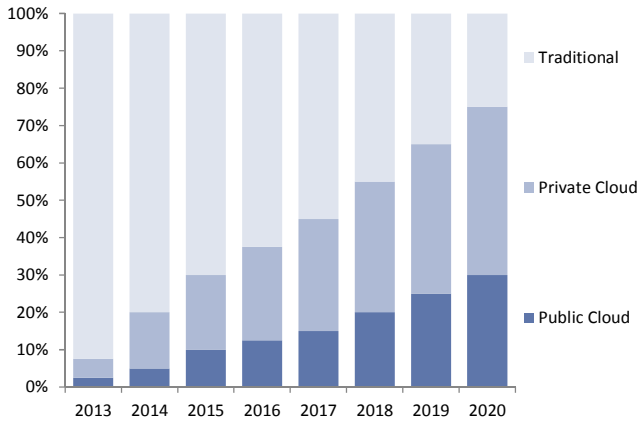
The re-architecting of enterprise data centers is in the early stages of a long journey. Our survey shows that while only 4% of workloads are run in public clouds today, CIOs expect this figure will move closer to 10% by the end of 2017 and continue to march higher from there (Exhibit 3). To put this into perspective, Amazon started the concept of IaaS in 2006 with its AWS offering and within a span of eight years the market has gone from zero to 4% penetrated and is expected to more than double just three years from now, based on survey results. We view these market forecasts as conservative and note that Gartner was recently quoted as saying workload penetration could hit 50% by 2018.

Exhibit 3: Percent of respondents who have and expect to move their applications to public cloud platforms



Source: Goldman Sachs Investment Research survey, December 2014.

Exhibit 4: New application development projects



Source: Gartner webcast, September 2014.

As the market has expanded to include both IaaS and PaaS, more and more enterprises are deciding to go all in in terms of public cloud adoption. Amazon highlighted a number of enterprises and ISVs that have already completed or are in the process of completing all-in migrations to its cloud at its AWS re:Invent conference this year, including Netflix, Suncorp Group, Kempinski, GPT, Time Inc., Emdeon, and Nippon Express. To be clear, we believe large enterprises will maintain a hybrid model, leveraging both public clouds and re-architected, more efficient, and more nimble data centers than they have seen before.

All of this, however, leads to unprecedented change for the infrastructure software and data center markets. This includes the type of software that gets consumed, the way in which it is deployed and procured, and the manner in which departments of large organizations get charged for their use of technology. In fact, while test and development workloads have dominated the migration to date, we believe that 2015 will mark the start of considerable production workload migrations.

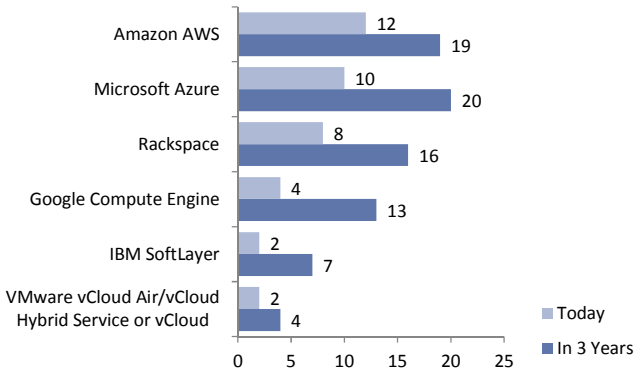
The Robin Hood effect: Passing savings to customers and commoditizing IaaS. Vendors in this space have gone out of their way to continually lower prices for public cloud IaaS. From AWS's inception to March 2014, Amazon has instituted 42 price cuts, while Google reduced pricing for core infrastructure in 2014 to track Moore's Law, passing savings onto customers (more on page 19). And although AWS did not announce a price cut for its IaaS offerings at its most recent AWS re:Invent conference, we see price competition as continuing, as Google and Microsoft have each vowed to be aggressive in this regard. Ultimately, we see the gross margin potential for an IaaS business at scale to be either in the 5-15% range, if pricing continues to be as competitive as it has been of late, or as high as 10-20%. We note that the lower band is similar to technology product distributors who run at 5-6% gross margins (e.g., Ingram Micro, Tech Data, and Synnex prior to its acquisition of IBM's customer care business) while the higher band would come from more scale that comes after covering the high levels of fixed investment required as well as more discipline on pricing. Given the economics of IaaS, and the fact that it is typically the on-ramp for public cloud adoption, we believe it will be harder for smaller, less-capitalized companies to compete effectively. Furthermore, we believe this is the reason PaaS adoption will be the focal point over time for these cloud providers, as the stickiness of the customer moves up considerably as they migrate up the cloud stack (IaaS, then PaaS and ultimately SaaS).

We view IaaS as a means to an end for many vendors, as customers adopt PaaS offerings and value added services. Increasingly we see less and less differentiation amongst the largest IaaS offerings. Vendors have been cutting prices while bulking up their features and functionality, which is one of the primary reasons we believe gross margins will be constrained.

In most cases, our conversations with CIOs suggest that they will actively evaluate all three major cloud providers and use more than one as a way to gain leverage on cost and avoid vendor lock in. A customer who has moved applications between cloud vendors stated that there was little engineering required to transition their applications from AWS to Azure. We believe that containers will offer even greater application portability and mobility between cloud vendors as well as between public cloud and on-premise environments. Therefore, we believe this dynamic will keep vendors price competitive in the IaaS layer, while PaaS is less likely to be as price competitive due to more differentiation and a higher difficulty to move applications if built on the PaaS layer.

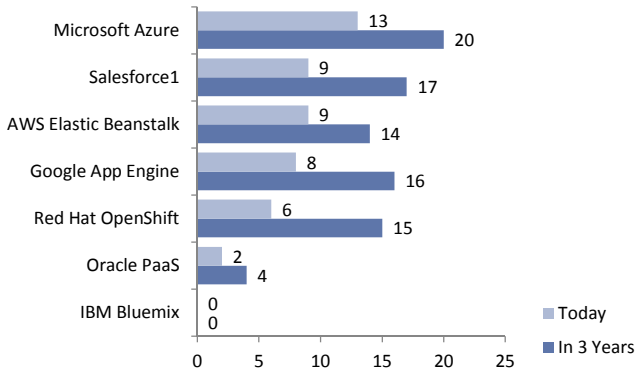
As such, we view IaaS as a means to an end, with the goal for many vendors to ultimately drive more customers to their PaaS offerings which should face less commoditization pressure, as each company will seek to leverage its proprietary solutions. For example, on AWS, customers can choose proprietary offerings such as Amazon's Aurora relational database or RedShift for data warehousing. On Google, users can choose Google's Cloud Datastore for their NoSQL database, or Google Cloud SQL for their relational database. As a result, we see technology differentiation driving gross margin potential for a PaaS business at scale in the 40%-60% range. This compares to utilities and telecom gross margins ranging roughly from 40-70%. In the area of PaaS, our CIO survey suggests that Microsoft Azure, salesforce.com's Salesforce1, and Google's App Engine will be forces in the PaaS market over the next three years.

Exhibit 5: Top Public IaaS Vendors
GS CIO Survey: Which vendor(s) are you using today and three years from now? (select all that apply)



Source: Goldman Sachs Investment Research Survey, December 2014.

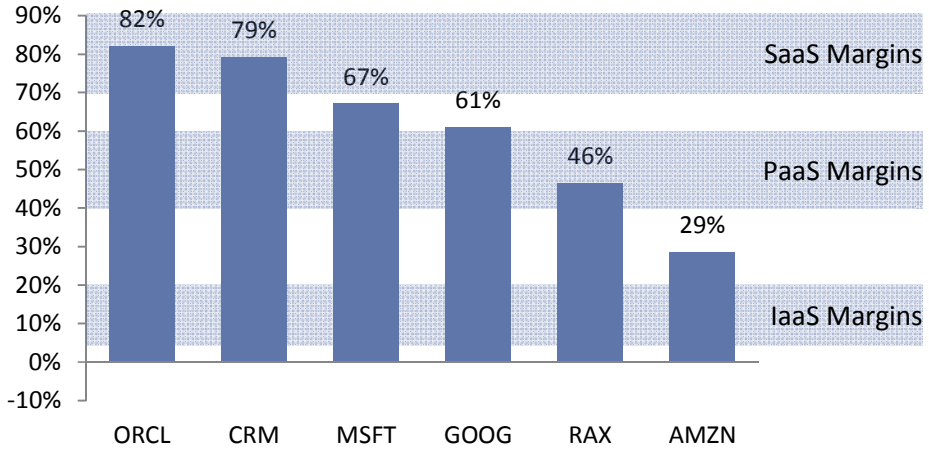
Exhibit 6: Top Public PaaS Vendors
GS CIO Survey: Which vendor(s) are you using today and three years from now? (select all that apply)



Source: Goldman Sachs Investment Research Survey, December 2014. RHT OpenShift is available as a public or private PaaS.

IaaS gross margin impact is negative for all vendors, but PaaS gross margin impact is vendor specific. The leading players in the market, as cited above, all stand to benefit from continued growth in public cloud workloads both for IaaS and PaaS. While this has positive top-line implications, gross margin implications will differ depending on the level which one is currently starting from. For example, IaaS is gross margin dilutive (on a fully costed basis) for all vendors, while PaaS would be gross margin additive for Amazon. On the other hand, at the middle of our forecasted gross margin potential (at scale) PaaS is likely a headwind to gross margins for Google, Microsoft, salesforce.com and Oracle.

Exhibit 7: Long-term gross margin estimates at scale versus company LTM gross margins



RAX is not covered by Goldman Sachs Global Investment Research.

Source: Company data, Goldman Sachs Investment Research.

Adds net new revenue for Amazon, Google, and salesforce.com, and to a lesser extent Oracle and Microsoft. For vendors such as Amazon, Google, and salesforce.com, these cloud offerings are completely additive to their revenue models. In the case of Oracle and Microsoft, while in some cases it represents net new revenue, in other cases it consists of taking an existing customers enterprise license agreement (typically multi-year contracts recognized over time or in the case of software updates/maintenance paid one year in advance and represent a percentage of the original upfront license payment) that is run on premise and moving those licenses to their respective clouds. For example, not only is Oracle targeting new customers to use its SaaS based solutions but it also is targeting existing customers who use its stack (for example, non-Fusion customers who run the Oracle E-Business Suite on an Oracle database) to move to its cloud. In this case, the customer would take its existing licenses for these products, continue paying maintenance, and pay Oracle an additional fee for the compute resources necessary to run these workloads on Oracle's cloud.

Can help boost renewal rates on ELAs, and win non-annuity customers. With Oracle and Microsoft, customers using cloud platforms can help drive renewal rates higher, as vendors are able to cross and upsell more services. In the case of Microsoft, we believe the shifting of workloads from on premise to Azure will represent in many cases a migration of existing workloads for enterprise customers with slight uplift related to the costs associated with running these workloads in the cloud for the compute resources required. Non-annuity customers (small and mid-sized organizations), conversely, will drive net new revenue for Microsoft, as these users were very rarely on recurring contracts and therefore Microsoft (or Oracle) should be able to generate materially more revenue per customer from these firms.

Keeping an eye on whether customers become vendor-indifferent to PaaS services in the public cloud. In the case of both Microsoft and Oracle, a key question to monitor going forward will be whether or not, and to what extent, the migration to the cloud (both in terms of new workloads and existing ones) impacts their respective deployment share. For example, will new database workloads increasingly take place in NoSQL or Hadoop environments or will developers choose to create apps in different environments/operating systems? We outline this in more detail on page 22.

Exhibit 8: Positioning in the cloud

Company	Public Cloud Platform Revenue	Public Cloud Platform as a % of Total LTM Revenue	Public Cloud Platform as a % of CY14E IaaS and PaaS TAM	Market Cap	Rating
Amazon	$4,031mn	5%	26%	$136bn	CL-Buy
Salesforce.com	$770mn	15%	5%	$38bn	CL-Buy
Google	ND	ND	ND	$341bn	Neutral
Microsoft	$721mn	1%	5%	$387bn	Sell

Market Cap as of January 7, 2015. Percentage of public cloud reflects LTM non-GAAP estimates. CRM cloud revenue reflects a run rate of October quarter's Salesforce1 and Other line. Oracle reflects LTM IaaS revenue only. Microsoft includes Azure only, not total commercial cloud. IaaS and PaaS TAM from Gartner, December 2014.

Source: Publicly available data, Goldman Sachs Investment Research.

What lies ahead for existing infrastructure software providers – a closer look at Citrix, Red Hat, and VMware

Increasing penetration of public cloud workloads represents a headwind to traditional software companies, in our view. Certainly revenue growth rates will continue to slow (even on a constant currency basis), but in our view it is the slope of the line that remains the biggest variable going forward. Our conversations with CIOs suggest that many will leverage existing licenses for infrastructure software in the public cloud, what is referred to as BYOL (bring your own license). While this is more likely to be the case for existing workloads, however, the headwind will come from two areas: (1) reduced requirements for excess capacity leveraged for bursting – this is capacity only required at certain times of the year or quarter (i.e., a tax preparation software company during tax season) and eliminating the need to own this capacity year round requires less spending; and (2) new workload growth which we believe will be biased towards a public cloud deployment model and where we expect traditional infrastructure software share to be lower than in the private cloud world.

With the aforementioned factors in mind, it is not surprising that infrastructure software vendors are trading at multiple levels close to their five-year trough. That having been said, we believe sentiment on names like Citrix and VMware is at all-time lows and the fact that we believe the slope of the pressure on their top line is not as steep as many expect in the near term suggests to us that any news perceived as in line with lowered expectations offers the potential for upside as experienced by Oracle post its November quarter results. Typically, the multiples of Citrix, VMware and Red Hat when looked at together have a high degree of correlation – ranging from 0.6 to 0.9 over the past five years depending on the multiple and pairing. Lately, however, Red Hat's multiple has started to diverge. In the case of Red Hat, this divergence started to occur post the release of its F3Q15 results in mid-December, at which point the differential to VMW's and CTXS's EV/FCF multiple expanded by about 2.5x. The question for the company now is whether or not the level of billings growth posted in the period (22% on a constant currency basis) is the sign that its overall level of growth will begin to materially accelerate a high teens level from our view that billings will stay in the low to mid-teens in the near-term.

While we believe that Red Hat is executing well and has potential to be a significant player in the area of PaaS and private IaaS, we see the shares as having the potential for underperformance over the next few quarters as, in our view, investor are expecting a material acceleration in billings in FY16, even on a constant currency basis, are questioned. While we expect a strong F4Q, we believe this is widely expected by investors. As such, we are downgrading Red Hat to Sell from Neutral and maintaining our 12-month price target of $70. As with VMware, threats and opportunities from emerging offerings such as

OpenStack and containers (to be discussed in an upcoming report) are not likely to be materially impactful over the next 12 months.

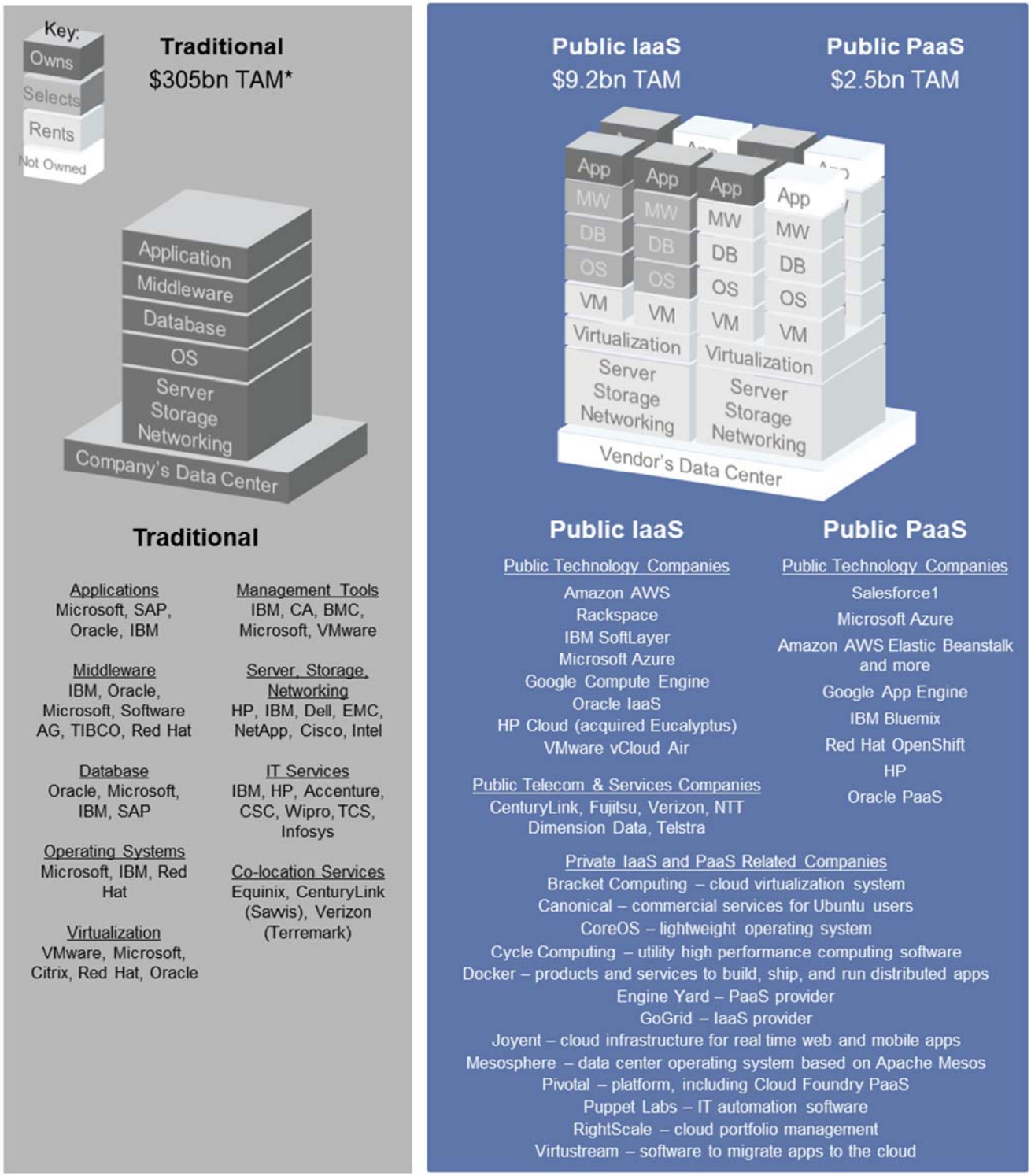
VMware (Buy rating, 12-month price target of $90 vs. prior $110 based on lower estimates) – VMware's industry-leading virtualization software cannot be consumed on top of public cloud platforms such as AWS, Azure, or Google's Cloud Platform. As such, the more we see new workloads move to these clouds, the less these workloads will utilize vSphere. While this certainly represents a headwind, private cloud workload growth will continue albeit at a slower pace, in our view, than that of public cloud workload growth. Furthermore, we believe VMware has only experienced a small penetration of its cloud management offerings, which our CIOs highlight is necessary to adopt over time for enterprise customers given virtual machine sprawl that has occurred over the past 5-7 years.

While there are legitimate concerns that arise from the migration of workloads to public clouds, we believe the market is overly bearish currently on the slope of the line of their revenue growth potential. We are lowering our 2015 revenue growth forecast from 15% to 10% growth and reducing our license forecast from 15% to 6%. As such, our new non-GAAP EPS forecast is $3.88 (prior $4.13) and consensus of $4.09. We also lower our 2015 CFO forecast from $2.59bn to $2.26bn as a result of our reduced earnings forecast but more so due to cash tax payments which we estimate will go from about $200mn in 2014 to $400mn in CY15. While we are lowering our estimates, we believe the buy side is already expecting a revenue guidance forecast in the 8-12% range.

Citrix (Buy rating, 12-month price target of $70) – The migration to both public cloud and a mobile first development environment represent significant headwinds for Citrix's core XenApp and XenDesktop revenue streams. As such, the company has had to pivot to focus more on its Enterprise Mobility offerings, ShareFile and NetScaler. In our view, the upcoming 4Q14 conference call carries even more importance than normal as the market awaits the company's top-line growth forecast for 2015 and a multi-year operating margin expansion plan. We continue to believe that Citrix needs to shrink its ambitions and focus R&D and S&M dollars more narrowly, reduce investments in non-growth areas and exit areas where they are underperforming. Ultimately, while it narrows its focus it also needs to lay out a game plan for how this will fall through to the bottom line over the next few years. If successful at presenting its plan on the upcoming 4Q14 EPS call, we see even a slight rerating in the shares as generating outperformance.

We outline top public and private companies in our cloud platform taxonomy below:

Exhibit 9: Cloud platform taxonomy and TAM estimates for 2013



Sample architectures are for illustrative purposes, each vendor and company architects their systems differently. *TAM doesn't include application software or enterprise communications applications. App = Application, MW = middleware, DB = database, OS = Operating System, VM = virtual machine.

*Source: *2013 TAMs from Gartner, December 2014. Companies based on publicly available information, Gartner forecasts and Goldman Sachs Investment Research.*

For an introduction to cloud computing we suggest beginning on page 32.

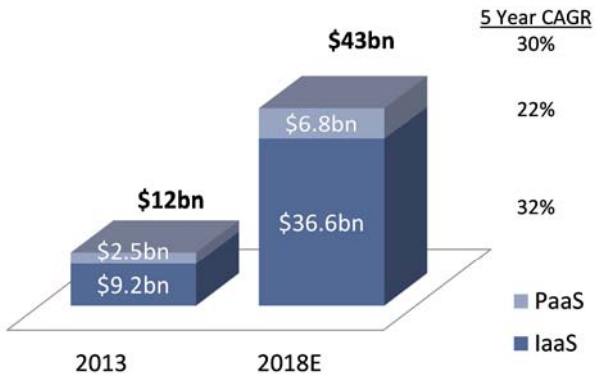
Contents

Cloud platform adoption: A matter of when, not if

Cloud platform market (IaaS and PaaS) is to grow at a roughly 30% CAGR though 2018 to about $45bn

Leading independent analyst firms, Gartner and IDC, estimate that cloud platforms (IaaS and PaaS) are expected to grow from $12-13bn in 2013 to $43-45bn in 2018, a 29-30% CAGR. Both Gartner and IDC believe IaaS will grow the faster of the two segments, at a 31-32% CAGR over the next five years.

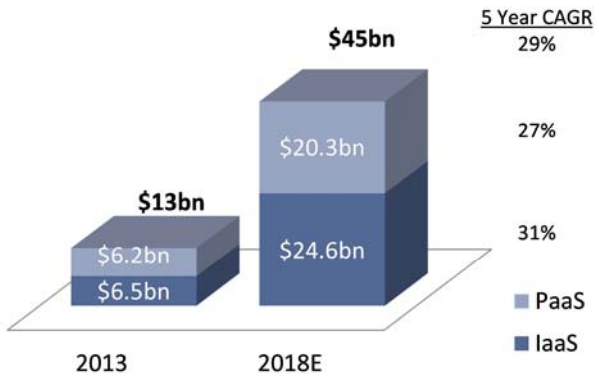
Exhibit 10: Gartner's cloud platform TAM estimate (IaaS and PaaS)



CAGR reflects 2013-2018.

Source: Gartner (December 2014) and Goldman Sachs Investment Research.

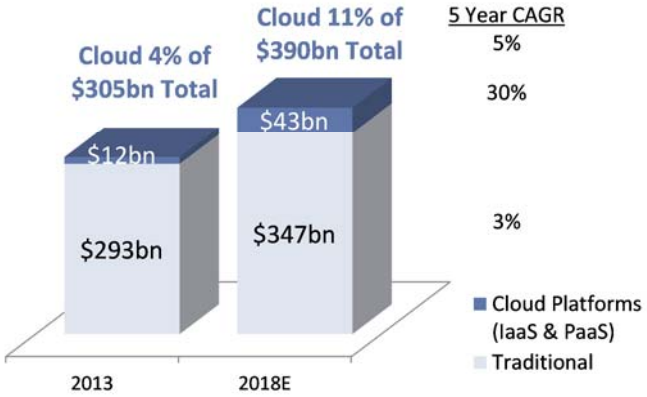
Exhibit 11: IDC's cloud platform TAM estimate (IaaS and PaaS)



Source: IDC (September 2014), and Goldman Sachs Investment Research.

This compares to traditional environments growing at a 3% CAGR over the same time period (Gartner 4Q14, data center systems and cloud infrastructure excluding IaaS & PaaS forecasts).

Exhibit 12: Gartner cloud platform TAM compared to data center and infrastructure software TAM



Source: Gartner 4Q14 forecast and Goldman Sachs Investment Research.

Cloud platform examples: Instagram, Netflix, Lionsgate and the CIA

There are over one million organizations using cloud platforms today. We summarize four examples below.

Instagram: From idea to a billion dollars in 19 months
Instead of going through the pain and time to set up its own infrastructure, Instagram ran its photo sharing application on Amazon AWS with just 12 employees. Just 19 months after inception, it was acquired by Facebook for roughly $1 billion. However, months after being acquired by Facebook, in April 2013, Instagram started migrating from AWS to Facebook's data centers.

Netflix: One of the largest cloud platform customers
Netflix has been using AWS to help run part of the underlying infrastructure for its core video streaming product since 2010. ZDnet calls Netflix "the biggest cloud app of all…that takes up a third of all internet traffic during peak traffic hours" (April 2013). Netflix moved to Amazon AWS for four reasons: (1) it needed to re-architect its product to scale horizontally, (2) it freed up engineers' time to focus on building and improving the business, (3) it could not predict its customer growth or device engagement well enough to accurately order the right amount of hardware needed, and (4) Netflix believes cloud computing is the future (Netflix Blog, December 2010). And despite total streaming subscribers increasing from 3mn to 33mn from 2008-2012, Netflix has not had to add traditional data center capacity since 2008 (Gigaom, March 2012). Netflix started to use Google's Cloud Platform for storage in 2013, but it continues to primarily use AWS (Wall Street Journal, November 2014).

Lionsgate: Expects Amazon AWS will save it 50% vs. a traditional environment
Lionsgate, the producer of feature films and TV shows, started using Amazon AWS in 2010 for testing and development of its SAP applications and running Microsoft SharePoint workloads. The company was able to save $1mn over three years and it believes "overall, moving to AWS will save the company about 50% versus a traditional hosting facility" (Amazon, September 2014).

We believe the industry reached a tipping point in 2013 with the CIA selecting Amazon to host its private cloud. The industry experienced what Wired calls a "seismic shift in cloud computing" in 2013, when the United States Central Intelligence Agency (CIA) selected AWS to build its private cloud for a maximum value of $600 million. Amazon beat out IBM, despite being the more expensive contract. The US Government Accountability Office stated that "while IBM's proposal offered…a price advantage over five years, the SSA (Source Selection Authority) concluded that this advantage was offset by Amazon's superior technical solution" (June 2013). However, this is not AWS's core product, but rather a special cloud that was built specifically for the CIA (what The Atlantic calls "a public cloud built on private premises" July 2014). Regardless, we still believe this was a significant change for the agency and the industry, validating that 1) AWS is secure enough for the CIA and 2) one of the most sensitive organizations in the world is adopting cloud platforms.

Cloud platform components and leaders

There are two major components of cloud platforms, infrastructure as a service (IaaS) and platform as a service (PaaS)

Infrastructure as a Service (IaaS). ***While still early on, AWS has taken a clear lead in public IaaS***. This includes raw IT resources, such as servers, storage, memory, networking

and software virtualization. Public IaaS is a combination of resources rented from a third party with the underlying physical or virtual servers shared with others outside of the purchasing organization. An example is Netflix, which runs its streaming product on Amazon's IaaS, AWS.

Platform as a Service (PaaS). ***We believe top PaaS offerings include Microsoft Azure, salesforce.com's Salesforce1, Amazon AWS, and Google App Engine*** (Exhibit 6). This is the layer that extends above the IaaS layer and provides application development and administration. The PaaS layer makes it much easier to configure and manage the underlying infrastructure so developers can focus more on building their applications. An example is Snapchat, which built and runs its application on Google's PaaS (Google App Engine). The end user of PaaS platforms ranges from developers to users who do not have a computer programming skills.

- Microsoft entered the market with its PaaS-only offering in November 2009 (we forecast $721mn LTM revenue for Azure, not total commercial cloud which accounts for Azure, commercial Office 365, and Dynamics). Microsoft's differentiation is its hybrid cloud approach, whereby enterprises can run their apps in Microsoft's data center, a partner's, or their own. Azure is the same infrastructure that powers Bing, Office 365, Skype, and Xbox Live.
- salesforce.com's Salesforce1 (roughly $770mn LTM run rate as of October 2014) platform took a differentiated approach, targeting both developers and the average business user who does not know how to code. The next generation of the Salesforce1 platform is Salesforce1 Lightning, announced in October 2014. Lightning makes it easy for anyone to build an app with drag-and-drop components. Apps can easily connect to other products or platforms and are instantly mobile. In 2014, Gartner placed Salesforce1 as a clear leader in its application PaaS magic quadrant stating that it is "by far the largest provider in the enterprise application PaaS market" (January 2014). Large companies have been built on Salesforce1, including Veeva (VEEV), which went public in 2013.
- Amazon extended its lead in IaaS to PaaS, with AWS Elastic Beanstalk and a number of other PaaS products. AWS Elastic Beanstalk leverages the strength of AWS's underlying IaaS platform. After a user uploads their application, AWS automatically does the load balancing, capacity provisioning, auto scaling, and monitoring.
- Google entered the public cloud space with Google App Engine (GAE) in 2008. Google is aiming to attract more startups to its platform after offering $100k in credit for Google Cloud Platform services (for qualified startups, offered September 2014). Google already has numerous startups using GAE, including Snapchat, Evite, and Khan Academy. While for now it appears Google is focused on the start-up community, we believe it has significant ambitions to go after the enterprise market in the next 12-18 months.
- Red Hat's public PaaS offering, OpenShift Online, became generally available in June 2013, half a year after its private PaaS offering was available. In Red Hat's November 2014 quarter, it landed its first multimillion-dollar OpenShift deal. We expect the company to make version three generally available in 2015, which includes OpenShift, RHEL Atomic, Docker containers and Kubernetes.
- Oracle announced major upgrades to its PaaS during its annual user conference on September 30. Oracle's cloud platform should appeal to its 400k customer base, as one of the highlights of Oracle's newly upgraded PaaS platform is its ability to move existing Oracle applications and database licenses to the cloud in one click. Oracle also announced that its IaaS pricing intends to be competitive with AWS, Azure, and others. Oracle highlighted a number of PaaS customers at its analyst

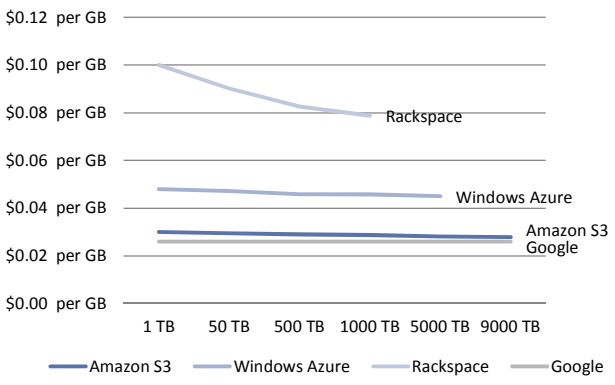
day, including AT&T, Mazda, Fujitsu, Heinz, KPMG, USAA, NBC Sports, Herbalife, BT and more.

The lines between public cloud/private cloud and IaaS/PaaS are blurring. Today, the technical difference between public and private clouds is how the underlying virtual or physical servers are shared with others outside of the organization. Public IaaS and PaaS are resources rented from a third party and the underlying physical or virtual servers are shared with others outside of the purchasing organization. Private IaaS and PaaS can sit within the organization's data center or be rented from a third party where the underlying infrastructure is dedicated to the purchasing organization. However, with 95% of private clouds currently run on premise (Gartner estimate, September 2014), one can make the delineation as public cloud is rented from a third party and private cloud is hosted within the company's firewall and be correct most of the time. The lines between IaaS and PaaS are starting to blur as well, as vendors who were once PaaS only (Google Cloud Platform and Microsoft Azure) added IaaS layers and IaaS vendors are adding more PaaS features.

Public cloud platform pricing model and benefits

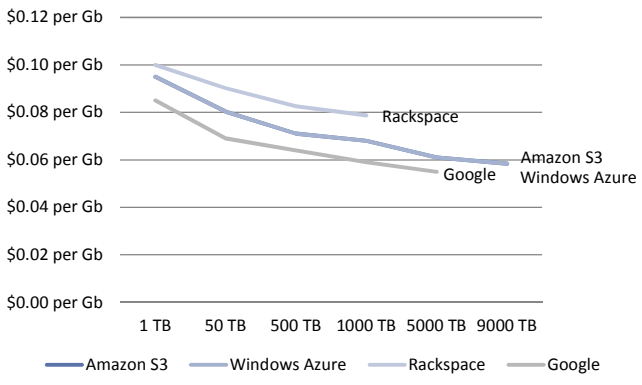
Pricing model. Public IaaS providers typically charge users based on the type of virtual server, often referred to as the "instance," they use. In Exhibits 13 and 14 below, we show the current IaaS storage prices on a per-month basis at two different points in time. Public PaaS pricing models, however, are inconsistent between vendors. salesforce.com's Salesforce1 charges on a per user per month basis and based on several factors such as the number of apps and custom objects, while others include certain features of the PaaS for free with the purchase of the underlying IaaS. Google's App Engine applications are free within a usage quota; after that, costs are by services. For example, the amount of stored data is free up to one gigabyte, and $0.18 per gigabyte per month after that.

Exhibit 13: IaaS storage prices as of September 15, 2014
Price per GB / month



Source: Company data, Goldman Sachs Investment Research.

Exhibit 14: IaaS storage prices as of February 1, 2014
Price per GB / month



Source: Company data, Goldman Sachs Investment Research.

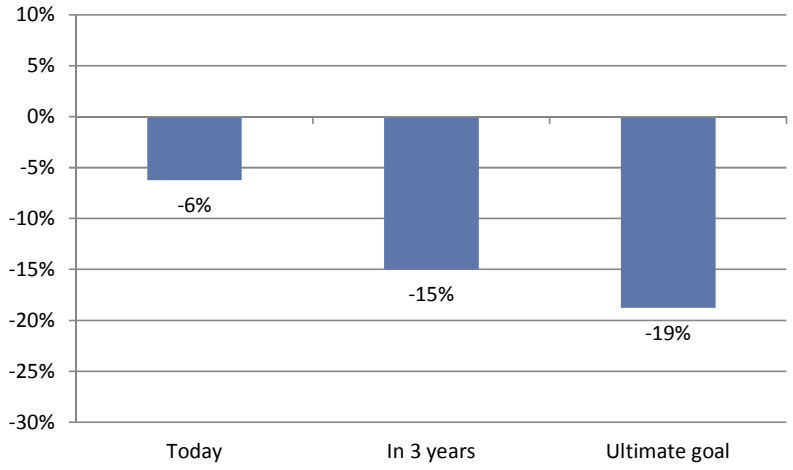
Public cloud platform benefits – We outline some of the top benefits of using public cloud platforms (more detail in the Appendix):

- Scalability
- Disaster recovery
- Shift from capex to opex, requiring less upfront capital
- Shorter implementation times
- Shifting the focus off of "keeping the lights on" and on the core business

- Global reach
- Faster release cycles
- Benefit from economies of scale
- Ease of updates and management in the future

Additionally, enterprises can save on the number of IT professionals that was once required to run and manage their data centers and infrastructure software. Responses to our proprietary survey show that enterprises have decreased headcount by 6% today after moving to the cloud, growing to 15% in three years, with the ultimate goal of around 20% (Exhibit 15).

Exhibit 15: Migration to the cloud is expected to decrease IT headcount (weighted average)
GS CIO Survey: How will your IT headcount change because of your migration to the public cloud?



Source: Goldman Sachs Investment Research, October 2014.

A look at potential cost savings – public cloud can be roughly one third the cost of hosting in house for a small to mid-sized company building continuous-use applications

The migration of public workloads is appealing to customers for a variety of reasons. In some cases it is cost driven, providing the ability to shift expenditures from capex to opex or shrinking datacenter footprints, saving on direct real estate costs, heating, cooling, power, etc. That having been said, many we have spoken with continue to cite that speed and agility of application testing, development and ultimately deployment are also key factors in the decision making process.

While there is no single method to build an enterprise infrastructure stack, for illustrative purposes, we outlined some of the costs a typical small to medium sized enterprise might consider when deciding whether to host an application in house or use a public cloud platform.

Adding a typical enterprise application. For example, the application might be a custom-built automation system for an enterprise's sales force in which sales reps can enter their interactions with clients and much more. In this scenario, we found that, over a five-year

time period, it costs $360k less, or roughly one third the price, to use a public cloud platform than building it in house. We assumed the following requirements:

- This is a small to medium-sized enterprise that does not have a large data center with excess capacity and support staff who have competencies in running servers, storage and databases.
- No existing enterprise license agreements in place. The enterprise will have to purchase new licenses with a 20% discount factored in.
- Full business continuity across two data centers.
- Each site requires two application servers.
- The company is running an enterprise database running 365 days x 24 hours.
- This scenario requires disk space (50 gigabytes maximum replicated).
- Maximum of 100 concurrent users.
- No price cuts over the five-year period.

However, we caveat that, for enterprises with extra data center capacity, more negotiation power or unlimited licenses (where an additional database or operating system, etc. will cost little to no money), the in house option could end up being cheaper than the public cloud scenario over time. That having been said, the enterprise would more than likely be able to reduce capital expenditures and trade these in for operating expenses instead; something which is increasingly preferable to many firms given the increased flexibility should business conditions change.

Exhibit 16: In house vs. public cloud costs for a continuous use application

Summary	Total In House	Total Public Cloud	Total Cost Savings	Annual Cost Savings ($)	Public Cloud/ In House (%)	In House vs. Public Cloud (x)
Compute + Operating System	$ 183,750	$ 15,436	**$ 168,314**	$ 33,663	8%	11.9x
Storage	$ 93,060	$ 92,760	**$ 300**	$ 60	100%	1.0x
Database	$ 270,750	$ 79,800	**$ 190,950**	$ 38,190	29%	3.4x
Total	**$ 547,560**	**$ 187,996**	**$ 359,564**	**$ 71,913**	**34%**	**2.9x**

Annual	Year 1	Year 2	Year 3	Year 4	Year 5	Total	% Total
In House							
Servers	$ 112,500	$ -	$ -	$ -	$ -	$ 112,500	21%
Data Center Costs	$ 9,000	$ 9,000	$ 9,000	$ 9,000	$ 9,000	$ 45,000	8%
Storage	$ 18,612	$ 18,612	$ 18,612	$ 18,612	$ 18,612	$ 93,060	17%
Operating System	$ 5,250	$ 5,250	$ 5,250	$ 5,250	$ 5,250	$ 26,250	5%
Database	$ 145,350	$ 31,350	$ 31,350	$ 31,350	$ 31,350	$ 270,750	49%
Total	**$ 290,712**	**$ 64,212**	**$ 64,212**	**$ 64,212**	**$ 64,212**	**$ 547,560**	**100%**
Public Cloud Platform (Amazon AWS)							
Compute + Operating System	$ 6,924	$ 529	$ 529	$ 6,924	$ 529	$ 15,436	8%
Storage	$ 18,552	$ 18,552	$ 18,552	$ 18,552	$ 18,552	$ 92,760	49%
Database	$ 15,960	$ 15,960	$ 15,960	$ 15,960	$ 15,960	$ 79,800	42%
Total	**$ 41,436**	**$ 35,041**	**$ 35,041**	**$ 41,436**	**$ 35,041**	**$ 187,996**	**100%**

Year 3 has additional costs for the public cloud scenario due to upfront costs for reserved instances on a three-year term.

Source: Goldman Sachs Investment Research.

The Robin Hood effect: Passing savings to customers and commoditizing IaaS

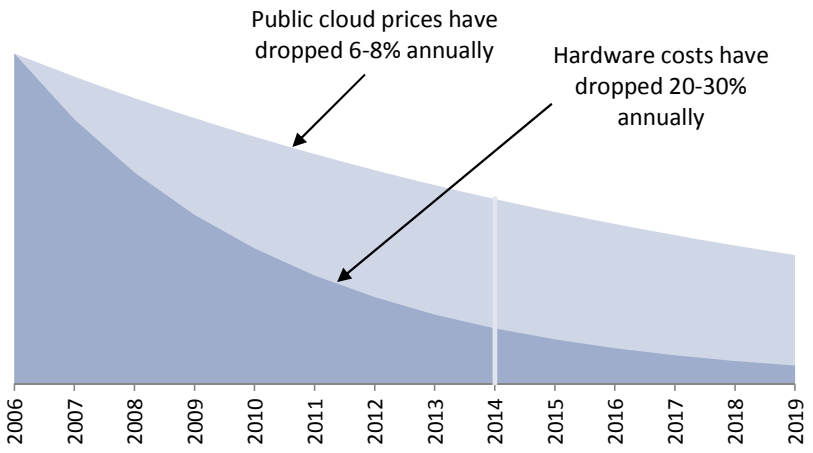
Unlike most new technologies that are performing well and are not pressured to lower prices, Amazon has gone out of its way to continually lower prices for AWS, passing savings that it has gained onto its customers. Amazon has instituted 42 price cuts since its inception to March 2014. Not only has Amazon reduced prices, but it is lowering prices while adding more features to its platform. In 2008 the company launched 24 significant new services and features, which grew to 48 in 2009, 61 in 2010, 82 in 2011, 159 in 2012, and 280 in 2013, and in 2014 it expects to have over 500 by the end of the year.

This "Robin Hood" effect has permeated throughout the industry, with Google moving to Moore's Law pricing in March 2014 (philosophy of pricing core infrastructure in line with Moore's Law, which drops roughly 20-30% annually; Exhibit 17), initiating a drastic 32% price cut on Google Compute Engine and changing Google Cloud Storage pricing to a consistent $0.26/GB (a 68% decrease for most users).

Shortly after, Amazon and Microsoft quickly followed suit. Amazon's Simple Storage Service (S3) prices were reduced by an average of 51%, Elastic Cloud Compute (EC2) prices were reduced by up to 40%, and Relational Database Services (RDS) prices were reduced by an average of 28%. Microsoft reduced its compute service pricing for Windows Azure by 27-65% across various services.

On October 1, Google dropped prices again, keeping in line with Moore's law, dropping Google Compute Engine prices by another 10%. Later, during Google's Cloud Platform Event on November 4, Google also cut prices by 23-79% for other services, including BigQuery storage, large cloud SQL instances and persistent disk snapshots.

Exhibit 17: Google argued that public cloud prices are not falling fast enough



Source: Google, March 2014 and Goldman Sachs Investment Research.

Vendors (and customers) expect IaaS pricing to continue to drop. Both Amazon and Microsoft have publicly stated it is committed to offering lower prices in the future. In early September the EVP of Microsoft's Cloud and Enterprise group said "This kind of hyperscale footprint really enables immense scale economics to the point where we can basically continually cut our prices for customers, and we can basically run an operation that is just cheaper than pretty much everyone else on the planet" (Microsoft website, September 2014). Oracle also announced it would price its IaaS product competitively with AWS, Microsoft, and others during its annual OpenWorld conference. The one major cloud

platform vendor that has held out from making major price cuts in 2014 is Rackspace. The company is instead focused on being a premium service offering, even for its entry-level customers.

Price stability…how long will it last. That said, for the first time, Amazon did not announce a price cut at its re:Invent user conference in November 2014. The suggestion from partners that we spoke with was that, as the next stage of workloads to move into the cloud are more mission critical than the previous test and development workloads, pricing becomes less the primary determinant than reliability, flexibility, and auditability and Amazon believes it wins on all of these fronts. Therefore, we may start to see a change in vendors' approach to pricing, but we believe it is too early to tell at this point.

Price cuts affected Amazon in 2Q14. Amazon saw weakness driven by 22 points of "North America Other" deceleration from AWS price cuts in March 2014, though AWS usage was up 90% yoy (GS analyst Heath Terry estimates AWS is 83% of total "North America Other" revenue in CY14E). In 3Q14, however, AWS also saw usage up close to 90% yoy, and slight sequential growth in its "North America Other" category. In fact, our conversations with customers suggest that the AWS price cuts helped to further interest in cloud migrations beyond even test and development.

Platform wars continue as vendors try to take share early

Whether it is pricing or promotions, top vendors are competing to drive adoption and grab share early, as many consumers of public and private cloud start small and expand over time.

- In September 2014, Google offered a promotion for a $100k credit in Google Cloud Platform services as an incentive for startups to write their applications on Google's cloud.
- Gartner wrote that "Microsoft often attaches $50,000 in Azure credits to enterprise license agreements" (September 2014).
- In November 2014, IBM offered a promotion for a $120k credit for startups to use IBM's cloud software, including Bluemix, its PaaS offering, SoftLayer infrastructure, Cloudant's database as a service, and more.

A war for talent has also taken place recently, with cloud platform vendors snagging key executives.

- Google hired Red Hat's CTO, Brian Stevens to be its VP of Cloud Platforms at Google.
- HP acquired Eucalyptus, and made CEO Marten Mickos the Head of HP's Cloud.
- Oracle hired Peter Magnusson to be the SVP of Oracle's public cloud, after his experience as the VP of Engineering at Snapchat and Engineering Director for Google where he was responsible for managing Google App Engine.

Cloud platform margins as vendors race to zero on IaaS

Price cuts are a necessary evil in order to win share early. **Over time, however, vendors can garner higher margins, as they benefit from economies of scale and customers adding on higher-margin products such as PaaS offerings.** With continual price cuts affecting the amount of top-line revenue vendors can generate, we believe IaaS products will run at thin margins for the foreseeable future. In the long run, when comparing IaaS, PaaS, and SaaS, we believe IaaS products will have the lowest relative

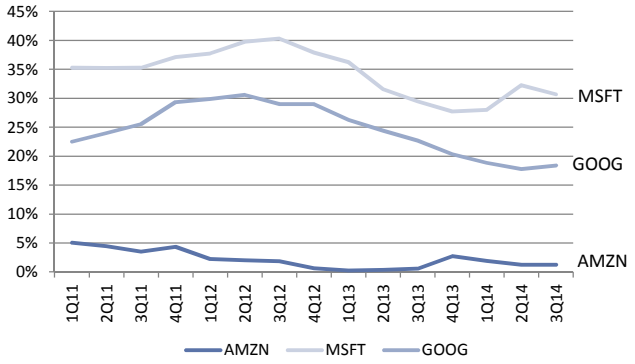
margins and SaaS the highest, given the vendor lock-in it creates and, as a result, higher relative pricing.

With this pricing dynamic, it will be difficult for large legacy vendors to maintain their current margin structure which is primarily driven by traditional license sales. As a result, efficiency in their operations will be key and more focus will be on growth in operating profit dollars versus growth in operating margins. While these vendors are likely to see an early gross and operating margin headwind, these margins can ramp higher over time if they are successful in driving users to higher margin PaaS and SaaS based offerings. We discuss this in more detail in the portfolio manager summary.

Capital intensity increasing. Over the past few years, we have seen the free cash flow margins of Microsoft, Google, and Amazon trend downwards, as their cloud businesses are becoming more capital intensive, in part due to increased investment in the public IaaS and PaaS products (servers, storage, networking equipment, etc).

Since 2011, each vendor has spent over $10bn in capex (Google $21bn, Microsoft $15bn, Amazon $13bn) including non-cloud platform products, or $49bn in total. This compares to capex of about $22bn in aggregate when looking back at the four years prior. While this figure is impacted by the inclusion of 2008 and 2009 during the credit crisis, it includes the height of euphoria in the economy in 2007 as well and nonetheless we believe serves to underscore the growing capital intensity of each of their businesses. It is important to note, however, that cloud platforms are a small percentage of their overall businesses, so we cannot make a direct correlation (Microsoft's public cloud business is roughly 1% of its overall business, Amazon 5%, and Google is not disclosed but we estimate also less than 1%).

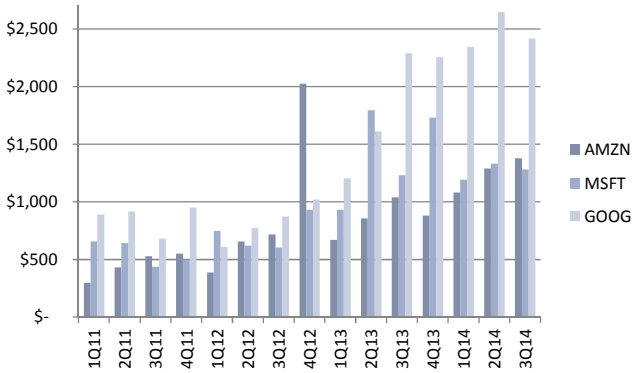
Exhibit 18: TTM FCF margins by quarter (%)



LTM FCF margin = LTM FCF / LTM revenue (calculated each quarter).

Source: Company data, Goldman Sachs Investment Research.

Exhibit 19: Capex per quarter ($mns)



Source: Company data, Goldman Sachs Investment Research.

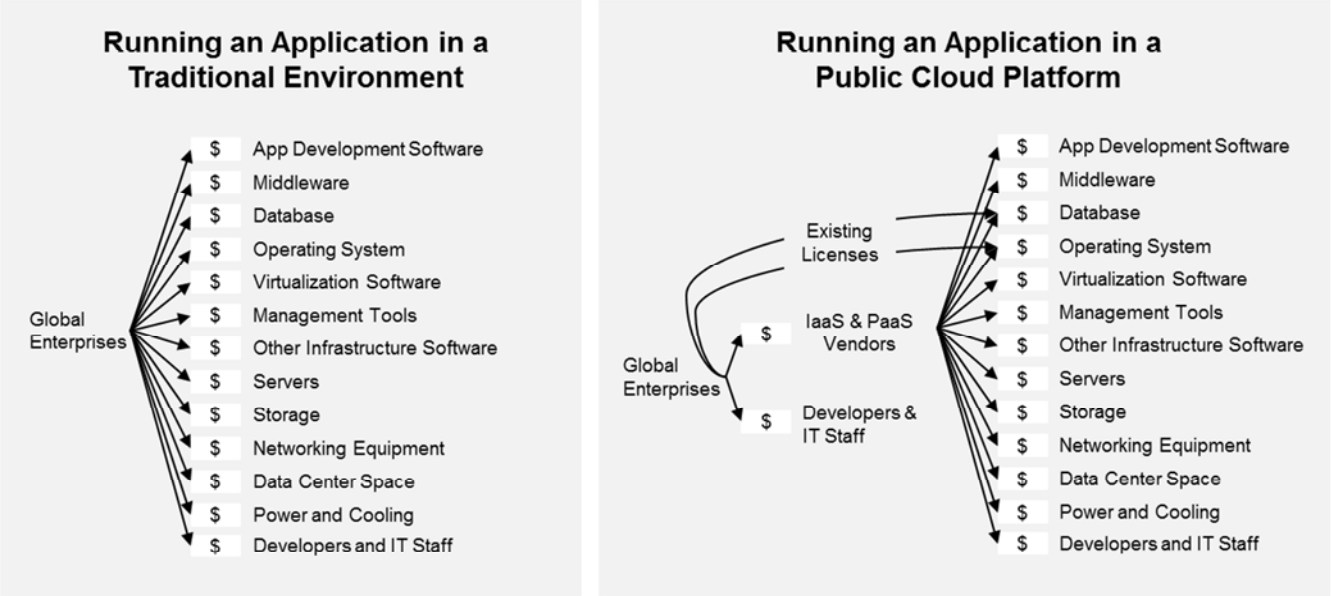
Disrupting over $300 billion of IT spend

Today, cloud platforms are additive to IT spend, as most companies are using cloud platforms for net new applications. However, over time cloud platforms have the potential to disrupt traditional data center systems and infrastructure software markets, a total of $305bn of worldwide IT spend in 2013 (Gartner, 4Q14 forecast), not including spend on data center space, power, cooling, staff, and services.

We believe this sea change will create a mix shift in IT spend. As shown in Exhibit 20, in a traditional environment, global enterprises negotiate and spend with handfuls of individual infrastructure software vendors and data center systems providers directly. However, in a public cloud environment, those same enterprises pay one or a few cloud

platform vendors directly. Those vendors can then choose to purchase from infrastructure software and data center system providers or create it themselves. In addition, in the public cloud, enterprises have the choice to use some of their existing software licenses in the cloud and negotiate directly with their existing vendors (i.e., if a customer already had a license for Microsoft SQL Server Enterprise they can use that same license on AWS).

Exhibit 20: Simplistic example of the change in IT spend between a traditional environment and a public cloud platform



"Other infrastructure software" includes data integration and data quality tools, security and storage management.

Source: Goldman Sachs Investment Research.

This mix shift will likely affect server virtualization, operating system database, and desktop virtualization vendors

As mentioned previously, public cloud vendors have the potential to disrupt not only the IaaS layer (which includes server virtualization) but also the layers above – namely, operating systems and databases. And while not directly related, desktop virtualization vendors are also impacted by the proliferation of cloud platform usage. We outline the four major categories affected below.

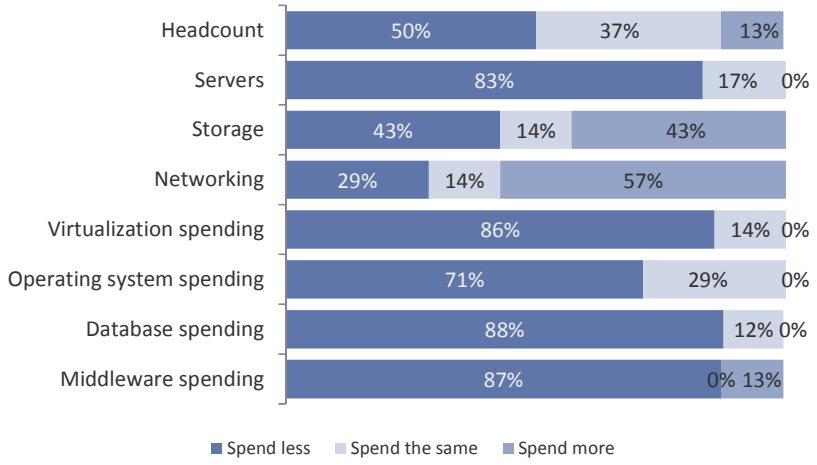
Server virtualization. While VMware, Microsoft, Citrix and Red Hat are the primary server virtualization vendors today, AWS and Google's Cloud Platform did not use any of the four vendor's software. AWS uses the same type of virtualization software as Red Hat, Xen, but not Red Hat's version.

- Amazon AWS uses Xen.
- Microsoft Azure uses Hyper-V.
- Google Cloud Platform uses KVM and containers.
- IBM Softlayer lets users choose between VMware, Citrix, Microsoft, and Parallel's virtualization software.

Our proprietary survey also shows that CIOs expect to spend 86% less on virtualization software as they move to the cloud. Respondents also expect to spend less on databases and operating systems at 88% and 71%, respectively. All three categories had zero

respondents that expected to spend more for virtualization, operating system and database software. However, we see these categories being impacted gradually based on our conversations with customers/partners that suggest existing licenses will be brought to the cloud platform vendors in many cases. That having been said, datacenter capacity that was used for "bursting" of workloads and as such sat idle most of the time will cause this capacity to get absorbed into the cloud over time, limiting the licenses required in these scenarios.

Exhibit 21: Changes in CIO spending as they move to cloud platforms
GS CIO Survey: How do you see your adoption of public cloud services impacting your spending with infrastructure software vendors?



Percentages are rounded.

Source: Goldman Sachs Investment Research survey, October 2014.

Operating systems. Microsoft, IBM, and Red Hat are the top three operating system vendors today (Gartner, March 2013). Unlike virtualization vendors, customers can still use Microsoft's server operating system on AWS, Azure, and Google's Cloud Platform. Red Hat is also available on AWS and Google Cloud Platform, but it is not a preset (or easily deployed) on Azure. But IBM's operating system is missing from AWS, Azure, and Google and even IBM's preset options.

Based on our conversations with customers, we have found that many customers are more vendor-indifferent with the infrastructure software they use in the public cloud than on premise. This could affect top operating system vendors today, as the choice to pay a premium for an operating system like Red Hat Enterprise Linux or using a free operating system like Ubuntu, CentOS, or CoreOS (without support) is as simple as picking one from the same drop down menu. To be clear, however, we believe this risk exists for new workloads versus existing workloads that migrate to the cloud. We list the following default operating system presets available by vendor below.

Exhibit 22: Cloud platform vendors – operating system preset/featured options

Amazon Web Services	Microsoft Azure	Google Cloud Platform	IBM Softlayer
Amazon Linux	Microsoft Windows Server	Debian	CentOS
Red Hat Enterprise Linux	openSUSE	CentOS	Debian
SUSE Linux	SUSE Linux	CoreOS	Cloud Linux
Ubuntu	Ubuntu	Ubuntu	Microsoft
Microsoft Windows Server	OpenLogic	Red Hat Enterprise Linux	FreeBSD
	Oracle Linux	SUSE Linux	Red Hat
		Microsoft Windows Server	Ubuntu
			Vyatta Network

These are the presets given by each vendor in the order they present on the website. These are not the only operating systems available by each vendor. Customers can access more operating systems by searching within each vendor's website or marketplace.

Source: from AMZN, MSFT, GOOG and IBM websites as of December 2014.

Databases. Similar to operating systems, leading database vendors such as Oracle, Microsoft, and IBM also run the risk of customers becoming more vendor agnostic in the public cloud. While we believe this is less likely for existing applications or workloads migrating to the cloud, it creates a risk for new development. Customers should be able to choose to use Amazon's new relational database, Aurora, as easily as they can choose to use Oracle in the same dropdown menu as soon as it is released (still in preview mode).

Exhibit 23: Cloud platform vendors – database presets/featured options

Amazon Web Services	Microsoft Azure	Google Cloud Platform	IBM Softlayer
MySQL	SQL Server	Google Cloud Datastore (NoSQL)	Microsoft SQL Server
PostgreSQL	Oracle Database	Google Cloud SQL (relational MySQL database)	MySQL
Oracle	DataStax Enterprise	Cassandra	Cloudera Hadoop
Microsoft SQL Server	Microsoft SQL Database (Datbase as a Service)	MongoDB	MongoDB
Amazon Aurora	Microsoft HDInsight		Basho Riak
Amazon DynamoDB (NoSQL)			
Amazon RedShift			

These are the presets given by each vendor in the order they present on the website. These are not the only databases available by each vendor. Customers can access more operating systems by searching within each vendor's website or marketplace. For Google, Cassandra and MongoDB are "click to deploy software packages" options.

Source: from AMZN, MSFT, GOOG and IBM websites as of December 2014.

Desktop virtualization. Additionally, with applications on cloud platforms being built for mobile use, this can negatively affect desktop virtualization vendors like Citrix or VMware. For example, before cloud platforms, a media company may have built a Microsoft application to access and manage its movie library. And to access that application outside of the office, it would have to use Citrix to remotely access its desktop or that specific application. Today, that same company can build a similar application that can be accessed through a desktop app, an internet browser, or an Apple or Android mobile device, and not need to remotely access through Citrix.

Profiles for AMZN, CRM, GOOG, MSFT, ORCL, RHT, IBM, and HPQ

Amazon Web Services (AWS)

We believe that, as the clear leader by revenue, AWS will use its first-mover advantage and key wins to continue its momentum. We expect AWS to grow revenue 53% yoy in CY15 to $6.8bn in public cloud platform revenue, above the market's combined IaaS and PaaS CAGR of approximately 30% (Gartner and IDC). However, we believe AWS's competitors will become even more aggressive over the next few years.

Background: Amazon launched its first cloud product in 2006 with the introduction of AWS Simple Storage Service (S3). Today, AWS offers compute tools (such as Amazon Elastic Compute Cloud or EC2), networking (Amazon Virtual Private Cloud or VPC), database (Amazon DynamoDB and Relational Database Service), PaaS (Elastic Beanstalk), management tools, and many more.

Public cloud platform revenue estimate ($4.0bn LTM, 5% of total revenue): GS Internet analyst Heath Terry estimates AWS will grow to $4.5bn in CY14 (+47% yoy) and $6.8bn in CY15 (+53% yoy).

Customers: Amazon AWS has over one million active customers (AWS conference, November 2014). Not only is AWS hosting new applications, but it has a number of migrating applications and entire data centers, including the following.

- All in migrations: Netflix, Suncorp Group, Kempinski, GPT, Time, Emdeon and Nippon Express.
- Migrating data centers to AWS: Conde Nast (saw 40% cost savings and better performance), Hess, News Corp (plans to save over $100mn over three years by migrating 75% of its infrastructure to AWS), The Weather Company .
- Moving business critical applications to the cloud: Conde Nast, Robeco, Macmillan, HOYA, Talanx.

Strengths: AWS is a pioneer and clear leader in this space, with an enthusiastic customer base. It has had some of the most publicized use cases.

Drawbacks: With the exception of the CIA, AWS has received some criticism for not catering to large enterprises who want Amazon to host a private cloud within the walls of their enterprise's data centers. And as the leader in the space, AWS will continue to see more price and feature competition over the next few years.

Key components of AWS:

- Amazon Elastic Compute Cloud (EC2): IaaS offering from Amazon that allows IT system administrators to efficiently manage computing resources.
- Amazon Simple Storage Services (S3): S3 is AWS's storage layer, which includes a simple web-services interface that allows users to store and retrieve any amount and type of data on demand. The architecture is the same as Amazon uses for its own web sites. S3 seamlessly interacts with EC2 to allow for data retrieval and analysis. Additional features of S3 are static website hosting, backup, archiving, and disaster management.
- Amazon Elastic Beanstalk: One of AWS's PaaS components where users can deploy and manage applications in the AWS cloud.
- Amazon Relational Database Services and Amazon DynamoDB (NoSQL database).

saleforce.com Salesforce1 Platform

We believe Salesforce1 will continue to be a share leader in the public PaaS market. Salesforce1 took a differentiated approach to PaaS, making the application development process easy enough so even business users can build a mobile app without any code. We believe this differentiated approach plus the ability to have the applications instantly mobile will help Salesforce1 benefit as more enterprises are creating mobile apps for their end customers.

Background: Salesforce1 is salesforce.com's easy-to-use PaaS offering whose primary programming language is Apex, a version of Java. Heroku (acquired in 2010) is a cloud platform PaaS supporting several programming languages, including Ruby on Rails, Java, Node.js, Python and Perl.

Public cloud platform revenue ($770mn run rate, 15% of total revenue): salesforce.com reported that its "Salesforce1 Platform and Other" category was on a $770mn run rate as of October 2014.

Customers: Total number not disclosed. The website states the platform "powers millions of mobile applications including the Salesforce1 Mobile App."

- Veeva (VEEV), Kenandy, FinancialForce, APPTUS for example built their core applications on Salesforce1.
    - These vendors highlighted the ease of use of Salesforce1 and its ability to customize the product vs. AWS.
    - Additionally, these vendors highlighted the benefit they get from being under the salesforce.com ecosystem from a marketing perspective. salesforce.com sales reps often pitch apps built on Salesforce1 and the vendors noted that this dynamic can serve as a driver for their businesses that other PaaS platforms do not offer in the same way.
- Docusign derives about 10% of its revenue through its Salesforce1 app.
- General Electric uses Salesforce1 to send data to service teams.
- Ford uses it to create targeted and personal customer relationships.
- Time Warner uses Salesforce1 for their field sales team, giving them access to territory maps on the go.

Strengths: Salesforce1 differentiated itself from other solutions by offering an easy-to-use PaaS where users can create an app without a computer programming background. The success and size of companies built on the platform, like Veeva (VEEV), Kenandy, Apptus, FinancialForce, has also helped other enterprises become more comfortable with using the platform.

Drawbacks: Salesforce1's platform uses a proprietary programming language, Apex, so if a customer wanted to migrate an old application onto Salesforce1, it would likely have to rewrite parts of it in this language. Heroku, however, can be used in multiple programming languages.

Key elements of Salesforce1:

- Point and click interface, no programming knowledge needed.
- Applications are instantly mobile.
- APIs help users connect to any product, device or platform easily.

Google Cloud Platform

Google is a relatively newer entrant to this space, but it can leverage the same massive infrastructure that it uses for its core business. We believe Google will take more share as price cuts and promotions help market to developers and startups. However, we believe the company will need to convince enterprise customers with strong SLAs and enterprise class customer service in order to meaningfully challenge AWS or Azure for mission critical workloads.

Background: Google entered the public cloud space with its PaaS offering, Google App Engine (GAE) in 2008. It later announced its IaaS cloud offering in 2012 at Google I/O, named Google Compute Engine (GCE).

Public cloud platform revenue estimate: Not disclosed.

Customer examples:

- Snapchat started using GAE the summer of 2011, choosing GAE because the CTO was familiar with it and knew they could have the application up and running quickly. GAE was still in preview when Snapchat launched the app, but it had faith that the product would scale. The CTO commented that the notion of moving off a public cloud once it reached a certain size is fading, as cloud platforms like Google are able to scale almost infinitely.
- Netflix, Zulily, and TiVo use Google for storage. Netflix is still primarily an AWS customer, but started using Google's cloud storage service in 2013 (Wall Street Journal, November 2014). Costco runs websites in several countries on Google, Citrix runs its developer platform on Google, and Airbnb uses Google Cloud Platform's translate API. Grandcentrix GmbH switched from AWS to Google in 2012 due to better server response and the ability to add more computers faster (Wall Street Journal, November 2014)
- Okta is considering Google as a backup to AWS, citing "Five years ago, when we were starting, Google's service didn't really exist and Amazon was the only complete option…Google is the second-place contender now" (Wall Street Journal, November 2014)
- Atomic Fiction, the company that creates visual effects for movies, moved to Google's platform in part due to its per minute billing (other vendors like AWS round up to the next hour).

Strengths: GCE runs on the same infrastructure that Google uses for the backbone of its internet search. Google's cloud platform has quickly become popular amongst organizations (or business lines/products) that run online and on mobile devices and want Google's simplicity of set up and scalability. Google has embraced containers, claiming in November 2014 that everything Google runs in its system is in a container. Google developed and open sourced Kubernetes, an open source orchestration system for Docker containers.

Drawbacks: Google has been adding more support for different operating systems. In March 2014, Google announced that it will start to support SUSE Linux, Red Hat Enterprise Linux, and Windows Server 2008 R2. Google is looking to expand its success with Snapchat to more startups, now offering $100k in credit for Google Cloud Platform services to qualifying startups. While much attention has been on the success of startups on Google's platform, many question how committed it is to the enterprise space. With the hire of Red Hat's former CTO, Brian Stevens, as Google's VP of Cloud Platforms, we believe Google can leverage his expertise to move more broadly into the enterprise.

Microsoft Azure

With an extensive customer base, Azure should automatically appeal to heavy Microsoft enterprises and Microsoft developers as well as new users. Unlike other vendors, Microsoft is able to leverage some of its own products in Azure (Hyper-V, Windows Server, and more) to help with margins as the space continues to lower prices. While we expect the company's success to continue, we believe its impact on gross margins needs to be contemplated.

Background: Microsoft entered the market with Azure, available as a PaaS-only offering in November 2009. Microsoft later launched its IaaS offering, which became generally available in 2013.

Public cloud platform revenue (~$720mn LTM, 1% of total revenue): We believe Azure will grow to $1.5bn in CY15 (74% yoy growth).

Customers: In June 2013, Microsoft said it had 250k Azure customers, averaging 1k new customers per day (Source: ZDNet). And in September 2014, Microsoft announced it was adding 10k new Azure customers per week. Microsoft also stated that, currently, 50% of the Fortune 500 uses Azure. Customer use cases include the following.

- NBC is using Azure for encoding video and livestreaming, starting with the Winter Olympics, then the World Cup, Sunday football, and now over 1,000 live events will stream simultaneously on Azure.
- UK retailer Marks & Spencer used Azure to scale social media and TV campaigns.
- Xerox created a cloud based video management system using Azure.
- Mazda saw 95% lower costs using Azure's Hybrid Cloud Storage product.
- Millman, a global life insurance company, uses Azure to run compute grids, doing actuarial modeling for financial services customers. As of September 2015, it was running on 50k compute cores for their customers.
- Sigma Systems Canada Inc., a telecom services company, was using both AWS and Azure. In 2013, it consolidated onto one provider, and chose Azure because "it was cheaper" and Azure had more global facilities, claiming "technically, there's very little difference between AWS and other providers now" (Bloomberg, November 2014).

Strengths: Microsoft can leverage its vast number of existing enterprise relationships with C-level executives around the world to sell Azure to as well as appeal to startups, as 40% of Azure revenue is from startups and ISVs (October 2014). While Azure is a logical choice for Microsoft developers and customers who currently use Microsoft's full enterprise stack, 20% of Azure is already on Linux (October 2014). Microsoft is able to offer true private and hybrid cloud deployments in addition to its public cloud, maximizing its deployment reach.

Drawbacks: Microsoft experienced outages in August 2014 and November 2014. A Gartner analyst for cloud services' tweet highlighted the severity of the issue: "Microsoft's disastrous inability to keep Azure outages confined to a single region is a major red flag for enterprises considering Azure" (Twitter and CRN, November 2014). While more than one vendor has experienced outages previously, we believe future outages will be heavily publicized as enterprises put more mission critical applications in the cloud. In addition, discounts and credits may be skewing Microsoft's Azure revenue numbers higher than reported. According to Gartner, Microsoft has spurred an "aggressive sales drive, including the bundling of free Azure credits and deep discounts with other Microsoft enterprise and volume licensing agreements" (Gartner, October 2014). And more specifically, Microsoft often attaches $50k in credit for Azure when customers sign an enterprise license agreement (Gartner, September 2014).

Oracle Cloud

Oracle's cloud platform should appeal to a portion of its 400k customer base, as one of the highlights of Oracle's newly upgraded PaaS platform is its ability to move applications or databases up to the cloud in one click. While Oracle has commented that its IaaS pricing strategy will be competitive with Amazon AWS, Microsoft Azure, and others, we believe its primary cloud focus will be to get existing Oracle application customers to migrate these workloads to Oracle. For example, a customer running Oracle's financials in the cloud, on top of an existing Oracle database, will be able to bring its current license to Oracle's cloud and only pay an additional fee for the infrastructure layer they will be consuming (compute, storage, etc.). It is on this layer (IaaS) that we believe Oracle will be aggressive with its pricing.

Background: Oracle announced major upgrades to its public PaaS offering on September 30, 2014, centered on easily moving existing applications to the cloud. Oracle has 19 data center facilities, 400 petabytes of storage, and supports 23bn transactions/day and 62mn users/day. This is the same infrastructure that Oracle builds on.

Public cloud platform revenue estimate ($541mn in LTM IaaS revenue, or 1% of its total revenue): This compares to $1.3bn in SaaS and PaaS revenue over the same period.

Customers: Oracle listed a number of PaaS customers at its analyst day, including AT&T, Mazda, Fujitsu, Heinz, KPMG, USAA, NBC Sports, Herbalife, BT, and more.

Strengths: Oracle can leverage its relationships with its 400k customers to gain further adoption of its cloud platform products. Oracle recently displayed its PaaS's capability to port applications or databases from an on-premise environment to Oracle's cloud easily and without having to rewrite apps or make any changes to the database.

Additionally, given that Oracle sells its own servers (via the Sun acquisition), we see its IaaS/PaaS offerings potentially garnering higher gross margins than Microsoft and Google, which purchase hardware from a third party.

Oracle also hired Peter Magnusson in September 2014 to be the SVP of Oracle's public cloud, after his experience as the VP of Engineering at Snapchat and Engineering Director for Google where he was responsible for managing Google App Engine.

Drawbacks: While Oracle already has significant revenue from these cloud platform segments, when customers look into IaaS and PaaS vendors, Oracle is not top of mind as often as Amazon AWS, Google Cloud Platform, and Microsoft Azure, according to our CIO surveys. We believe Oracle's cloud announcement at its annual user conference on September 30 should help bolster awareness amongst its customer base.

Key components of Oracle's Cloud platform:

- IaaS – Oracle plans to price its IaaS product competitively with Amazon AWS, Microsoft. Customers can access the IaaS storage product using cloud and on-premise clients and get secure and granular access control.
- PaaS – According to Oracle, customers can move any existing Oracle application or database to the cloud by pushing a button and move it back without changing the underlying code. The move also modernizes database applications, automatically compresses the data 10 to 1, encrypts data, and lets users add mobile, social and analytic features.

Red Hat OpenStack and OpenShift

Relatively later to the game, Red Hat's IaaS (OpenStack) and PaaS (OpenShift) products became generally available in mid-2013. In our view, expectations for Red Hat are high, with investors expecting cloud revenue to be a significant portion of the business in the near term. As more enterprise move to the public cloud and have more and cheaper operating system options to compete with, we see this potentially serving as a headwind to Red Hat's growth. Additionally, while OpenStack and OpenShift should continue to grow, it will still take time before it reaches a tipping point where it is used for a material percent of production and mission critical use cases.

Background: As a leading provider of open-source Linux operating system technology (Red Hat Linux, or RHEL), middleware (JBoss), and virtualization technology (Red Hat Enterprise Virtualization), Red Hat extended and utilized some of the same technology to create Red Hat's open hybrid cloud.

Customers: FICO and Cisco are Red Hat OpenShift customers. Nanyang Technological University in Japan is a Red Hat OpenStack customer. Red Hat partnered with Cisco, so Cisco's Unified Computing System bundled solution is based on Red Hat Enterprise Linux OpenStack. While there are likely more Red Hat IaaS and PaaS customers, many are not disclosed publicly.

Strengths: Red Hat's OpenStack Platform has tight integration with Red Hat Enterprise Linux, which should serve as a competitive differentiator, as well as OpenStack's community support around open source compared to AWS, salesforce.com, and others. Additionally, similar to Microsoft Azure, Red Hat caters to enterprises looking to support hybrid environments. Red Hat could continue to benefit from its relationship with Cisco, as 19 of Cisco's top 20 customers told Cisco they plan to use OpenStack (August 2014 quarter call).

Drawbacks: We believe OpenStack and OpenShift still account for a very small portion of Red Hat's overall business. While there has been an incredible amount of buzz around OpenStack in 2013 and 2014, it is still very early for both technologies. While there are likely some production deployments of Red Hat's versions of OpenStack and OpenShift, we have yet to see a stockpile of named, high-profile customers in production. To be clear there is a solid opportunity for the company in this area if they can execute and compete with current leaders. While it ranked fifth in terms of usage from our population of CIOs, we would expect traction to increase over the next few years, albeit its competition is formidable. In January 2014, Gartner did not rank Red Hat as a "leader" in its application PaaS magic quadrant (salesforce.com and Microsoft were the only companies in this category), but ranked it as a "visionary" along with eight other vendors.

Key components of Red Hat's cloud products:

- IaaS – Red Hat's IaaS offerings include Red Hat Enterprise Linux OpenStack Platform (RHEL OSP, generally available July 2013) and CloudForms, a hybrid cloud management product that works across Red Hat and other platforms.
- PaaS – Red Hat's PaaS offerings include OpenShift Online, its public PaaS (generally available June 2013), and OpenShift Enterprise Premium, its private PaaS (generally available November 2012).
- Public cloud revenue from users and organizations purchasing Red Hat's products (i.e., Red Hat Enterprise Linux) from its 80 certified public cloud providers.

IBM SoftLayer / Bluemix

Background: IBM made an aggressive move into the IaaS market with the purchase of SoftLayer for $2.0bn that closed in July 2013. Since then, IBM has continued to invest in the business including an additional $1.2bn to expand SoftLayer's global data center footprint to 40 locations by 2015. Bluemix is the company's PaaS offering based on Cloud Foundry that went GA in June 2014.

Public cloud platform revenue estimate: IBM does not disclose public cloud platform revenue, though it does note that exiting 3Q14 "as-a-Service" revenue was at a $3.1bn run rate compared to $1.7bn in "as-a-Service" revenue in 2013. Note that these figures capture more than just IaaS/PaaS.

Customers: IBM has disclosed several customers for SoftLayer including Daimler, Whirlpool, Macy's, and Sicoss Group with GameStop and Vivocha publicly named as a customers for Bluemix.

Strengths: IBM has a significant hardware installed base to leverage in migrating customers to a hybrid-cloud strategy. IBM views this as the intersection of "systems of record" (i.e., on-prem legacy platforms including mainframe) and "systems of engagement" (i.e., mobile, cloud). In addition, IBM can leverage Global Technology Services (GTS) relationships to drive adoption of its IaaS/PaaS initiatives.

Drawbacks: Per the recent CIO survey, IBM was mentioned by few respondents. This highlights that IBM's offerings may not yet be fully appreciated by the marketplace and indicates the headwinds to adoption ahead compared to leaders in the space.

HP Helion

Background/Strategy: HP Helion was introduced in May 2014 and incorporates both HP's legacy cloud offerings as well as new OpenStack-based technology. HP Helion Public Cloud includes both IaaS and PaaS functionality. Going forward, the company plans to invest over $1bn over the next two years on cloud-related product and engineering initiatives. In addition, in September 2014, HP purchased Eucalyptus, a provider of open-source software that enables building of private and hybrid clouds. Along with the transaction, Eucalyptus CEO Marten Mickos joined HP to serve as head of HP's Cloud Business.

Appendix

Cloud Computing 101

The notion of cloud platform services was pioneered by Amazon Web Services with the introduction of its Simple Storage Service in 2006 and also salesforce.com in 2007 with their what is now its Salesforce1 offering. Prior to the emergence of these cloud services, organizations seeking to deploy new applications or extend existing applications were first required to deal with the complex and often expensive process of procuring and provisioning infrastructure components (including hardware, operating systems, databases, middleware, etc.) before the application development process could even begin. And, beyond the capital spending requirements, these deployments also involved significant operating spend related to hiring IT administrators to manage all of the underlying infrastructure components. Accordingly, it seems that infrastructure served as a significant inhibitor to the speed of innovation among large well-established companies but more meaningfully with smaller businesses and entrepreneurs. Today, companies can essentially "rent" cloud platform services from Amazon, Google, Microsoft, and others, to quickly get up and running with less initial capital and less IT staff to manage it over time. This lets companies focus on the core of their businesses.

The easiest way to differentiate between PaaS and IaaS is to consider the services utilized by the end customer. In the case of IaaS, the user is leveraging core system infrastructure including compute, storage and networking. IaaS can apply to an organization's owned data center or managed by third party providers, and available for consumption on a subscription basis by an end user (examples include: Amazon EC2 or S3 (compute or storage), Google Compute Engine, Microsoft Azure, VMware vCloud Air, etc.).

With PaaS, the user has access to core system infrastructure, as is the case with IaaS, but also to application services (including development tools and libraries) intended to significantly simplify and enhance the application development process as well as ongoing administration. Examples include: salesforce.com Salesforce1, Google App Engine, Microsoft Azure, Amazon Elastic Beanstalk, etc.).

Public cloud platform benefits

Some of the top benefits of cloud computing are as follows.

- **Scalability and capacity on demand.** Enterprises no longer need to heavily over provision to accommodate for spikes in demand. Cloud computing has made it easy to add thousands of servers to accommodate a spike in traffic and lower the amount of capacity needed when the event is over.
- **Disaster recovery.** Enterprises are able to perform disaster recovery often faster and cheaper using public cloud, because enterprises would need less dedicated capacity when not in recovery mode.
- **Shift from capex to opex.** Enterprises no longer need thousands to millions of dollars of upfront capital to build out the infrastructure before they are able to build an application or a website. Now enterprises and consumers can purchase only what they need initially and can add more as needed.
- **Shorter implementation times.** Companies are able to get up and running in minutes rather than weeks, not having to buy and ship the physical hardware, find data center space, implement and test the hardware before they start coding.

- **Shifting the focus off of "keeping the lights on" and on the core business.** Enterprises can spend more time on their core business instead of constantly maintaining IT.
- **Global reach.** Enterprises can quickly deploy applications in multiple countries or regions without having to worry about the complicated logistics.
- **Faster release cycles.** Developers are able to put out releases faster and more often using cloud platforms. Plus, if applications are limited by older underlying infrastructure, companies can point and click to add more servers or update the infrastructure software.
- **Economies of scale.** Vendors like Amazon and Google get economies of scale from their large customer bases, which often transfer into lower pricing for end customers.
- **Ease of updates and management in the future.** Always on software should start to permeate to the infrastructure layer, enabling automatic updates that are pushed to the end customer multiple times per year, rather than once over multiple years.

A closer look at IaaS, PaaS, and SaaS

As mentioned above, infrastructure services (IaaS) are raw IT resources that are either managed on premise or by a third party (for example Amazon or Rackspace) that are made available for consumption on an as needed basis.

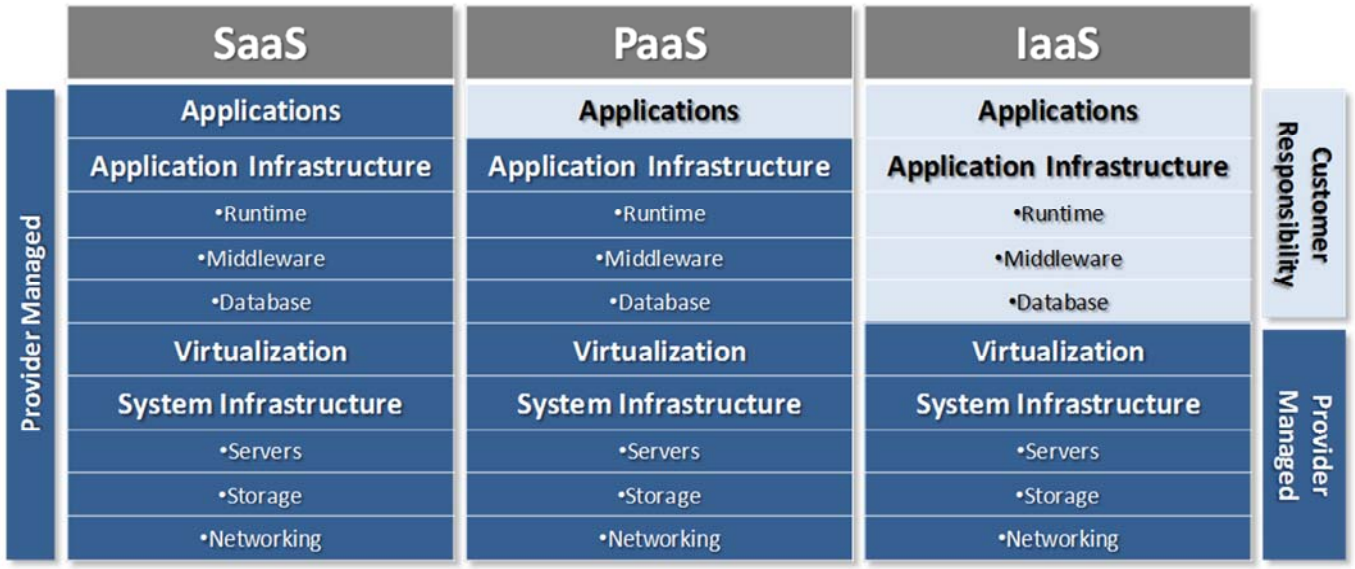
Who uses IaaS and why: Infrastructure services have a wide range of customers, from the largest multi-national corporations, to the public sector, down to SMBs and the individual developer. Although there are many reasons why users opt to take advantage of public cloud services, cost is often a consideration (a shift from capital expenditures to operating expenses, with the potential for a lower total cost of ownership for certain workloads) as does the appeal of significantly increased agility. With the traditional method of on-premises workload deployment, there can be a lengthy delay (weeks to months) between idea conception and implementation given the need to procure or provision physical hardware (servers, storage, networking) and related infrastructure software (operating system, middleware, database). The related cost, both in dollars and time, dramatically infringes on the resources available for innovation. For example, IDC has stated in the past that for every $1 invested in new IT infrastructure, another $8 is spent on maintaining legacy IT (IDC 2007).

IaaS significantly simplifies this process since it allows for self-service access to infrastructure resources, essentially to anyone with a credit card. Per the Amazon Web Services website: "You can deploy hundreds or even thousands of servers in minutes, without talking to anyone. This self-service environment changes how quickly you can develop and deploy applications and allows your team to experiment more quickly and more frequently."

Perhaps more important than the profile of the user taking advantage of cloud computing resources today are the types of workloads that are being run in the cloud (mission critical or not) as well as the extent to which entities are taking advantage of public cloud resources. For example, an early-stage internet company might choose to launch its B2C website using infrastructure services from Amazon, though a very large multi-national entity may choose to only offload seasonal workloads (e.g., virtual desktops for seasonal workers) to public cloud services while maintaining business critical applications in house.

Our field work suggests public cloud infrastructure services are largely being used for non-mission critical new workloads as an alternative to ordering and setting up new infrastructure, but there are cases of large enterprises migrating a significant percentage of their infrastructure to the cloud, including Netflix, Time, and Suncorp Group (as referenced earlier in this document).

Exhibit 24: Types of cloud services (IaaS, PaaS, SaaS)



Source: Goldman Sachs Investment Research.

A closer look at PaaS: Platform services go beyond simple infrastructure, extending to application development and administration. This is the layer that extends above the IaaS layer and provides application development and administration. The PaaS layer makes it much easier to configure and manage the underlying infrastructure so developers can focus more on building their applications. The end user of PaaS platforms ranges from developers to users who do not have a computer programming skills.

Key market participants include Microsoft Azure (with origins in PaaS that were extended into IaaS), Amazon with Elastic Beanstalk and other services, Google App Engine, salesforce.com with Saleforce1, Red Hat with OpenShift, Pivotal CF, Oracle's PaaS, among others.

How SaaS fits in: Software as a Service (SaaS) is the most widely adopted of the three clouds thus far. The term SaaS has become synonymous with established vendors such as salesforce.com, Workday, and NetSuite. Users of SaaS are leveraging the entire IT stack of the vendor, from the application itself all the way down to the system infrastructure. The benefits of migrating to SaaS-based applications stem from lower capital expenditure requirements as a result of reduced server requirements (as well as other technology such as database and middleware offerings), a faster time to deployment, the potential for a smaller IT personnel footprint, as well as the ability to pay on a per-user basis and scale this as needed (as contract lengths are typically one year in duration).

Over the next 5 -10 years we see the hybrid cloud model as being the most popular enterprise architecture

While AWS recently showcased over a handful of enterprises that have migrated or intend to migrate all of their infrastructure to the cloud, we believe the vast majority will adopt a hybrid cloud model over the next 5-10 years. Hybrid cloud is simply defined as a combination of public and private clouds. And like mainframes, which are still used by over 71% of the Fortune 500 (IBM, May 2014), we do not believe enterprises will move 100% off of their current infrastructure quickly.

Top catalysts/barriers to adoption

As it is still early days for both PaaS and IaaS, organizations are still largely in the process of evaluating the various platforms and determining use cases. And there are multiple factors that would impact the speed of adopting cloud platforms. In particular, there are ongoing concerns around data security (heightened by PRISM), compliance, especially for highly regulated industries (such as financial services), and the technical requirements of deploying an application in the cloud (PaaS or IaaS).

And while data security was often cited as a top concern by companies looking to adopt public cloud, recent data suggests data center security is becoming less of a concern. In North Bridge Venture Partners' 2014 cloud survey, 49% of respondents cited security as an inhibitor compared to 55% in 2012. We outline some of the top barriers and catalysts below.

Exhibit 25: Top Barriers and Catalysts to Cloud Adoption

Top Barriers

- Comfort around security
- Compliance
- Confidence to put mission critical applications and workloads in the cloud
- Added complexity with managing multiple environments (hybrid cloud)
- Outages
- Fear around vendor lock in

Top Catalysts

- Growth in mobile and internet applications
- Data center refreshes
- IDC expects 10-100x growth of new "killer apps" (Dec 2013)
- Developers becoming more influential in IT spend

Source: Public company data, Goldman Sachs Investment Research.

Red Hat (RHT, Sell): Downgrade to Sell from Neutral

Source of opportunity

We are downgrading Red Hat to Sell from Neutral with a 12-month price target of $70, for 4% upside vs. 13% upside for the rest of our coverage. Expectations are high for Red Hat after a strong print last quarter (November 2014 quarter, F3Q15), and in our view, investors are expecting billings growth to accelerate materially in FY16, driven by strong up- and cross-sell activity. Last quarter, billings grew +19% yoy (+22% FX adjusted). And while we expect strong growth next quarter (February 2015 quarter, F4Q15), we still believe billings growth will decelerate next fiscal year as Red Hat faces strong FX headwinds and growth in cloud workloads. We forecast +14% yoy billings growth in FY16 (consensus +14%) vs. +15% in FY15. Typically, the multiples of Citrix, VMware, and Red Hat when looked at together have a high degree of correlation – ranging from 0.6 to 0.9 over the past five years depending on the multiple and pairing. Lately, however, Red Hat's multiple has started to diverge. This divergence started to occur post Red Hat's F3Q15 results in mid-December, at which point the differential to VMW's and CTXS's EV/FCF multiple expanded by about 2.5x. Given the stock's outperformance since earnings (+10% versus the S&P at -2%), market sentiment is calling for material acceleration in billings growth in 2016, which we believe is unlikely.

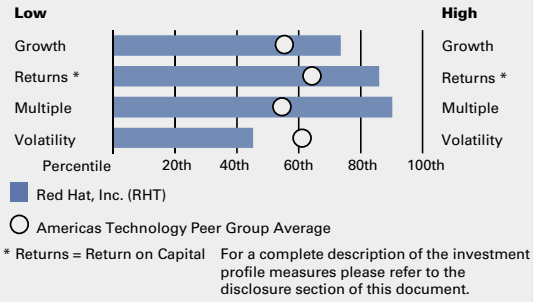
Catalyst

While we believe that Red Hat is executing well and has potential to be a significant player in the area of PaaS and private IaaS, we see shares as having the potential for underperformance over the next few quarters as, in our view, investor expectations for a material acceleration in billings in FY16, even on a constant currency basis, are questioned. While we expect a strong F4Q (February 2015 quarter), we believe this is widely expected by investors. As such, we believe it is appropriate to take profits given our view that the stock is close to being fairly valued.

Valuation

We are downgrading our rating to Sell (from Neutral) with no changes to estimates or 12-month price target ($70). Our price target is based on a weighted average including a fundamental valuation component (85% weight) and an M&A component (15% weight). The fundamental component is based on a three-pronged valuation approach composed of a DCF, EV/billings and EV/FCF. Our fundamental valuation yields a price target of $70 based on DCF (1% FCF perpetuity growth rate, unchanged from prior), 5.0x CY15 EV/billings (unchanged from prior), and 20x CY15 EV/FCF (unchanged from prior). The M&A component assumes an EV/TTM revenue multiple of 7.0x (unchanged from prior) based on the average EV/TTM revenue multiple for historical software deals greater than $1.0bn, and yields a valuation of $69. Our billings growth estimate is 14% yoy for FY16 compared to 14% yoy consensus, while our CFO growth estimate is 8% yoy compared to 12% yoy consensus.

Investment Profile



* Returns = Return on Capital

For a complete description of the investment profile measures please refer to the disclosure section of this document.

Key data	Current
Price ($)	68.74
12 month price target ($)	70.00
Market cap ($ mn)	12,900.7
Dividend yield (%)	0.0
Net margin (%)	16.7
Debt/total capital (%)	40.4

	2/14	2/15E	2/16E	2/17E
Revenue ($ mn)	1,534.6	1,783.1	2,029.1	2,310.8
EPS ($)	0.93	0.95	1.21	1.49
P/E (X)	54.0	72.5	56.8	46.3
EV/EBITDA (X)	18.0	24.3	19.8	16.4
ROE (%)	18.6	22.0	27.6	27.5

	11/14	2/15E	5/15E	8/15E
EPS ($)	0.26	0.25	0.24	0.30

Price performance chart

Share price performance (%)	3 month	6 month	12 month
Absolute	18.4	25.1	20.0
Rel. to S&P 500	11.7	20.7	7.9

Source: Company data, Goldman Sachs Research estimates, FactSet. Price as of 1/09/2015 close.

Key risks
If overall IT spending growth increases significantly from current levels, new products become a material portion of revenue faster than expected.

What would make us more positive?
If the company were to show a material acceleration in billings growth over the course of its upcoming FY which we believe would signal signs of adjacent product adoption in emerging areas related to OpenStack and containers.

VMware valuation

We are lowering our 12-month price target $90 (from $110) based on lowered estimates, with no change to our rating. We are lowering our CY15 revenue growth forecast to 10% yoy (from 15%) and FCF growth forecast to 1% yoy (from 14%) to reflect higher cash taxes. Our price target is derived from our three-pronged valuation approach, which includes a DCF, EV/billings, and EV/FCF analysis. This is based on an EV to CY15E billings multiple of 4.5x (from 5.5x, due to a lower growth rate), 17x EV/ FCF analysis multiple (from 20x, due to a lower growth rate). Finally, our DCF assumes a FCF perpetuity growth rate of about 1% (unchanged from prior). Key risks include macro and competition from other providers such as MSFT and CTXS.

Rating and pricing information

Amazon.com Inc. (B/A, $300.46), Google Inc. (N/A, $506.91), Microsoft Corp. (S/A, $47.59) and salesforce.com, Inc. (B/A, $58.59)

Disclosure Appendix

Reg AC

We, Heather Bellini, CFA, Heath P. Terry, CFA, Bill Shope, CFA, Nicole Hayashi, Shateel Alam, Jack Kilgallen, Perry Gold and Matthew Cabral, hereby certify that all of the views expressed in this report accurately reflect our personal views about the subject company or companies and its or their securities. We also certify that no part of our compensation was, is or will be, directly or indirectly, related to the specific recommendations or views expressed in this report.

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The precise calculation of each metric may vary depending on the fiscal year, industry and region but the standard approach is as follows:

Growth is a composite of next year's estimate over current year's estimate, e.g. EPS, EBITDA, Revenue. **Return** is a year one prospective aggregate of various return on capital measures, e.g. CROCI, ROACE, and ROE. **Multiple** is a composite of one-year forward valuation ratios, e.g. P/E, dividend yield, EV/FCF, EV/EBITDA, EV/DACF, Price/Book. **Volatility** is measured as trailing twelve-month volatility adjusted for dividends.

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