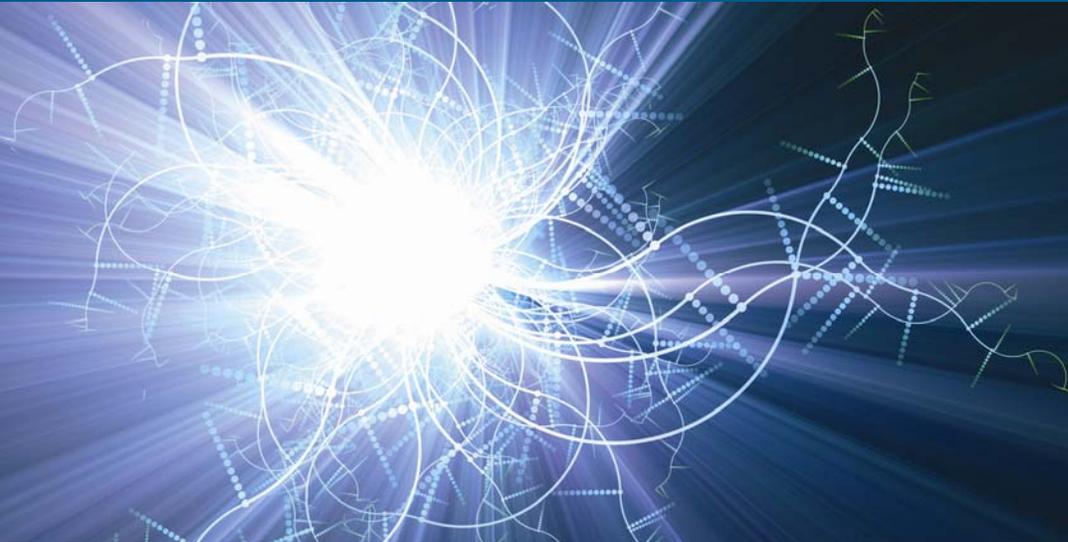


May 23, 2011

## MORGAN STANLEY BLUE PAPER



## Cloud Computing Takes Off Market Set to Boom as Migration Accelerates

**Public cloud workloads may increase at a 50% CAGR in the next three years—about twice as fast as the market currently anticipates.** Our AlphaWise evidence is based on the first global survey of IT managers on cloud migration in the US, Europe and Asia-Pacific. Among the 300 IT decision-makers we interviewed, the percentage using the public cloud is expected to rise from 28% to 51% in three years, while the portion of their workload running in the cloud likely will more than double, from 10% to 22%.

**Server growth shifts to the cloud...** We have revised our global technology team's server model to reflect these findings. We estimate that the number of servers shipping into public-cloud environments will grow at a 60% CAGR through 2013. This migration of workloads from on-premise environments to the public cloud will continue to be a key driver of technology spending.

**..and on-premise server growth moves downward.** Survey respondents cited server hardware as the primary area of savings from the migration to cloud computing. They expect to reduce server spending by 8.6% over the next three years. Vendors that depend on on-premise server shipments will likely be hard hit.

**Capturing the cloud.** In this report 17 analysts from seven industries discuss how shifts in workload location, increased use of virtualization and grid computing, and denser workload-to-server ratios affect various sectors in the IT universe—both positively and negatively. We tend to favor cloud service providers that are consolidating demand onto their platforms and vendors that support the build-out of cloud environments. We identify eight companies that are best positioned for the opportunities we see in cloud computing—Accenture, Salesforce.com, Broadcom, EMC, Juniper Networks, Quanta, Rackspace, and VMware. A basket of all the names, identified as “Best Positioned for Cloud Migration,” is available under the Bloomberg ticker MSMSBPCM.

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Cloud Computing Takes Off

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## Measuring Cloud Impacts: Stronger than Investors Anticipate

### Cloud Growth Drivers

**Public cloud workloads may increase at a 50% CAGR in the next three years—about twice as fast as the market currently anticipates.**

Our AlphaWise global survey of more than 300 IT decision-makers suggests workloads running in public cloud environments will grow at a 50% CAGR over the next three years, with 25% growth in managed hosting workloads.

**Cloud service providers growth will likely have a longer tail than consensus reflects.** We expect to see improving breadth and depth of adoption as the percentage of respondents running workload in the public cloud grows from 28% today to 51% in three years and the percentage of workloads running in the public cloud grows from 10.0% to 21.5%.

**Looking for best-positioned companies in the cloud arms dealers.** We see explosive growth in public cloud servers (63% three-year CAGR) and solid growth in managed hosting servers (more than 12%). Vendors best positioned to benefit from the clouds build-out are likely to do well.

### Key Beneficiaries

- **Accenture.** Increasing assessments and IT strategy work are good for consultants, and Accenture is the best positioned here.
- **Broadcom.** Broadcom's Trident family of data center switches will benefit the company as infrastructure builds increase due to the migration to cloud-based server environments.
- **Salesforce.com.** SaaS workloads expected to sustain a 50% CAGR through 2014 are well ahead of the 11% new billings growth we model. With new apps ramping and a strong PaaS offering, Salesforce will be a key consolidator of cloud demand.
- **EMC.** Increased storage consumption in managed/cloud data centers, an expanding partner ecosystem and product set, and balanced software-hardware mix make EMC a top pick.
- **Juniper Networks.** With one of the only truly flat data center architectures today, QFabric arms Juniper with a first-to-market advantage for large-scale data center and cloud build-outs.
- **Quanta.** Usage of lower-cost Asian original design manufacturers (ODMs) among the large public cloud vendors is ramping up; Quanta is well positioned to gain share during the shift to the cloud.
- **Rackspace Hosting.** One of the only remaining pure plays in the IaaS space, Rackspace appears firmly established among Enterprise and small/medium businesses as a primary option for cloud deployment.
- **VMware.** Just 32% penetrated into x86 workloads, further penetration of core server virtualization could sustain near-20% growth in the core, while management, virtual desktop infrastructure (VDI), and public cloud drive above-consensus revenues.

Over the past five years, cloud computing has become one of the defining secular trends within technology, and we believe the effects are just beginning to be felt across the industry. This Blue Paper is the Morgan Stanley global technology team's most comprehensive effort yet to gather what we have learned thus far on what is driving the movement of workloads to cloud computing environments and to measure and forecast the effects of that movement.

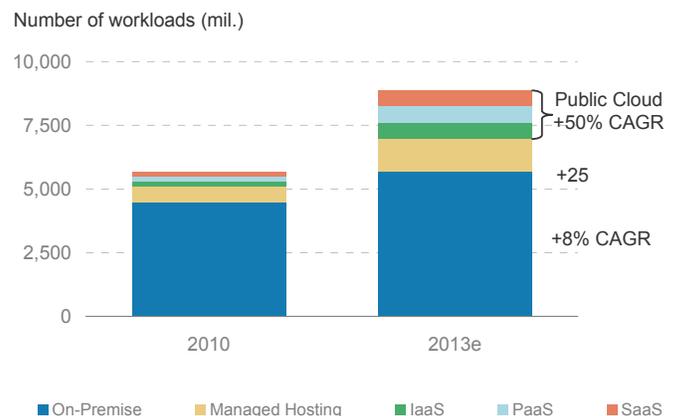
The bottom line: The migration of workloads to cloud environments will be one of the primary drivers of technology spending over the next three years, producing significant growth opportunities for those companies positioned to provide cloud services or build out cloud infrastructures. Conversely, cloud migration will present significant challenges for vendors tied to on-premise server environments.

### Migration to the public cloud reaching an inflection point.

Our work suggests a 50% CAGR in the growth of public cloud-based workloads over the next three years. Our analysis suggests robust growth not just for the newer, less-developed markets in the public cloud like Platform as a Service (PaaS) and Infrastructure as a Service (IaaS), but also the more mature Software as a Service (SaaS) segment — where we forecast workloads growing at a similar 50% CAGR. Within on-premise environments, the provisioning of workloads into private cloud or virtualized environment should see rapid expansion as well, growing from 32% of workloads today to 52% in three years.

Exhibit 1

### Our Survey Suggests a 50% CAGR in Public Cloud Workloads over the Next Three Years...

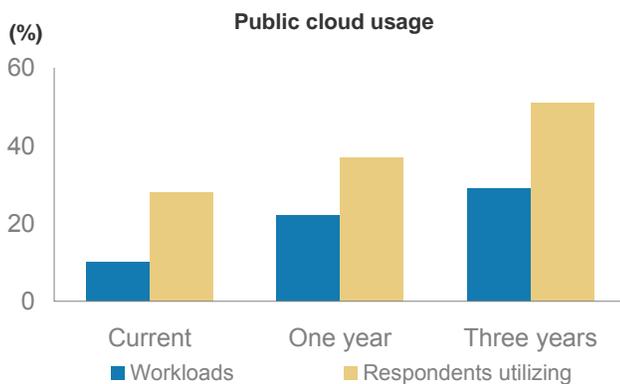


e=Morgan Stanley Research estimates.  
 Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

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**Breadth and depth of public cloud adoption expanding rapidly.** In our AlphaWise survey, 28% of respondents reported that they run workloads in a public cloud today; in three years, that percentage is expected to expand by more than 80% to 51%. Accompanying this is an expansion in the depth of penetration, with the percentage of overall workloads running in the public cloud growing at a 29% CAGR to 22% from 10% today.

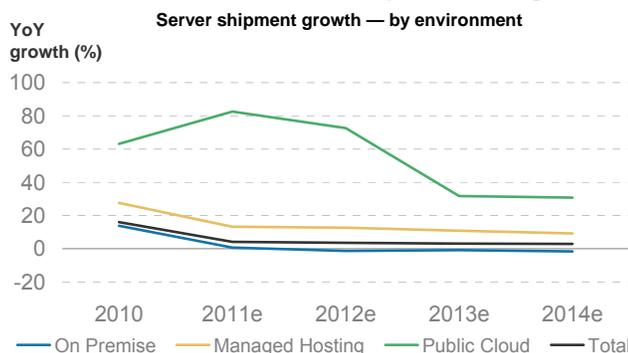
Exhibit 2  
**...as Both the Breadth and Depth of Usage Expands**



Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

**Server spending sees the biggest negative impact from this shift in the near-term.** Given the combination of workloads shifting to public cloud environments and the increasing utilization seen in on-premise server environments from virtualization and private cloud technologies, our revised server model now forecasts a -1% CAGR in on-premise server shipments over the next three years. This trend will result in near-term beneficiaries among vendors supplying the build-out of public and private cloud environments and longer-term challenges for vendors tied strongly to on-premise corporate server demand.

Exhibit 3  
**...While On-Premise Server Shipments Stagnate**



e=Morgan Stanley Research estimates.  
 Source: Morgan Stanley Research

**Secular Cloud Challenges**

**Server spending the most negatively affected by the move to the cloud.** In our AlphaWise survey, 54% of our respondents cited server hardware as a top-three area of cost savings from the move to cloud computing. The average 8.6% expected reduction in server spending over the next three years due to the move to the cloud, dwarfs the 1.0% and 0.4% expected savings for storage and networking, respectively.

**On-premise server growth goes negative.** A shift of workloads to more-efficient cloud environments and increased utilization of current server resources in private cloud environments push on-premise new server shipments to a -1% CAGR over the next three years in our model.

**Challenges for vendors tied to the growth of on-premise data centers.** Growth drivers are shifting as vendors try to incorporate public cloud strategies; those slow to move will see significant headwinds to growth.

**Models in Flux**

- **Brocade.** Brocade offers a competitive fabric-based strategy, but its ability to execute and penetrate large accounts remains a concern.
- **Cisco.** Lacking a flat architecture for large-scale cloud deployments in its portfolio, we believe Cisco remains in a defensive position.
- **Capgemini.** With about 50% of its outsourcing business (20% of total) coming from information technology outsourcing (ITO), we see potential for short-term headwinds.
- **Hewlett-Packard.** Hewlett-Packard lacks a clear strategy to attack cloud data centers with traditional server and networking products. However, converged portfolio is taking share in on-premise data centers.
- **Microsoft.** Microsoft's dominant share in server operating systems is almost solely in on-premise environments. However, its public cloud offerings polled the strongest of any vendor in our survey.
- **Red Hat.** While well positioned for the cloud build out, Red Hat's current subscription base is largely tied to on-premise deployments, and its virtualization, PaaS, and IaaS offerings are nascent.
- **SAP AG.** A ramp in the BBD reseller network is likely to drive higher top-line growth and meaningful revenue contribution for the group. We estimate business-by-design (BBD) revenues at €83 million in 2012e (less than 1% of group SQL server reporting services), reaching about €900 million in 2015e, about 10% of group SSRS.

**Potentially Secularly Challenged**

- **Atos Origin.** With about 40% of its sales derived from ITO, we see the company facing material booking/revenue headwinds in the near term.
- **Dell and QLogic.** The demand shift to cloud service providers purchasing from Asian ODMs puts server growth at risk.
- **Symantec.** About 50% of company revenues are tied to on-premise servers and storage, and SaaS-based businesses represent just 11% of revenues.

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## SUMMARY OF KEY TAKEAWAYS BY INDUSTRY

<p><b>Hardware</b></p> 	<p><b>As companies shift from on-premise to managed or public cloud environments, x86 server share leaders are at risk of market share loss to Asian ODMs.</b></p> <ul style="list-style-type: none"> <li>• Hewlett-Packard and Dell, x86 market share leaders, are most at risk from a depressed on-premise server demand environment.</li> <li>• Asian ODM's like Quanta and Wistron that ship directly to the largest cloud service vendors will outgrow premium vendors and continue to gain market share.</li> <li>• Savings reaped from virtualization and the cloud will be spent on technologies that can improve growth and/or profitability; data analytics is likely to do well.</li> </ul>
<p><b>Storage</b></p> 	<p><b>Storage spend will continue to benefit from increased consumption in managed/cloud IT data centers, with only a mild offset as companies decrease on-premise storage spend.</b></p> <ul style="list-style-type: none"> <li>• We prefer EMC for its recent broadening of the product suite, partner ecosystem expansion, and more balanced software/hardware mix (which can reduce gross margin volatility) as compared with peers.</li> </ul>
<p><b>Semiconductors</b></p> 	<p><b>Cloud build-outs drive the need for greater data center switching, security, and processing power.</b></p> <ul style="list-style-type: none"> <li>• Broadcom is our preferred play on growth in the cloud-based data center switch market.</li> <li>• The compute resources needed to meet security requirements from cloud-build outs increase by greater than 10 times; Cavium Networks benefits most from the higher compute needs.</li> </ul>
<p><b>Software</b></p> 	<p><b>Public cloud growth will be stronger and longer lasting than investors expect; at the same time, a stagnant on-premise server market means shifting growth drivers for many infrastructure vendors.</b></p> <ul style="list-style-type: none"> <li>• A 50% CAGR in public cloud workloads should drive the upside to our current models for cloud service providers; vendors able to consolidate demand like Salesforce.com and SuccessFactors will be the key beneficiaries, in our view.</li> <li>• A 20% CAGR in virtualized servers sustains VMware's core business, while investments in management, virtual desktop, and public cloud infrastructures become larger growth drivers.</li> <li>• Growth drivers are shifting for Red Hat, as server growth shifts significantly towards cloud environments.</li> </ul>
<p><b>Network Equipment</b></p> 	<p><b>Adoption of cloud architectures should drive the off-premise data center switching market to a 21% CAGR through 2015, leading the total data center market to 10% growth over the same period.</b></p> <ul style="list-style-type: none"> <li>• As cloud adoption grows, a share shift toward higher-scale public cloud and managed hosting data center switching equipment should drive off-premise switching to grow at a 21% CAGR, to \$3.5 billion, through 2015.</li> <li>• We forecast the much larger on-premise data center switching market, which in 2010 stood at 25% of the total Ethernet market, to grow at a far more subdued 5% rate over the same period.</li> <li>• Juniper Networks is our preferred play on the cloud build out, as QFabric gives the company a first-to-market advantage for large-scale data center and enterprise cloud build-outs.</li> </ul>
<p><b>Telecom Services</b></p> 	<p><b>The large cap telco sector has prioritized cloud computing as a way to enhance wireline growth.</b></p> <ul style="list-style-type: none"> <li>• Telco cloud offerings continue to lag larger IT integrators and cloud specialists for mindshare among IT decision makers.</li> <li>• We see the recent spate of acquisition activity as a means to accelerate cloud growth and broaden the telco solution set to more fully encompass cloud-based offerings.</li> <li>• Rackspace appears firmly established among enterprise and small/medium businesses as a primary option for cloud deployment.</li> </ul>
<p><b>IT Services</b></p> 	<p><b>The emergence of cloud computing forces CIOs to redesign their fundamental IT strategies, creating opportunities for firms that can assist in the transition.</b></p> <ul style="list-style-type: none"> <li>• Increasing assessments and IT strategy work is good for consultants; Accenture is the best-positioned company here.</li> <li>• Cognizant Technology Solutions' on-site investments give the company a horse in the race and a better position for outsourcing work.</li> <li>• CSC has new "as a service" offerings and incorporates the cloud into all of its new ITO pursuits, which is a positive and will be critical to the company's long-term success.</li> </ul>

## What We Did and Why

Blue Papers are collaborative reports focusing on key secular themes transcending both sectors and geographies, where Morgan Stanley looks to define the key debates and give investors a clearer understanding of what will define the companies most likely to benefit from or be challenged by those trends. Within the technology industry, cloud computing represents a key secular theme, and one that has significant impacts across all sectors. Admittedly, cloud computing is a topic on which much has been written. What differentiates this project is its focus on analyzing and quantifying the effects of the migration of application workloads to cloud environments. This measurement enables us to estimate better the magnitude and longevity of cloud impacts and to understand the derivative impacts on existing technologies. There are four main components to this project:

- 1) **Global survey of cloud computing usage intentions.** The basis for our analysis is a global AlphaWise survey of 309 IT decisions makers on where application workloads are currently run, where they expect workloads to run going forward, and what the spending impacts from the migration of workloads to cloud environments might be.
- 2) **Server model revised to a workload-based framework.** Servers are the base unit of data center build-outs in this exercise. Our revised server model incorporates the effects of higher workload densities in virtualized and grid environments and explicitly forecasts server shipments by on-premise, managed hosting, and public cloud environments to understand better the effects these technologies and the shifting deployment mix has on overall server demand. Our three-year unit CAGR forecast drops from 6% to 3.4%.
- 3) **Impacts on ancillary technologies and stocks.** Analyst from all technology sectors globally took the conclusions of the global survey and our analysis of the server impacts and reflected how these trends would affect the companies in their sectors. What appears to be a clear negative for x86 server market share leaders like Dell and Hewlett-Packard is likely a strong market opportunity for Asian ODMs like Quanta and Wistron. VMware has plenty of headroom in its core server virtualization space, and as investments in management, virtual desktop, and the public cloud begin to ramp up, Juniper has a significant first-mover advantage in aligning its switching product strategy to the needs of public cloud service providers over Cisco, which continues to focus on the

enterprise. High network and compute demands of service providers should benefit semiconductor providers that focus on high signal integrity at high data speeds with low power consumption. Finally, transitions in IT architectures are a positive for consultants, and Accenture is best positioned to benefit here.

- 4) **Cloud computing primer.** For investors coming up to speed on the secular trend or looking for a refresher, our primer offers the most comprehensive report yet on the markets, players, and emerging trends in cloud computing.

### Overview of Key Concepts

- **Workloads versus servers.** Workloads represent units of application functionality that run on a server, most often complete applications. Historically, in x86 server environments companies would run just one application workload per server. The advent of server virtualization software for x86 CPUs and more powerful CPUs designed to better enable virtualization allowed companies to run multiple workloads per server effectively. In virtualized environments, a workload is often equated to a virtual machine (VM). Public cloud vendors make use of grid and multi-tenant architectures, in addition to virtualization, to enable multiple workloads to run on a single server.
- **Workload density.** This indicates the average number of workloads run on a server. IDC estimates an average of 6.6 workloads being run per server in virtualized environments today. Industrywide, we estimate that close to 20% of servers are running multiple workloads today, carrying close to 50% of total workloads. However, given that 80% of servers still run one workload, the industrywide workload density is closer to 1.5.
- **On-premise versus private cloud.** On-premise refers to the ownership and location of a company's data center or servers, owned and managed by the customer and located either on its own premises or in a colocation facility. Private cloud refers to a set of technologies that enable the pooling of compute resources used in on-premise environments. We estimate that only 17% of on-premise servers utilize any private cloud technologies.
- **Public cloud versus managed hosting.** Both are third-party hosted compute environments. However, in public cloud environments compute resources are shared dynamically among all customers, where as infrastructure is

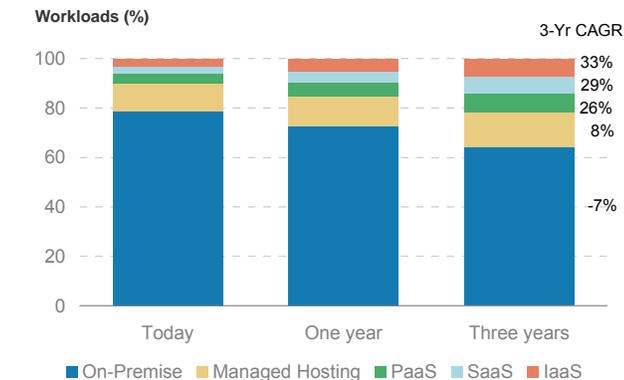
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dedicated to a particular customer in managed hosting.

## Key Macro Conclusion

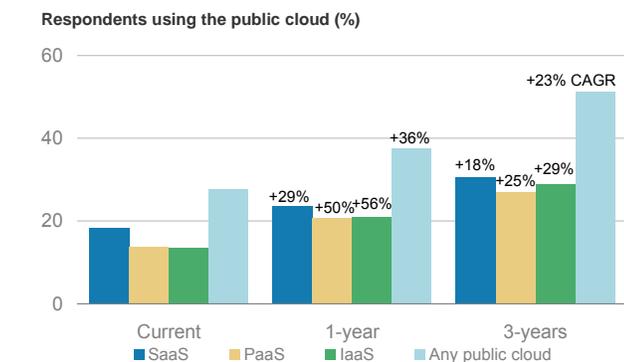
**Public cloud to show robust growth over the next three years.** Currently, only 28% of IT managers globally report running workloads in any type of public cloud environment. SaaS deployments are most common (18%), with PaaS and IaaS both being used by just under 14% of respondents. Over the next three years, both the breadth and depth of public cloud usage is expected to expand greatly, with a 23% CAGR in the number of respondents who expect to utilize the public cloud for some percentage of their application workloads and a 29% CAGR in the percentage of workloads expected to be run in public cloud environments. This 29% CAGR in the percentage of workloads run in public cloud environments, plus the 16% CAGR we forecast for workloads overall, yields 50% growth in public cloud workloads.

Exhibit 4  
**Global Survey Reveals a Robust Migration of Workloads to Public Cloud Environments...**



Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

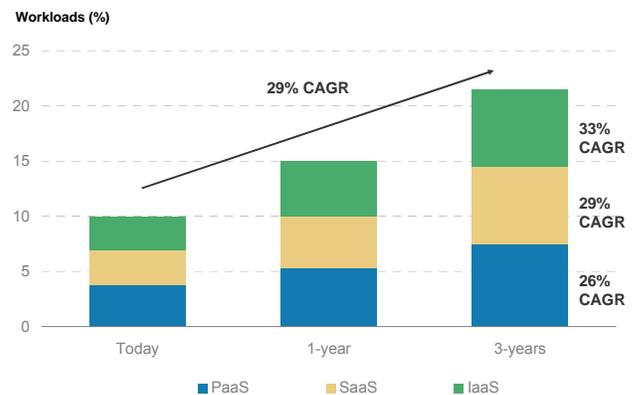
Exhibit 5  
**...and Broadening Usage, with Over 50% Expecting to Use Public Clouds within Three Years**



Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

**Growth in workloads a clear positive for cloud service providers.** A 50% growth rate for workloads run in public cloud environments is a clear positive for cloud service providers and significantly above market expectations — particularly in more mature segments like SaaS, where our analysis indicates workload growth can sustain a 50% CAGR through 2013. This type of growth compares favorably to the 11% CAGR in new billings growth we currently forecast for SaaS market leader Salesforce.com and would suggest considerable upside in the model. The strongest growth is expected from the IaaS market at a 54% CAGR. Amazon, with its broadening portfolio of compute services and large partner ecosystem, is likely to continue benefiting here. While public cloud represents only 14% of Rackspace revenues today, success with this offering is more likely to affect its stock price than similar success would affect Amazon's. We currently model a 46% CAGR in Rackspace's cloud business, a forecast well supported by our analysis. By comparison, industry analyst groups Gartner, IDC, and 451 forecasts a 25% three-year CAGR in the total public cloud market.

Exhibit 6  
**All Public Cloud Options Grow Well: Durability of SaaS Growth Perhaps the Biggest Surprise**



Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

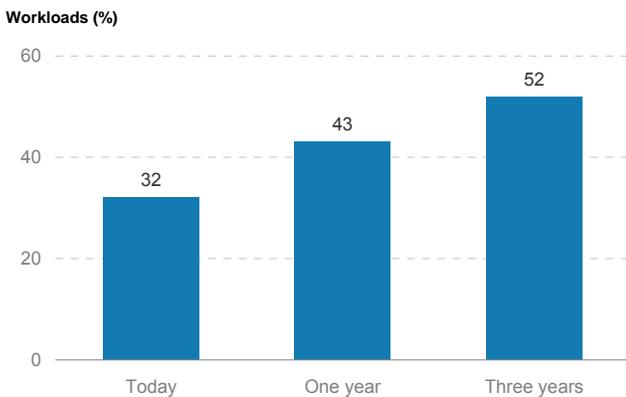
**Vendors supporting the build-out of public cloud environments are key beneficiaries.** While our analysis focuses on servers, all the elements associated with the build-out of public cloud environments are likely to benefit. Within servers, public cloud vendors tend to favor Asian ODMs like Quanta and Wistron over tier-1 vendors like Hewlett-Packard and Dell, but within networking and storage we found a more robust opportunity for tier-1 vendors. Juniper has a clear time-to-market advantage with its QFabric solutions geared towards service providers and large-scale data center build-outs; we believe QFabric will help Juniper to sustain nearly 20% growth in infrastructure products through 2013. Continuous growth in data volumes and clearly defined cloud

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strategies should help EMC take share, no matter the location (cloud or on-premise). VMware has invested heavily in building out its suite of cloud solutions, from the full PaaS suite in Cloud Foundations to actual SaaS applications with Zimbra and SlideRocket; these solutions should give the company strong legs for growth in the public cloud.

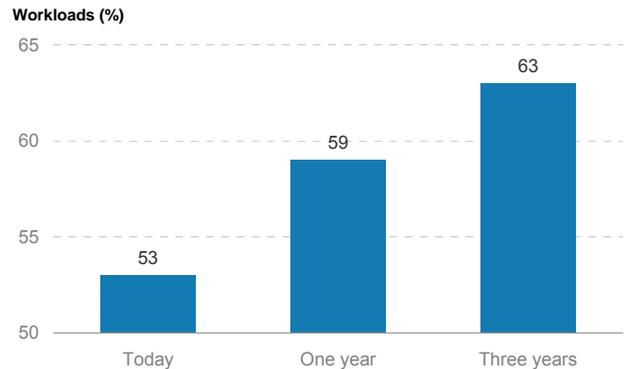
**On-premise environments getting more efficient.** At the same time that workloads are being deployed more often from highly efficient public cloud environments, the efficiency of on-premise server environments is improving as well, due to the increased usage of virtualization and other private cloud technologies. Survey respondents report 32% of their on-premise workloads are running in virtualized or private cloud environments today and they expect that percentage to expand to 52% in three years, driving a 33% CAGR in virtualized workloads. Non-virtualized workloads remain essentially flat during this same period. The increased usage of private cloud technologies is driving server utilization rates significantly higher as well. While the absolute self-reported utilization rates here seem high as compared with the levels reported by the industry experts we have consulted, the 17% improvement in expected utilization reported by IT managers is directionally very significant.

Exhibit 7  
**Increasing Penetration of Virtualization and Private Cloud Technologies into x86 Workloads...**



Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

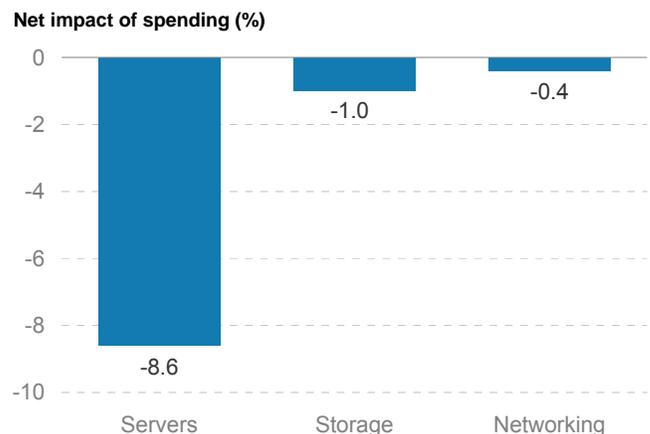
Exhibit 8  
**...Driving Higher Utilization Rates in On-Premise and Colocated Servers**



Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

**Servers expected to be the greatest source of cost savings.** In our survey questions about expected net cost changes in spending on key data center components and about work areas where respondents expect to see the largest cost savings, server hardware was shown clearly to be the technology that will receive the biggest blows in the move to cloud computing. Respondents moving workloads to the public cloud expect on average an 8.6% decline in server spending over the next three years, well ahead of the 1.0% average decline in storage spending and 0.4% decline in networking spend. This result was corroborated by more than 50% of respondents who cited server hardware as a top three area of expected cost savings due to the move to cloud computing.

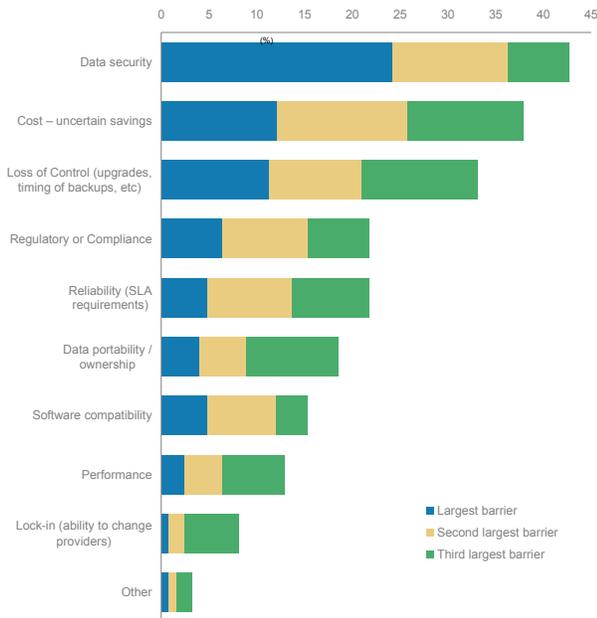
Exhibit 9  
**Three-Year Decline in Server Spending Because of Cloud Migration...**



Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

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Exhibit 10  
**...as More Than 50% of Respondents Cite Server Hardware as a Top-Three Area for Cost Savings**

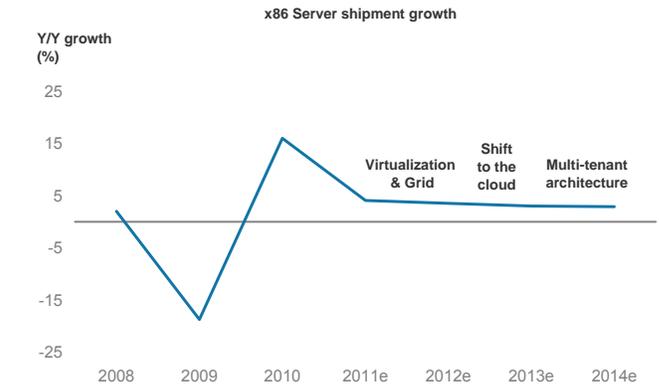


Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

**Several forces compressing on-premise server spending.** After seeing a strong rebound in the economic recovery, we believe a combination of compressive forces acting upon the server market will keep overall server shipment growth below historical levels. Our revised server model now forecasts a 3% CAGR in total server shipments through 2014, down from 6% previously. This reflects a -1% CAGR in on-premise servers, offset partially by very strong growth in public cloud environments (54% CAGR) and decent growth in managed hosting environments (12% CAGR).

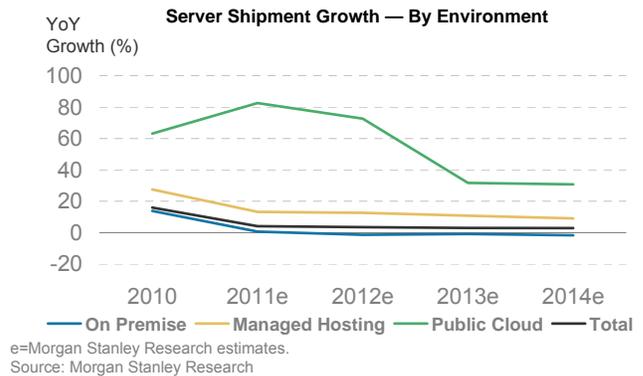
We estimate that on-premise servers make up about 87% of total server shipments today, and we expect that on-premise servers will still account for 74% of overall server shipments in 2014, even with the shift in workloads toward public cloud and managed hosting. Thus, we anticipate that the build-out of public cloud infrastructures will have a relatively small impact on overall server growth.

Exhibit 11  
**Multiple Compressive Forces Weighing on Server Shipment Growth**



Source: Morgan Stanley Research

Exhibit 12  
**On-Premise Server Growth Expected to be Stagnant, but Cloud Sees Extensive Build-out**



e=Morgan Stanley Research estimates.  
 Source: Morgan Stanley Research

**Weak server growth a significant headwind for vendors still heavily leveraged to on-premise environments.** The tier-1 server vendors like Dell and Hewlett-Packard are the most obvious names likely to face this challenge. However, across sectors there are vendors still significantly tied to the growth of on-premise data centers. Host bus adapters (HBAs) represent over 70% of QLogic's revenue, tying them closely to server shipments in non-cloud environments. While building out their public and private cloud offerings, we would estimate that Red Hat still derives about 70% of revenues from server operating systems in on-premise environments. With an estimated 80% data center share today and no flat architecture for large-scale cloud deployments, we believe Cisco remains in a defensive position.

## Our Cloud Analysis Drives the Following Rating Changes

Please see the reports published concurrently with this Blue Paper for details on our changes in recommendation for the following names. In addition, Teradata has been added to the Morgan Stanley Best Ideas list.

Ticker	Rating
CRM	EW → OW
TDC	EW → OW
HPQ	OW → EW
QLGC	EW → UW

## alphawise Evidence

### Core Questions for Evidence Research

- What is the current penetration of cloud computing and how is it expected to change in the next one to three years?
- What is the potential impact on on-premise servers and server-related markets?
- Who are the likely beneficiaries of greater adoption of cloud computing?
- What are the key barriers to the adoption of cloud environments?

### The Evidence

**Majority of respondents are already using some sort of cloud and expect more than one third of their workloads to be in the cloud or managed hosting in three years**

- Public cloud is expected to increase its share of workloads from today's 10% to 22% within the next three years.
- Managed hosting's share is likely to increase from today's 11% to 14% of all workloads during the same period.

**Servers are likely to be negatively affected by migration to cloud, but storage and networking are less so.**

- Reduced use of on-premise servers by 18% over the next three years could drive cuts in server spending by 9%.

**Microsoft is likely to gain the most from a broader adoption of public cloud environment.**

- Of respondents, 68% expecting to move workloads to cloud mention Microsoft as the vendor of choice.
- IBM is the most mentioned among those moving workloads to managed hosting.

**Security concerns are the dominant barrier to adoption for 43% of respondents.**

- Costs/uncertain savings is the second most-often mentioned reason (38% of respondents) for not migrating to a cloud environment.
- Fewer respondents believe that software compatibility (15%) or cloud's performance (13%) are areas of concern.

### What Gives Us Confidence

- **Breadth of the survey.** We conducted 304 phone interviews with decision-makers of IT strategy and policy (US, 103; Europe, 101; and Asia-Pacific, 100), representing 106 companies have 1 to 500 employees and 198 have more than 500 employees.
- **Timeliness of the data.** Fielding conducted March– April 2011.

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## Measuring Cloud Impacts: The Coming Server Squeeze

### Key Points

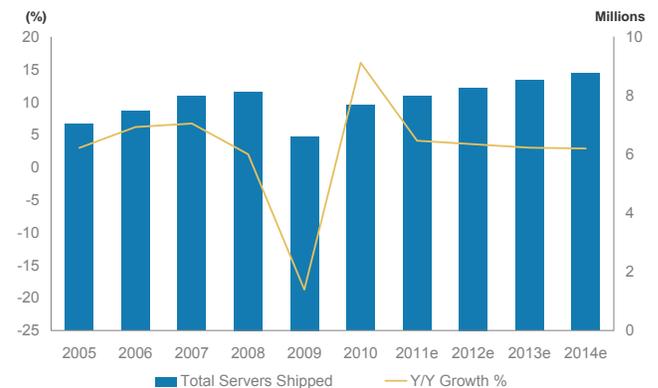
- Increasing utilization rates industrywide create significant headwinds for server shipment growth. We now forecast servers growing at just a 3.4% three-year CAGR, down from our 6% prior forecast.
- These headwinds are exacerbated by the movement of workloads to cloud environments. Our survey suggests the percentage of workloads running in on-premise environments falls from 79% today to 62% in four years.
- Offsetting stagnant server shipment growth into on-premise environments is a 12% three-year CAGR for server shipments into managed hosting environments and a robust 54% CAGR for servers shipping into public cloud environments.

Our global survey of over 300 IT managers suggests a steady shift in workloads moving out of company owned, on-premise compute environments to managed hosting and public cloud environments. We estimate that more than 20% of workloads have already moved off premise during the last six years, reaching a key inflection point for accelerated adoption. (Past technology cycles have accelerated after reaching a 20% adoption rate.) By 2014, we expect only 62% of workloads will be run on on-premise. Our work suggests that servers in managed hosting and public cloud environments run at higher utilization rates than typically found in on-premise environments. Thus, the movement of workloads to the cloud, along with the rising utilization rates seen in on-premise deployments from the adoption of virtualization and private cloud technologies, creates significant headwinds for server unit growth — particularly in on-premise environments.

**Moving to a workload based server model.** We have re-engineered our server model to forecast server growth discretely in: 1) on-premise, 2) managed hosting, and 3) public cloud environments — as based on the shift of workloads into these environments. Additionally, we forecast the effects of increasing rates of virtualization within these server bases. Bottomline, over the next three years we expect that on-premise server shipments will decline at a 1% CAGR while shipments into managed hosting environment grow at a 12% CAGR and shipments into public cloud environments at a 60% CAGR. Overall, our server unit growth forecast for 2011 drops from 6% to 4.1%, below the five-year average of 5% and well below the strong rebound to 16% growth in 2010. Over the next three years we expect overall server shipments to grow at a 3.4% CAGR as headwinds from the shift to the cloud continue to mount.

Exhibit 13

### Mounting Pressures from the Shift to Cloud Computing Will Weigh on Server Growth



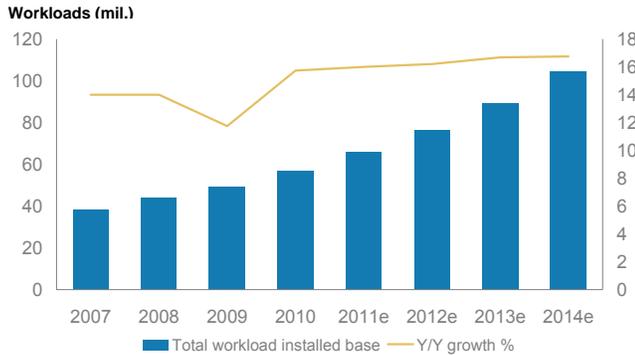
e=Morgan Stanley Research estimates.  
Source: IDC, Morgan Stanley Research

Our revised server model uses application workloads as the basis for our estimates. Analyzing the deployment environment and number of workloads per server (density) provides unique insights on the shifting dynamics of server units growth, in our opinion. We base our new server model on four key variables:

- 1) **Workload installed base growth.** As server environments become increasingly virtualized and workloads shift to high utilization cloud environments, the traditional drivers of server growth (application growth and refresh) become more disaggregated from actual server shipments. By changing the basis of our forecast to workloads, we believe we can better understand how these shifts affect server shipments. In 2010, we estimate there were 56.9 million workloads running worldwide, based on the sum of the last four-and-a-half years of workload shipments, as defined by IDC. Conversations with industry analysts suggest annual workload growth has held relatively consistent at 14-15%. Improvements in application development and deployment tools in recent years is lowering the time to market for new application workloads. At the same time, the availability of public cloud infrastructure lowers the upfront capital expense of deploying new application workloads. As we have seen in other cycles, new enabling technologies can spur growth of use cases to take advantage of the new capabilities (e.g., higher bandwidth internet connections leads to VoIP). Thus, we believe workload growth can actually accelerate over the next several years.

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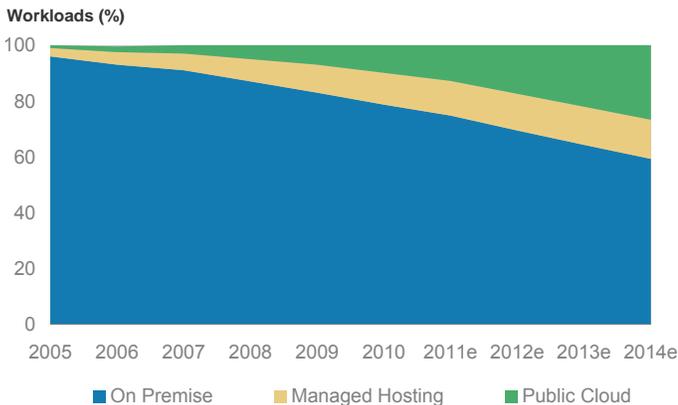
Exhibit 14  
**Better Enabling Technologies (Cloud/Frameworks) Can Spur Higher Growth in Workloads**



e= Morgan Stanley Research estimates.  
 Source: IDC, Morgan Stanley Research

2) **Location of workloads: On-premise, managed hosting, or public cloud.** Location is important because of the variations in workload density seen in different environments and the contrasts in buying behavior between enterprise customers and service providers. In general, our work suggests that public clouds run more workloads per server and use more shared compute technologies (e.g., virtualization, grid, and multi-tenant architectures), leading to high rates of unit consolidation. On the other hand, on-premise data centers run more applications on standalone, dedicated servers (one-to-one relationships), which do not compress server units. Service providers are more likely to use white box servers or build their own servers, and enterprises are more likely to look for a full-service vendor for on-premise deployments.

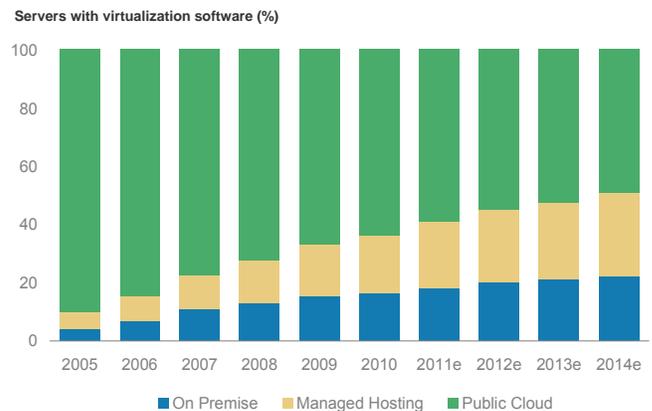
Exhibit 15  
**Workloads are Moving Away from On-Premise Environments**



e=Morgan Stanley Research estimates.  
 Source: IDC, Morgan Stanley Research

3) **Percentage of servers running virtualization.** We estimate on-premise data centers use the least amount of virtualization software as many mission-critical applications and workloads remain on dedicated servers within a company's own data center. We estimate the use of virtualization or shared compute technologies increases at managed hosting sites and is 100% in public cloud environments.

Exhibit 16  
**Increasing Virtualization Adoption at All Data Center Locations**

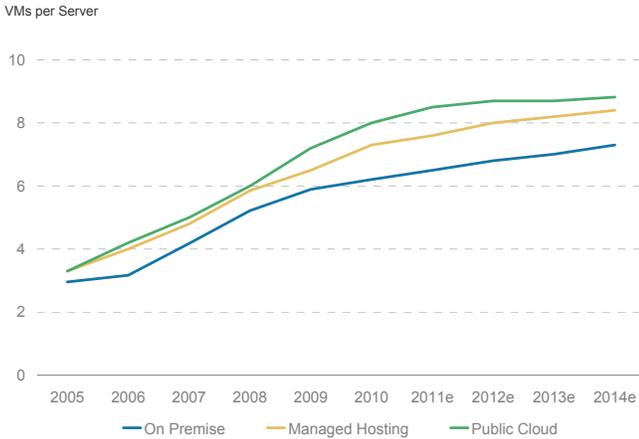


e=Morgan Stanley Research estimates.  
 Source: IDC, Morgan Stanley Research

4) **VM workload-to-server ratio.** Whether a shared compute environment (like a multi-tenant architecture) or actual VMs running on servers, the consolidation effect on servers is similar. Our conversation with public cloud providers and industry experts suggests that the server consolidation rates in the public cloud tend to be higher than in managed hosting or on-premise environments. There are various reasons for this: 1) within SaaS environments the applications are optimized to run on their particular infrastructure; 2) many cloud applications tend to be more lightweight than applications running in on-premise environments; and 3) the management skill sets within cloud providers tend to be higher than those in commercial on-premise environments.

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Exhibit 17  
**Public Cloud Data Centers Achieve the Highest Levels of Workload Consolidation**



e=Morgan Stanley Research estimates.  
Source: IDC, Morgan Stanley Research

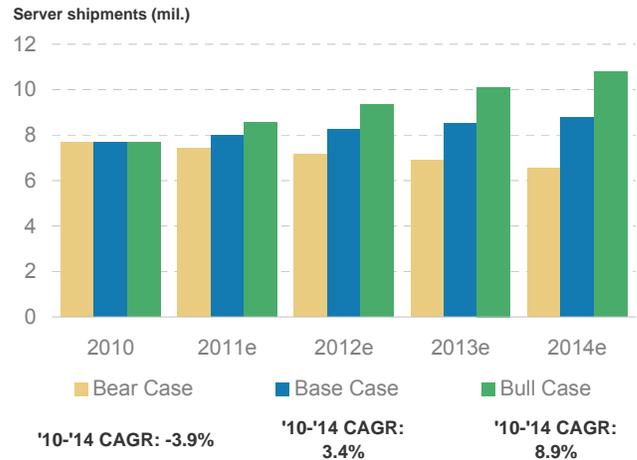
**Scenario analysis and sensitivities.** Our base case server model rests firmly on the expected workload deployment characteristics reported in our survey work for today, one year from now, and three years from now. Some of the benefits of our new workload-based server model is to be able to: 1) test the sensitivities of server growth to the pace of some of these key technology trends we see in the industry, and 2) be able to develop bull and bear case scenarios for server growth based on potential changes in these key variables.

Exhibit 18  
**Key Assumptions behind our Server Model**

	2009	2010	2011e	2012e	2013e	2014e
<b>Workload Growth (%)</b>						
Bull		15.7	17.0	18.5	20.4	20.5
Base		15.7	16.0	16.2	16.7	16.8
Bear		15.7	15.0	14.0	12.5	11.8
<b>VM Workload per Server</b>						
Bull	5.9	6.2	6.5	6.8	7.0	7.3
Base	5.9	6.2	6.5	6.8	7.0	7.3
Bear	5.9	6.2	6.7	7.2	7.6	8.4
<b>On-Premise Workload (%)</b>						
Bull	83	79	76	72	68	64
Base	83	79	75	69	64	59
Bear	83	79	74	68	62	57

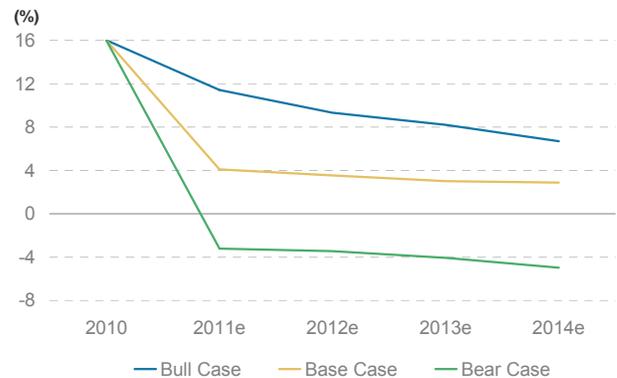
Source: Morgan Stanley Research

Exhibit 19  
**Base Case Implies 3.4% Server Shipment CAGR, 8.9% in Bull Case, -3.9% in Bear Case**



e=Morgan Stanley Research estimates.  
Source: Morgan Stanley Research

Exhibit 20  
**Server Growth Could Continue in the 7-12% Range in our Bull Case, -3% to -5% in Bear Case**



e=Morgan Stanley Research estimates.  
Source: Morgan Stanley Research

As we look through the key sensitivities in the model, the two most important assumptions to server growth relate to the percentage of workloads deployed in on-premise environments and the mix of virtualized (hosting VMs) versus non-virtualized (non-hosting VMs) servers. All else being equal, a lower percentage of workloads being deployed on-premise lowers overall server shipment growth. This is because public cloud providers like Salesforce.com are able to compress multiple workloads onto each of their servers (in the case of Salesforce.com, up to 30:1); any migration from on-premise environments will result in lowered server

demand. In our model we have assumed a 8.5:1 compression ratio in 2011 for public cloud environments, versus an average of 2.0 workloads per server in on-premise environments (virtualized servers run 6.5 workloads, and non-virtualized run 1.0). Therefore, where 8.5 workloads would require 4.25 servers in an on-premise environment, those same workloads only require one server now in the public cloud.

Exhibit 21

### Increased Shift from On-premise Environments Reduces Overall Server Growth

	2011 Server growth		2012e Server growth	
% of Workloads on-premise	76.8	10.6	71.4	10.2
	76.3	9.0	70.9	8.5
	75.8	7.4	70.4	6.9
	75.3	5.7	69.9	5.2
	74.8	4.1	69.4	3.5
	74.3	2.5	68.9	1.9
	73.8	0.8	68.4	0.2
	73.3	-0.8	67.9	-1.4
	72.8	-2.5	67.4	-3.1

e=Morgan Stanley Research estimates.  
Source: Morgan Stanley Research

Likewise, as we alter the mix of virtualized versus non-virtualized servers being shipped, we see a similar level of volatility with small changes in the assumption. Similar to the way public cloud providers compress workloads: With 6.5 workloads running on one virtualized server (as our forecast suggests), an increased demand for virtualized servers will lead to a significant reduction in demand for physical servers (at a 6.5:1 rate in 2011). For every 1% point reduction in the mix of non-virtualized server shipments as a percentage of the total, we would expect to see an impact of more than 2% on the overall server market growth rate.

Exhibit 22

### Higher Percentage of Servers Used in Virtualized Environments Reduces Overall Server Growth

	2011 Server growth		2012e Server growth	
Physical server shipments as % of total server shipments	85.7	14.9	83.8	13.5
	84.7	12.0	82.8	10.8
	83.7	9.2	81.8	8.2
	82.7	6.6	80.8	5.8
	81.7	4.1	79.8	3.5
	80.7	1.8	78.8	1.4
	79.7	-0.5	77.8	-0.7
	78.7	-2.6	76.8	-2.6
	77.7	-4.6	75.8	-4.5

e=Morgan Stanley Research estimates.  
Source: Morgan Stanley Research

Finally, as we look at the VM-per-host compression rate of 6.5:1 mentioned above, we see that it too is highly relevant, though it would have to have a more significant movement to make as much of an impact. For instance, an adjustment of roughly 6% to the VM-per-host ratio—from 6.5:1 to 6.9:1—only changes the server growth rate by about 3%. However, in the prior two sensitivities, we see that an adjustment of only 2% would have just as much of an impact, demonstrating the importance of those first two assumptions in the server model.

Exhibit 23

### Increased VM Density per Server Reduces Overall Server Growth

	2011 Server growth (%)		2012e Server growth (%)	
VM per host	6.9	1.0	7.2	0.6
	6.8	1.8	7.1	1.3
	6.7	2.5	7.0	2.0
	6.6	3.3	6.9	2.8
	6.5	4.1	6.8	3.5
	6.4	4.9	6.7	4.3
	6.3	5.7	6.6	5.1
	6.2	6.6	6.5	5.9
	6.1	7.4	6.4	6.8

Source: Morgan Stanley Research

## Measuring Cloud Impacts: Cloud Compression Effects

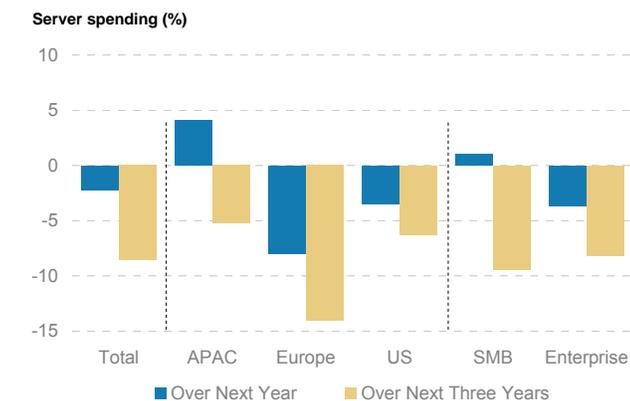
### Key Points

- A key benefit from the move to cloud computing cited by our survey respondents is lower server spending. On average, respondents expect to lower server spend by 2.2% in one-year and 8.6% over the next three years.
- Within on-premise environments, virtualization is expected to continue increasing utilization rates – from 53% today to 63% in three years.
- Our analysis suggests the migration to public cloud environments can compress server demand by 12-17% over the next three years, although some of that impact is already being felt in current server shipment rates.
- Overall, we lower our 2011 and 2012 server unit growth forecast to 4.1% and 3.5% (from 6% in 2011 and 2012), respectively. Our three-year unit growth CAGR of 3.4% compares to our previous forecast of 6%.

The movement of workloads into cloud environments has significant effects on both where and how data center capacity is built out. While there has been a lot of focus on the secular beneficiaries in the move towards cloud computing, investors have been less focused on the derivative impacts from the movement of workloads to cloud environments. Our survey work indicates server shipments will likely see the largest negative impact from the migration to the cloud, with storage less affected and networking the most protected hardware sector.

Exhibit 24

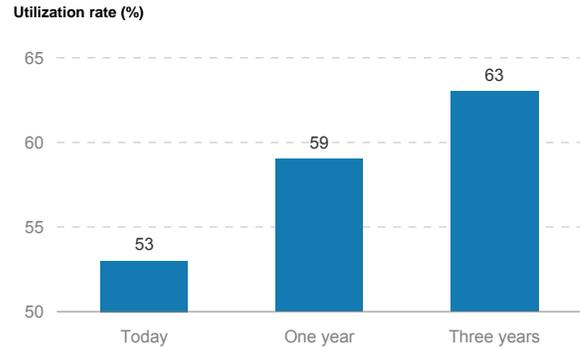
### Server Spending Expected to See Declines across All Geographies, Company Size



Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

Exhibit 25

### Utilization Rates Continuing to Increase

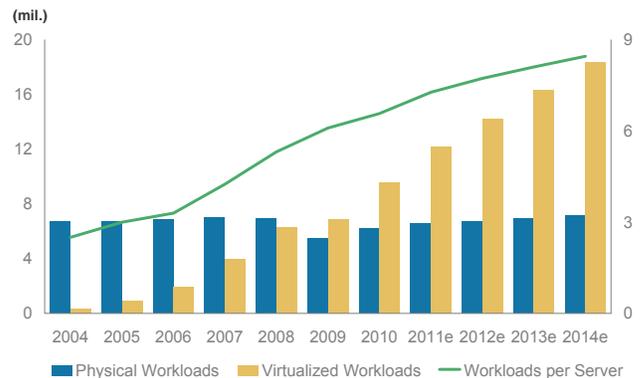


Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

**Higher utilization of on-premise servers.** Overall utilization rates for servers are increasing as rising costs (power, cooling, space, and management) have caused the traditional paradigm of one application workload per x86 server to come under significant pressure. Within customers' own data centers, server virtualization technology enables multiple workloads to run on a single server. Application workloads continue to migrate to virtualized environments — with the compression ratio of workloads per server rising steadily. Our survey indicates 32% of on-premise x86 application workloads are running in virtualized environments today (up from just 3% reported by IDC for 2006) and are expected to grow to 56% of workloads by 2014. IDC estimates the average number of workloads or VMs per server in virtualized environments has risen from 3-to-1 in 2005 to 6.6-to-1 today, with the ratio expected to rise to 8.5-to-1 by 2014.

Exhibit 26

### Virtualized Workload Shipments Forecasted to Significantly Outpace Non-virtualized Workloads



Source: IDC, Morgan Stanley Research

Based on our conversations with vendors and industry experts, managed server environments are likely further ahead in both the percentage of workloads running in virtualized environments and the workloads per server they are able to run. The move to public cloud environments has similarly affected server utilization and workload to server ratios. As Salesforce.com's CEO Marc Benioff notes, Salesforce.com runs customer relationship management (CRM) application workloads for their 92,000 customers on 3,000 servers and estimates that if these customers ran a CRM application on premise, 245,000 servers would be used. Even using a more conservative 1-to-1 workload per server ratio (versus the 1-to-2.7 ratio implied in Benioff's comments), Salesforce.com sees a 30-to-1 compression of workloads per server versus on-premise deployments. While Salesforce.com is likely at one end of a broad spectrum of workload-per-server ratios, this example effectively illustrates the compressive nature of the migration to public cloud computing on server demand. The architectures of both IaaS and PaaS cloud also use similar multi-tenant, grid, and virtualized architectures to run multiple workloads per server as well.

## Derivative Impacts from the Move to the Public Cloud

While the impacts and benefits to end customers from adopting public cloud solutions are widely detailed in this Blue Paper and elsewhere, the efficiency gains and subsequent effects on the wider technology ecosystem are not nearly as well described. For instance, take a small business currently running a CRM application either developed internally or licensed for on-premise usage. That application workload likely requires its own dedicated server, storage, and networking hardware, electricity, and management tools. With a CRM solution in a SaaS deployment, the company's need to invest in hardware infrastructure and management software diminishes, particularly as this process repeats across numerous other types of applications like human resources, payroll, travel/expense management, etc. As the transition occurs across thousands of companies, there is a significant aggregated impact on hardware purchasing requirements, especially on those for servers. The SaaS vendors will make up for some of the decreased demand, because they too need to run these workloads on some type of processing power. However, because of the multi-tenant and virtualized architecture in public cloud services, SaaS vendors provide significant efficiencies across the stack and contribute to the need for less hardware.

Though most companies we spoke to preferred not to project how many servers their customers would require if running

their apps on premise, several were willing to discuss how many servers they run their businesses on and the ranges of what type of consolidation ratios might be reasonable. If we assume, conservatively, that each customer would have operated the on-premise workload on only one server, we see that there is a wide range of efficiencies.

There are a few factors responsible for the different levels of server compression impacts, including the end-customer size (enterprise versus small/medium business), application type (CRM, HR, ERP, etc.) and technical requirements, vendor technical architecture, and other factors. In contrasting RightNow with Salesforce.com, for instance, larger implementations push RightNow's average ASP to nearly \$100,000, while Salesforce.com's ASP is less than \$20,000; so Salesforce has smaller customers that would otherwise have to run servers at low utilization rates. Based on conversations with industry experts, we believe Salesforce is the exception rather the norm and that most companies tend to fall into the 2-10x range.

Exhibit 27

### Compression Ratios Vary Widely

	Number of DCs	Number of servers	C:S Ratio	ASP
Salesforce.com	6	3,000	30.7	18.0
SuccessFactors	6	250	12.8	65.4
RightNow	3	1,000	1.9	97.6
DemandTec	3			232.1
Intralinks	3			230.4
Taleo	3			48.4
NetSuite	3			29.3
Ultimate Software	3			103.5
Cornerstone OnDemand	2			91.0
Omniture	4	1,800	0.3	56.8
Concur				30.6
Kenexa	7			28.9

Source: Company data, Morgan Stanley Research

### Impact from Public Cloud Migration Expected to Reach 1.7 Million Servers by 2013

Using the workload projections in our model and respondents' expectations for the percentage of their workloads in each type of public cloud environment, we were able to calculate the total impact on server shipments from workloads moving to SaaS/PaaS/IaaS environments. In our base case estimate, we calculate a 13.6% headwind embedded in new server growth in 2010, or slightly more than 1 million actual server shipments. However, this represents a figure that has built up over time, and the incremental impact is far less. In our base

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case, we project an incremental impact of 285,000 in 2010, declining to 190,000 by 2013, leading to a 19.3% total server headwind, or about 1.7 million servers by 2013.

Exhibit 28

### Roughly 190,000-285,000 Annual Incremental Server Impact from Public Cloud

	2010	2011e	2012e	2013e
Total server migration	1,461,954	1,868,394	2,165,750	2,452,229
Public cloud vendor server purchasing				
Lower consolidation ratio	890,913	1,130,784	1,324,292	1,513,565
Base case	420,340	530,949	626,283	720,406
Higher consolidation ratio	242,157	304,792	361,425	417,693
<b>Net server loss at</b>				
<b>Lower consolidation ratio</b>	571,041	737,610	841,458	938,664
% of new servers	7.4	8.9	9.8	10.5
Incremental server impact	162,651	166,569	103,848	97,206
<b>Base case</b>	1,041,614	1,337,446	1,539,466	1,731,823
% of new servers	13.6	16.2	17.9	19.3
Incremental server impact	286,974	295,831	202,021	192,357
<b>Higher consolidation ratio</b>	1,219,797	1,563,603	1,804,325	2,034,536
% of new servers	15.9	19	21	22.7
Incremental server impact	332,871	343,806	240,722	230,212

e=Morgan Stanley Research estimates.

Source: Morgan Stanley Research

### Quantifying the Direct Impact of Workloads Moving to SaaS Environments

Appendix 2 explains in fine detail the procedure we used to calculate the impact for each element of the public cloud and a variety of scenario analyses, and here we provide a high-level summary of the impact from SaaS.

1) We combine our server model's workload forecast with data from our survey: Our survey indicates that in 2013 7.0% of workloads will run in SaaS environments, as compared with 3.2% today, and we estimate that in 2013 6.3 million workloads will run in a SaaS environment, as compared with 1.8 million today. This leads to an estimated 1.3-1.7 million incremental workloads in SaaS environments for each of the next three years.

Exhibit 29

### Roughly 1.3-1.7 Million Workloads Expected to Move to SaaS Environments For Each of Next Three Years

	2010	2011e	2012e	2013e
Total workload base	56,850,696	65,946,807	76,630,190	89,412,106
% of workloads in SaaS	3.2	4.7	6	7
Workloads in SaaS environment	1,819,222	3,099,500	4,597,811	6,258,847
Incremental workloads moving to SaaS	836,790	1,280,278	1,498,311	1,661,036

e=Morgan Stanley Research estimates.

Source: Morgan Stanley Research

2) We quantify how many of these workloads come from virtualized environments as opposed to physical ones. As the virtual machine workload to server ratio is significantly higher than 1:1, these shifts represent smaller impacts to server sales than those on non-virtualized servers. We assume that

the incremental workloads moving to SaaS have the same proportion of virtualized to non-virtualized as the underlying installed base composition (55% in calendar year 2011 increasing to 65% by calendar year 2013). Using historical and expected proportions, we estimate total gross server migration of roughly 690,000-730,000/year, or 10,000-190,000 incremental gross servers.

Exhibit 30

### New Workloads in SaaS Environments Should Lead to 10,000-190,000 Incremental Gross Server Migration...

	2010	2011e	2012e	2013e
Incremental workloads moving to SaaS	836,790	1,280,278	1,498,311	1,661,036
Virtualized workloads (% of Total)	49	55	61	65
Virtual workloads being migrated	408,087	704,153	913,970	1,079,673
Virtual machine compression factor	6	6	7	7
Virtual machine server impact	73,633	112,746	132,907	146,164
Non-virtualized workloads	51	45	39	35
Non-virtual workloads being migrated	428,704	576,125	584,341	581,363
Non-virtual machine compression factor	1	1	1	1
Non-virtual machine server impact	428,704	576,125	584,341	581,363
Total server migration	502,337	688,871	717,249	727,526
Incremental server impact	191,636	186,534	28,378	10,278

e=Morgan Stanley Research estimates.

Source: Morgan Stanley Research

3) We then net this gross server migration figure against incremental server purchases that the SaaS providers will have to make. However, since their multi-tenant architecture allows them to gain efficiencies by consolidating numerous companies onto the same server, there is not a 1:1 impact. Our base case assumes a 5:1 compression ratio (one server purchased for every five migrated from on-premise), our bull case use a 10:1 ratio, and our bear case, 2:1.

4) The result is a total embedded server headwind of 550,000-580,000 units per year in our base case, or an incremental 150,000-server impact in 2010 and 2011, before the additional headwind eases to 22,000 in 2012 and 9,000 in 2013.

Exhibit 31

### ... However, Impact is Partially Mitigated by SaaS Vendor Purchases

	2010	2011e	2012e	2013e
Total server migration	502,337	688,871	717,249	727,526
SaaS vendor server purchasing				
Lower consolidation ratio: 2-to-1	251,169	344,436	358,624	363,763
Base case: 5-to-1	100,467	137,774	143,450	145,505
Higher consolidation ratio: 10-to-1	50,234	68,887	71,725	72,753
<b>Net server loss at</b>				
Lower consolidation ratio: 2-to-1	251,169	344,436	358,624	363,763
% of new servers	3.3	4.2	4.2	4.1
Incremental server impact	95,818	93,267	14,189	5,139
Base case: 5-to-1	401,870	551,097	573,799	582,021
% of new servers	5.2	6.7	6.7	6.5
Incremental server impact	153,309	149,227	22,702	8,222
Higher consolidation ratio: 10-to-1	452,103	619,984	645,524	654,774
% of new servers	5.9	7.5	7.5	7.3
Incremental server impact	172,473	167,881	25,540	9,250

e=Morgan Stanley Research estimates.

Source: Morgan Stanley Research

Cloud Computing  
**Industry Takeaways**

## Industry Takeaways: Hardware

Katy Huberty  
Scott Schmitz

While x86 server share leaders (and their suppliers) are likely structurally challenged by the shift to the cloud, storage could be a key winner in the build-out, while cost saving can help fund high-value projects like analytics.

### Best-Positioned

- **EMC.** Broad product portfolio and clearly defined cloud strategies help EMC take share and benefit from data growth, no matter the location (cloud or on-premise).
- **Teradata.** Cost savings from moving to the cloud frees budgets for value-add IT spend. Teradata is best-positioned to benefit and should outgrow the Street revenue forecast by more than 3 points over the next three years.
- **Quanta.** Server sales should double year over year, making up 5% of total sales and 10% of profits at the end of fourth quarter 2011, up from 2-3% of sales and 5% of profits in 2010.
- **Wistron.** Server sales should make 4% of 2011 total sales and 8% of profits. We expect its server sales will start to show stronger growth momentum in the second half of 2011 and will grow at least 20% year over year in 2012.
- **NetApp.** The strength of NetApp's core NAS product line, growing distribution, and ease of use in virtual environments helps NetApp continue to take share in the overall storage market.
- **IBM.** IBM appears well positioned for growth in managed hosting environments. Additionally, the company is well-positioned to benefit from growth in analytics and storage with only limited exposure to x86 servers.

### Potentially Challenged

- **Dell.** Risk of share loss to cloud competitors and new computing paradigms in servers and PCs (11% and 55% of revenue) are not offset by emerging data center strategies.
- **QLogic.** High dependence on slowly growing server units in non-cloud environments and lack of catalysts until the ramp of Intel's Romley platform in 2012 could make 2011 a difficult year.

### Models in Flux

- **Hewlett-Packard.** Hewlett-Packard lacks a clear strategy to attack cloud data centers with traditional server and networking products. However, its converged portfolio is taking share in on-premise data centers.
- **Cisco Systems.** Cisco's UCS server share gains could represent a margin headwind.

## Defining Best-Positioned in Hardware

As companies shift from on-premise to managed or public cloud environments, x86 server share leaders Dell and Hewlett-Packard are at risk of market share loss to Asian original design manufacturers (ODMs) like Quanta and Wistron, which ship servers directly to some of the largest cloud services vendors. We have downgraded Hewlett-Packard to Equal-weight and reiterated our Underweight on Dell. We view Quanta as the best-positioned ODM to take server share but also view Wistron as a potential beneficiary.

Storage spend will continue to benefit from increased consumption in managed/cloud IT data centers, with only a mild offset as companies decrease on-premise storage spend. We prefer EMC for its combination of 1) recent market expansion into low-end storage, big data/analytics, server-based flash technology; 2) expansion of partner ecosystem (already ahead of last year's net partner adds just four months into 2011); and 3) more balanced mix of software/hardware as compared with storage peers, which can reduce gross margin volatility.

We believe savings reaped by virtualized and cloud data centers will be spent on new technologies that can help improve corporate revenues and profits. In our view, the category that is best positioned to gain share of IT wallet spend is data analytics. We have upgraded Teradata to Overweight, from Equal-weight, and believe the company will grow more than three points faster than Street models over the next three years.

## Cloud Computing Disrupts Hardware Spend

The adoption of Cloud computing is shifting hardware spending away from on-premise environments towards managed hosting and cloud providers. According to our survey of more than 300 IT decision makers, servers (-8.6%), storage (-1.0%), and networking (-0.4%) spend are each expected to decline at on-premise (in-house) data centers over the next three years. This is consistent with our expectation that only 59% of IT workloads will be running in on-premise data centers by 2014, as compared with 79% today. However, we believe that the increasing hardware spend by managed hosting companies and public cloud providers can offset the declines at on-premise locations, particularly for the storage and networking categories. We note that storage is the only hardware category that operates on a consumption model, forcing increased spend over time.

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Servers will likely see the largest disruption caused by the changing competitive landscape and higher levels of virtualized servers as spending moves to the cloud.

**Server units most at risk**

Three primary factors are changing the fundamentals of the server landscape:

- Workloads moving off premise to managed hosting and public cloud infrastructures;
- The growth of server shipments at ODMs, or “white-box,” in cloud infrastructures; and
- Rising server utilization rates from the adoption of virtualization.

**Workloads shift off premise**

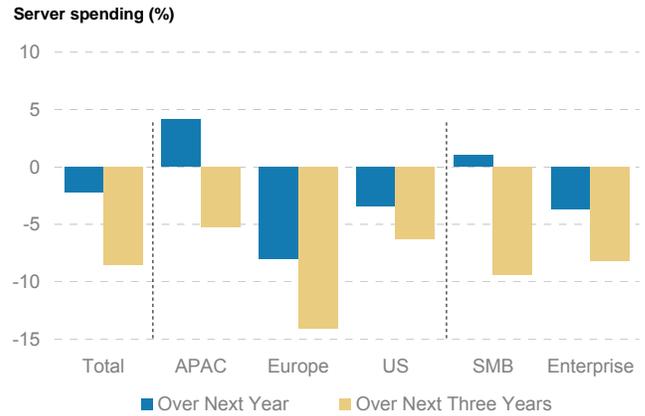
According to our survey, 79% of IT workloads are running at on-premise data centers today, but over the next three years respondents expect that only 64% of workloads will run at in-house data centers. What’s more, 51% of respondents are running their entire infrastructure on premise today, but in three years less than 30% of companies will not have moved at least some workloads to managed hosting or public cloud environments (IaaS, PaaS, or SaaS). Because of this shift, IT decision makers plan to reduce server spend at on-premise locations by 9% over the next three years.

We still expect mission-critical workloads that are either performance- or security-sensitive to remain on premise. However, for less critical workloads, IT managers are taking advantage of flexible capacity at public cloud environments that reduce up-front capital expenditures in favor of scalable operating expenses. By moving workloads off premise, IT departments also save on the cost of staff, maintenance, and power, which can run at 4 times the cost of the hardware.

We redesigned our server model to capture the shift of workloads by forecasting server growth in on-premise, managed hosting, and public cloud environments. As on-premise spending declines, managed hosting and public cloud spending should increase. We model server units at on-premise data centers to decline 1% over the next three years, while managed hosting and public cloud server units increase at a 11% and 53% CAGR from 2010–14. In total, we model a 3% CAGR in server units over the next three years, down from 6% previously.

Exhibit 32

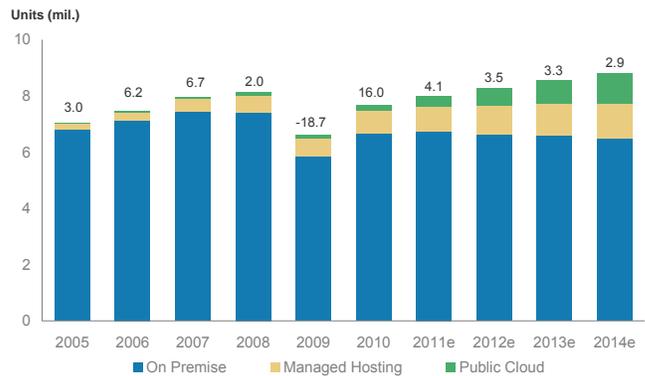
**On-Premise Servers Are Expected to See the Largest Spending Decline, but...**



Source: Company data, AlphaWise<sup>SM</sup>, Morgan Stanley Research

Exhibit 33

**...Managed Hosting and Public Cloud Spend Continue to Drive Server Unit Growth**



2010 - 2014 Server Unit CAGR  
 Public Cloud 53% Managed Hosting 11% On Premise -1% Total 3%

e=Morgan Stanley Research estimates.  
 Source: IDC, AlphaWise<sup>SM</sup>, Morgan Stanley Research

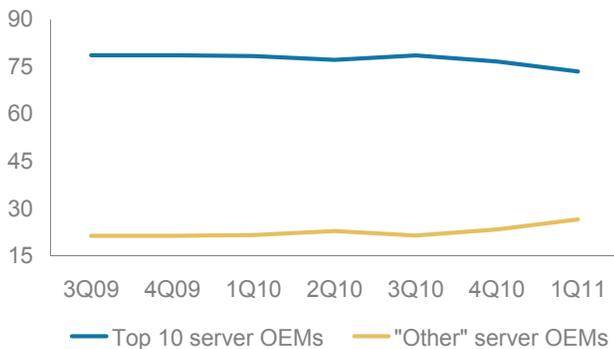
**ODMs Take Server Share in Cloud Environments**

We see a significant shift in the competitive landscape between on-premise server sales, which typically benefit the top three x86 Server OEMs—Hewlett-Packard, Dell, IBM—and the managed or cloud server sales, which increasingly benefit ODMs in Asia, including Quanta and Wistron. Anecdotally, we have heard that some cloud service providers have decreased the percentage of servers ordered from top server vendors from as much as 75-100% historically to 50% today. We believe the impact of the market share shift will cause Hewlett-Packard and Dell to grow more slowly than the overall server market over the next several years.

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To illustrate the market share shift, Gartner server shipment data shows that market share among the top 10 server vendors decreased from nearly 80% a year ago to 73% in first quarter 2011. We expect this shift to continue in the coming quarters.

Exhibit 34  
**Market Share of “Other” Server Vendors on the Rise**



Source: Gartner, Morgan Stanley Research

We believe Quanta and Wistron are the two best-positioned server ODMs to benefit from cloud computing. We estimate Quanta's server sales will double year over year, making up 5% of total sales and 10% of profits at the end of fourth quarter 2011, up from 2-3% of sales and 5% of profits in 2010. We project Wistron's server sales will account for 4% of 2011 total sales and 8% of profits, with server sales starting to show stronger growth momentum in the second half of 2011, growing at least 20% year over year in 2012. We have identified two specific shifts caused by the cloud that benefit Quanta and Wistron:

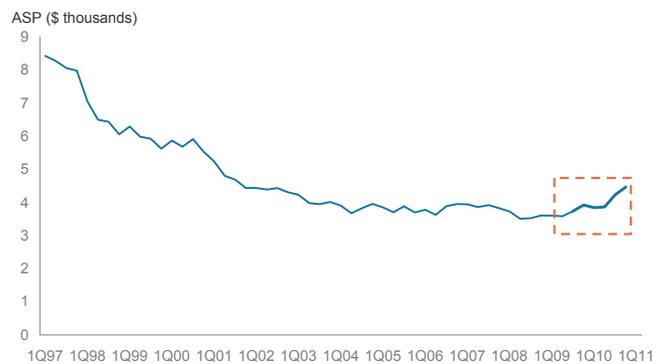
- **Direct hardware order placements from Internet service providers and telecommunication companies.** Quanta and Wistron's server customer base is broadening from existing original equipment manufacturers (OEMs) like Hewlett-Packard and Dell to Internet service providers and telecommunication providers. Quanta and Wistron are seeing a paradigm shift as Internet service providers are gradually placing server, storage, and switch orders, as well as client device orders for cloud applications (i.e., tablet PCs), to ODMs directly, bypassing OEMs. We believe the growth in the “Other” category in the exhibit highlights the beginning of this trend. We believe ODMs benefit from more competitive pricing and their ability to customize products required by Internet service providers and telecommunication customers.
- **Total hardware and software solutions for cloud services.** Not only are Quanta and Wistron selling

hardware products direct, they are also working with telecom operators to provide complete cloud solutions. In this new business model, Quanta and Wistron build the software and hardware infrastructure, while telecommunication operators provide the customer services. As this model develops, ODMs are exploring different applications such as shared software architectures for small/medium businesses to reduce costs and specific applications for education and healthcare. However, the contributions from this new business model will not be substantial until 2012.

**Virtualization Impact on Servers**

The overall utilization rates for servers are on the rise. Increasing costs (power, cooling, space, and management) have caused the traditional paradigm of one application workload per x86 server to come under significant pressure. Within customers' own data centers, server virtualization technology enables multiple workloads to run on a single server. While workload consolidation puts some pressure on server units, it is also driving deployment of higher-density servers. As a result, server ASPs (x86 servers) have started to increase on a year-over-year basis during the ramp of server virtualization. The biggest risk to the rising ASP trend is more aggressive competition from ODMs, particularly as off-premise servers approach 20% of server shipments.

Exhibit 35  
**Increasing x86 Server ASPs Due to Virtualization**

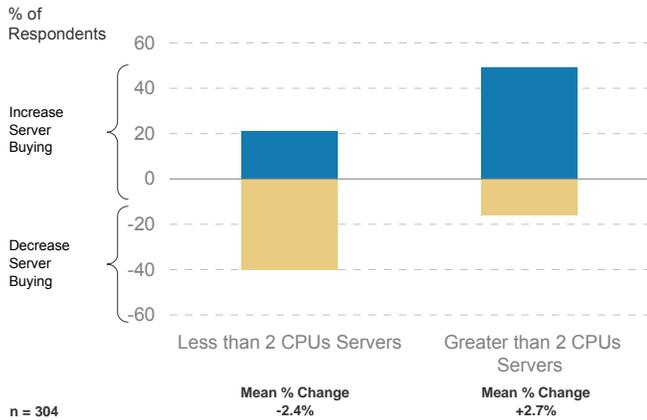


Source: IDC, Morgan Stanley Research

Responses from our AlphaWise survey indicate server ASPs should continue to rise. Over the next three years, 50% of IT decision makers plan to purchase servers with two or more CPUs, while 40% plan to decrease spending on servers with two or fewer CPUs. In total, respondents expect to increase spend by 2.4% on servers with more than two CPUs and lower spend by 2.9% on lower configurations.

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Exhibit 36  
**Virtualization Is Driving an Increase in CPUs per Server**



Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

Accelerated workload growth rates are a potential derivative of virtualized environments, which could act as a tailwind to server unit growth. Under the traditional distributed computing model, provisioning new workloads often takes days, in part due to the requirement to power cycle equipment during narrow windows of off-peak hours. Virtualization allows new workloads to be provisioned in minutes without shutting down existing workloads or infrastructure. With virtualization penetration expected to increase across data center locations to 52% of workloads in three years from 32% today, we could see an acceleration of new workload growth, which ultimately leads to higher server units. We currently model a steady workload CAGR of 16% through 2014, but if workload growth accelerates to 20% annually, as in our bull case, server unit growth could be as much as 4-5 percentage points above our base case CAGR of 3.4%.

**Vendor Impact from Server Shift**

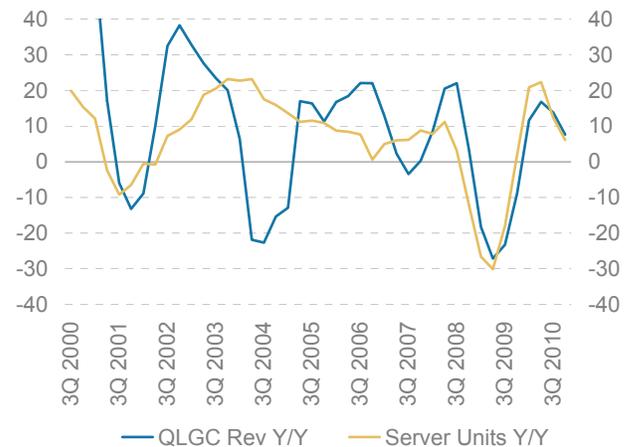
**Potentially Challenged: Dell and QLogic Most Exposed to Share Shift to ODMs**

We believe as much as one-half of Dell's server shipments historically were to cloud environments and that the shift to lower cost server providers – namely Quanta and Wistron – represents a risk to Dell's server revenue and profit stream (roughly 11% of revenue, 20% of profits today).

Roughly 72% of QLogic's revenue comes from host bus adapters (HBAs) that help connect servers to storage area networks, typically in on-premise data centers. Given our expectation for a 1% decline in on-premise server shipments over the next three years, we see downside risk to the

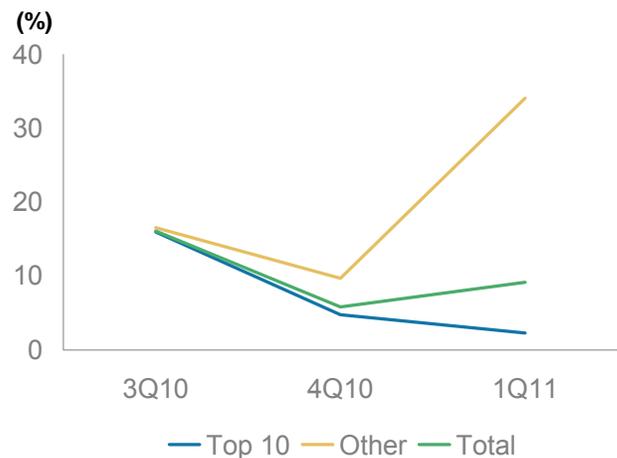
Street's forecast for 7% QLogic revenue growth over the same three-year period. One potential offset to slower HBA growth is the adoption of faster 10GbE server networks, a market where QLogic current holds 11% market share, versus 54% in HBAs (Dell'Oro). The development of the 10GbE market can increase QLogic's revenue content-per-server in on-premise server shipments and allow the company to participate more broadly in cloud server shipments. That said, we do not see this market meaningfully affecting models before 2012.

Exhibit 37  
**QLogic's Revenue Growth Is Tightly Correlated with Server Units, but...**



Source: Company data, Morgan Stanley Research

Exhibit 38  
**... QLogic Will Not Participate in Server Unit Growth Driven by ODMs**



Source: Gartner, Morgan Stanley Research

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**Model in Flux: Hewlett-Packard at Risk of Server Share Shift but Storage/Networking Portfolios Are Wildcards**

We continue to see the potential for Hewlett-Packard to unlock enterprise value over the next 12 months by selling off underperforming assets, like PCs, and investing more heavily in enterprise software, networking, and storage (see our January 3, 2011 note, *Risks Priced in with Upside in Enterprise; Becoming a Sum-of-the-Parts Story*).

That said, we see secular pressures in more than 80% of Hewlett-Packard’s revenue base that are difficult to ignore in the near term, mainly slowing printer and PC growth, risk of server share loss to ODMs, and risk of slowing outsourcing revenue growth with the adoption of cloud computing. We also view it as unlikely that Hewlett-Packard will make meaningful structural changes to its revenue base (e.g., selling PCs) before the company’s WebOS tablets ramp in second half 2011. In sum, we believe Hewlett-Packard’s current valuation prices in some of the growth and competitive risks and that valuation downside is limited, but we see here a catalyst that could significantly revalue the company as a post-2012 event. As a result, we shift to an Equal-weight rating for now.

Hewlett-Packard derives about 12% of revenue and 14% of operating profit from servers but we would note that the company’s server segment enjoys a 50% incremental operating profit, which benefits EPS in a strong server revenue growth environment such as the one the company enjoyed over the past year. If server growth slows in the next few years, operating profit could slow even further.

**Cisco Is Gaining Server Traction**

Cisco has already amassed more than 3,000 customers for its UCS server platform, reaching orders at a \$900 million annual run-rate nine quarters since launch, or \$650 million on an annual revenue run-rate basis as of fiscal second quarter 2011. Even so, Cisco’s overall share of the market remains small, at an estimated 9% of the blade server market on a dollar basis. Because the unified computing system (UCS) solution is pre-integrated, we continue to believe that UCS could be a substantial opportunity for Cisco, particularly in the commercial (i.e., small-medium enterprise) on-premise data center market as an alternative to IBM and Hewlett-Packard. However, we estimate gross margins are about 36% for the UCS platform, well below Cisco’s corporate average of more than 60%. In addition, margins could be pressured even further in the move to cloud architectures as Asian ODMs gain

share, implying that success in servers could pressure Cisco’s overall gross margin, making further share gains bittersweet.

**Storage Benefits from Data Growth, Regardless of Location**

Storage has a distinct advantage over other hardware categories – it is consumed instead of used. This rule holds regardless of where workloads or applications are running. Therefore, we expect a minimal negative impact to total storage revenue as workloads shift to the cloud. IDC forecasts data growth of 50% annually through 2014, consistent with that of the four years prior. Unlike server and networking gear, which process and transfer a continual flow of data, storage is more analogous to a consumable business model. This makes storage less susceptible to unit pressures seen in the server market. Additionally, the slowing hard disk drive (HDD) areal density curve could help storage growth remain robust.

According to our survey, IT decision makers intend to reduce storage spending by 1% at on-premise data centers over the next three years. Comparing this to our expectation that nearly 20% of workloads will move off premise and require storage over the same time leads us to believe storage growth will not show signs of slowing down.

Exhibit 39  
**On-Premise Storage Spend Expected to Decline 1% over the Next Three Years**



Source: Company data, AlphaWise<sup>SM</sup>, Morgan Stanley Research

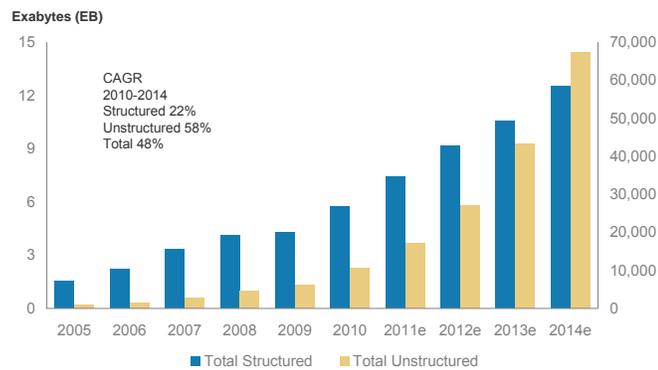
**Growth of Unstructured Data a Key Driver**

The growth of unstructured data (does not fit a pre-defined data model such as files, pictures, and video), is driving changes to traditional storage architectures. According to IDC, unstructured data accounts for 89% of the 48% annual data growth rate. Put another way, unstructured data is growing 58% annually versus only 21% for structured data (fits pre-defined data model such as databases). The explosive creation of unstructured data is driving a shift in storage architectures from scale-up (vertically add resources in a

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single storage node) to scale-out (horizontally add capacity or nodes). Scale-out allows hundreds or thousands of nodes to act as a single system, which increases capacity without significant performance degradation. Key scalable storage technologies include scale-out SAN (EMC's V-Max), scale-out NAS (EMC's Isilon), and Object storage (EMC's Atmos and NetApp's Bycast).

Exhibit 40  
**Unstructured Data Could Account for More Than 80% of Capacity Shipped by 2014**



e=Morgan Stanley Research estimates.  
 Source: IDC, Morgan Stanley Research

While Storage Area Networks (SAN) and Network Attached Storage (NAS) are traditional architectures altered to scale horizontally, Object storage is a growing form of storage in cloud environments. Object storage uses commodity servers to create clusters of storage. It does not utilize a file system like NAS storage or block management like SAN storage, but instead uses application programming interfaces (APIs) such as representational state transfer (REST) or simple object access protocol (SOAP), which tell the application how to store and retrieve object IDs. Object storage is best suited for users with multiple data center sites in multiple geographic locations. Many Internet cloud storage providers use object storage for its scalability and multi-tenant capabilities.

**Security and Data Loss Are Key Concerns of Cloud Storage Models**

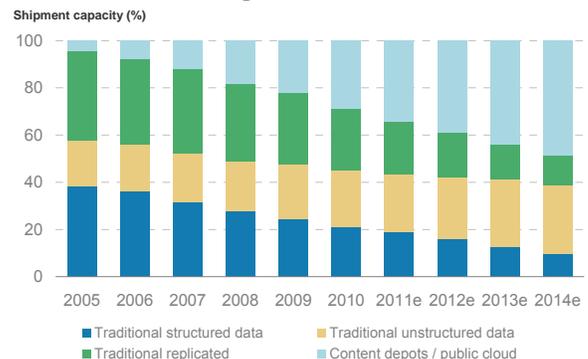
According to a recent study of 247 Fortune 1000 companies by the 451 Group, 87% of CIOs do not plan to utilize cloud storage for archive or lower-tiered storage, which are the most likely use cases. Many point to security and loss of control as the primary reasons. However, cost is also a major barrier. On the surface, cloud storage appears like a significantly cheaper alternative to purchasing expensive storage arrays for on-premise storage. Pricing for Amazon's Simple Storage Solution (S3) starts at \$0.14 per gigabyte (GB) per month, versus roughly \$0.50 to \$1.00 per GB for on-premise storage

arrays. However, cloud storage providers such as S3 also charge a bandwidth fee that often makes using the cloud less economical. Amazon's S3 charges \$0.10 per GB to transfer data in and similar rates (scales depending on size) to transfer data back out. This may make sense for some archive uses, but the total cost (capacity and bandwidth), combined with security concerns, is limiting real adoption of cloud storage.

Even if CIOs become more comfortable storing data off site, we do not see service providers or standalone cloud storage providers (S3, Nirvanix, Egnyte, PEER1 Hosting, Zetta) as a major threat to storage hardware providers such as EMC or NetApp. Storage hardware providers act as the arms dealers to cloud providers. Therefore, hardware providers will continue to benefit from the underlying growth in data. While consolidation from individual enterprise customers to the cloud may pressure the overall amount of storage required as cloud providers operate at higher utilization rates, we believe the limited rate of cloud storage adoption and uncertain use of multi-tenancy for storage environments will minimize the overall impact.

Despite the concerns that exist around public cloud storage, the cloud is clearly a large source of data growth. According to IDC, nearly half of all storage shipment capacity will be to public cloud and content depots by 2014. IDC defines content depots as organizations that gather, organize, and provide access to large repositories of digital content such as news, stock quotes, financial and technical analysis, job listings, videos, and music. IDC believes unstructured data accounts for 95% of data from public cloud and content depots. Most content depots are large Internet-based companies that still operate their own data centers.

Exhibit 41  
**Data Creation Coming from the Cloud**



e=Morgan Stanley Research estimates.  
 Source: IDC, Morgan Stanley Research

**EMC and NetApp Best-Positioned Storage Vendors**

We believe EMC and NetApp continue to be the best positioned companies in the storage market and will continue to take share. Over the last five years, EMC's market share has increased from 21% to 25.6%, while NetApp's share has increased from 6.3% to 11.1%, according to IDC. EMC and NetApp have stayed ahead of storage competitors through heavy R&D investments and targeted acquisitions. As a percentage of revenue, EMC and NetApp each spend about 11% and 14% on R&D each year respectively, which compares favorably with our group average of mid-single digits.

EMC remains our favorite name in the storage space given the strength of its product portfolio and clear strategies to capture growth in the cloud. EMC's recent product announcements make it competitive in the high-end, midrange, and low-end, as well as growing cloud markets such as scale-out NAS and object storage. EMC is also expanding into the analytics market with Greenplum and support for Hadoop. EMC is well-positioned in the backup space with Data Domain. Additionally, EMC owns 80% of VMware, the leader in virtualization, which is the major force behind the cloud.

## Industry Takeaways: Software

Adam Holt  
Keith Weiss, CFA  
Jennifer Swanson, CFA  
Adam Wood

The accelerating migration of workloads into the cloud means: a) SaaS-based application vendors have a longer tail than consensus reflects; b) companies with exposure to both private and public cloud infrastructure build-out will continue to outperform; c) platform stories will increase in relevance over the next three years; and d) companies with heavy exposure to on-premise server environments, without a clear strategy for leveraging the cloud, are likely secularly challenged.

### Best Positioned

- **Salesforce.com.** With a broad Cloud offering spanning from apps to platforms, Salesforce is disproportionately well positioned to benefit from the 50%+ CAGR forecasted for public cloud workloads. We estimate Salesforce grew new billings 53% in fiscal 2011, but our model currently forecasts just an 11% three-year CAGR. Given a robust SaaS market forecast, an expanding application suite, and entry into new markets like PaaS, we see considerable upside to these estimates.
- **VMware.** The near-20% three-year CAGR for virtualized server shipments in our server model is supportive of the 19% three-year server license CAGR in our model, while penetration of management and desktop virtualization opportunities should increase deal sizes and drive upside to consensus.

### Models in Flux

- **Microsoft.** With a dominant share in server operating systems, but almost solely in on-premise environments, Microsoft has significant revenue at risk. However, their Azure PaaS offering and Dynamics SaaS offering polled strongest of any vendor in our survey.
- **Red Hat.** The public cloud makes extensive use of open source, and with solutions in infrastructure and application development / deployment, should leave Red Hat well positioned for the public cloud build-out. However, its subscription base today is largely tied to traditional on-premise deployments, while virtualization, PaaS, and IaaS offerings are nascent.
- **SAP AG.** A ramp in the business-by-design (BBD) reseller network is likely to drive higher top-line growth and meaningful revenue contribution for the group. We estimate BBD revenues at €83 million in 2012e (<1% of group SSRS), reaching ~€900 million in 2015e, ~10% of group SSRS.

### Potentially Challenged

- **Symantec.** About 50% of revenues have significant elements tied to on-premise servers and storage. SaaS-based businesses represent just 11% of revenues.

## Defining Best-positioned in Software

The secular trend of cloud computing has been driving out-performance in software stocks for the past two years, and almost every name in software has developed a cloud story of some sort. However, we believe this represents just the first leg of the shift of workloads into the cloud. This first leg of the migration has been largely dominated by SaaS-based applications and the virtualization of on-premise server environments. There is substantial growth left in these areas and our survey suggests a 50% CAGR in SaaS-based application workloads over the next three years, while our revised server model suggest an 18% CAGR for servers shipping with virtualization into on-premise environments. At the same time, we look for the beneficiaries of the next leg of cloud adoption to be concentrated in three areas:

- **SaaS-based application suites** well positioned to consolidate additional functionality and become the cloud factories of tomorrow. In our view, enterprises will increasingly look to source more cloud-based services from fewer vendors, in order to better integrate their data, simplify management, and reduce their spending – analogous to the move toward application suites we have seen in client server computing. Our preferred companies here are Salesforce.com and SuccessFactors.
- **PaaS clouds** are poised to be the environment of choice for application development and deployment going forward given their ease of use, low up-front capex requirements, and time-to-market advantages. Traditional application development has been the purview of large enterprises and software vendors targeting just the largest end-markets. PaaS should enable smaller companies and software vendors to develop application functionality to automate a much broader spectrum of business processes, potentially accelerating the development of new application workloads. Given application development and deployment tools are a \$13+ billion market today in the on-premise world, PaaS has the potential for strong growth over the next five years; our survey suggests a 46% CAGR for workloads in PaaS cloud environments over the next three years. Our preferred companies here are Salesforce.com and Microsoft.
- **The arms dealers** supplying underlying technologies for the development of these public cloud environments. Public cloud providers have performance and scale needs well ahead of most enterprises, but they also have

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technical skills well above most enterprises. Open source has come to be a first choice in terms of technology for cloud providers, but some tried and true high-performance, closed-sourced technologies like Oracle’s database support well known names like Salesforce, SuccessFactors, IntraLinks, and Taleo. Our favorite arms dealers are Oracle and VMware.

Exhibit 42

**Cloud Strategies: Everbody’s Got at Least One**

	Exposure	Positioning	Name/Type of Offering
<b>Cloud Buildout</b>			
CHKP	Low	Medium	Virtual Edition
CTXS	Low	High	XenServer and NetScaler
FIRE	Low	Medium	Virtual Defense Center / Immunit
MSFT	Medium	Medium	Hyper-V
ORCL	Medium	High	Oracle Database and Middleware
RHT	Medium	High	Cloudforms, JBoss, and RHEL
VMW	High	High	vSphere
<b>Cloud Service Providers - SaaS</b>			
ADBE	Low	High	Omniture Marketing Suite
AU	Medium	Medium	Autonomy Interwoven - Web Analytics / ECM
CRM	High	High	Sales, Service, Marketing, Data, and Collaboration
DMAN	High	High	Retail/CPG Solutions
IL	High	High	Collaboration and Document Sharing
INTU	High	High	Quickbooks Online, Mint
MSFT	High	High	Dynamics CRM/ERP
N	High	High	OneWorld Application Suite
ORCL	Low	Medium	Fusion Apps / Siebel OnDemand
RNOW	High	High	CX Contact Center/Web/Social
SAP	Low	Medium	Business ByDesign
SFSF	High	High	Business Execution Suite
SGE	Low	Medium	Sage One
TLEO	High	High	Talent Management Suite
<b>Cloud Service Providers - PaaS</b>			
CRM	High	Medium	Force.com <sup>1</sup> , Heroku, VMForce
INTU	High	High	QuickBase <sup>1</sup>
MSFT	High	High	Azure
N	High	Medium	SuiteCloud <sup>1</sup>
RHT	Low	High	Makena, OpenShift
RNOW	Low	Medium	CX Cloud Platform*
VMW	High	High	CloudFoundry, SpringSource, VMForce
<b>Other Derivatives</b>			
AKAM	Medium	High	Application Acceleration to SaaS Companies
SWI	Low	Medium	VM Monitoring
SYMC	Medium	Medium	Message Labs / Symantec.Cloud

1 Attached to SaaS Offering

**Key:**  
 High / Strong: [Blue Box]  
 Medium / Average: [Grey Box]  
 Low / Poor: [Red Box]

Source: Company data, Morgan Stanley Research

**Next Generation of SaaS: Not All Clouds Created Equal**

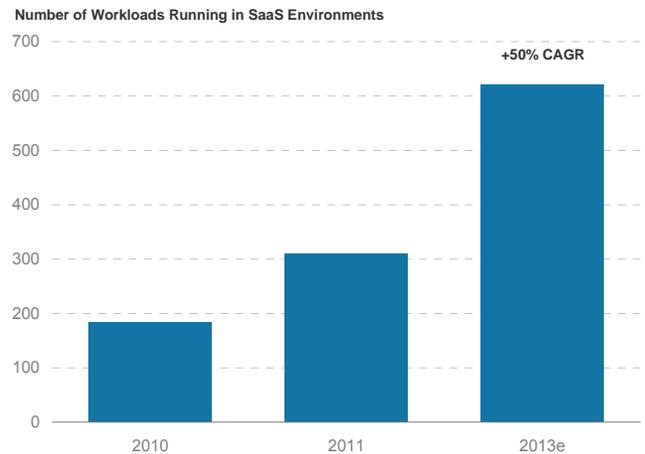
**Salesforce.com and SuccessFactors best-positioned.**

SaaS companies generate revenue primarily based on the number of users subscribing to their service. This allows companies greater flexibility by being able to provision new users quickly and adjust spending as economic or business conditions merit, as the supporting infrastructure is already in

place at the hoster’s site. While increasing user adoption and application workloads moving into SaaS environments should result in strong growth to the entire ecosystem, the spoils of victory will not be distributed equally. The best-positioned companies of the next generation of SaaS will be defined by two dimensions: 1) vendors best able to consolidate application functionality onto their platforms while accelerating end user penetration, and 2) vendors playing in application markets most ripe for moving to SaaS.

Exhibit 43

**A 50% Three-Year CAGR in SaaS-Based Workloads Underpins Strong Industry Growth**



e=Morgan Stanley Research estimates.  
 Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

**SaaS Workload Growth — Stronger for Longer.** Our survey suggests a 29% CAGR in the percentage of workloads expected to be deployed in SaaS-based environments over the next three years. However, this actually understates the growth of SaaS-based workloads as the application workload growth has averaged about 14% over the past several years, and if anything is poised to accelerate, given the lowered bar for developing and deploying new application functionality. Based on our assumption of a 16% CAGR in workloads, SaaS-based workloads would grow at a 50% CAGR over the next three years. Most SaaS-models price on a per-user basis, so the growth in workloads is not a straight driver of SaaS billings, but this would suggest a robust growth environment going forward.

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Exhibit 44

**Bigger is Better: Largest Vendors with the Broadest Offerings will Consolidate the Market**

	Customers	Users
Concur	>10,000	NA
DemandTec	355	~16,000
Intralinks	4,700	NA
NetSuite	30,000	NA
RightNow	1,900	~300,000
<b>Salesforce.com</b>	<b>97,700</b>	<b>~3,000,000</b>
<b>SuccessFactors</b>	<b>4,000</b>	<b>~9,000,000</b>
<b>Taleo</b>	<b>&gt;5,000</b>	<b>~20,000,000</b>

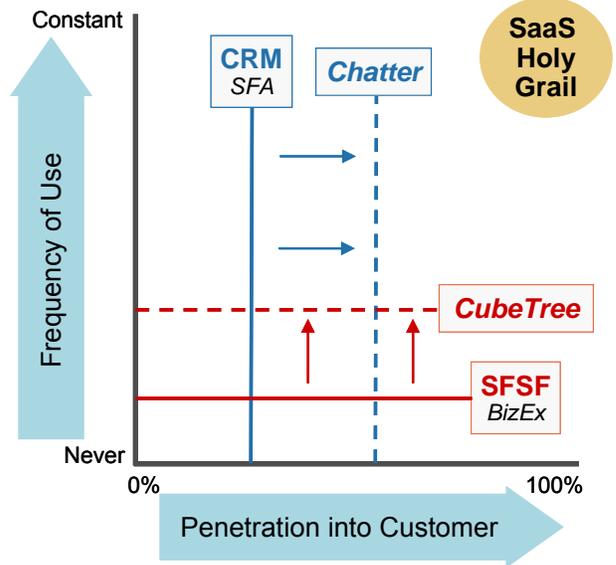
Source: Company data, Morgan Stanley Research.

**Bigger is better.** While the rising tide has lifted just about all boats in the SaaS market over the past several years, going forward, increasingly we expect customers to consolidate their purchasing onto fewer platforms. This is partially to avoid mistakes of the past, where application silos of the client server migration created isolated islands of information that customers later had to spend a lot of money to integrate. More applications on a single SaaS platform means more information in one environment. Consolidation will also be driven by several advantages that naturally accrue to larger SaaS platforms. Some of these are common to all application vendors (on-premise or in the cloud): A larger vendor has more development dollars to spend on moving the products forward; common administration of users lowers management costs; and larger user bases accrue a larger ecosystem of partners. Some are specific to SaaS-based applications: Network effects are possible in SaaS-based environments, as illustrated by products such as Salesforce’s Partner Relationship Management, which enables the sharing of information amongst partners on its platform.

Salesforce.com and SuccessFactors today have both large user bases and some of the most popular applications – meaning, a significant number of users across the company are using them. SuccessFactors has natural ubiquity, as employees across an entire company use strategic human resources functionality like performance reviews and goal management. The challenge for SuccessFactors is to increase the frequency with which their products are used. Salesforce’s Sales Force Automation applications are used constantly by their customers’ sales people, but sales makes up only a fraction of the total employees in any organization. With their Chatter collaboration product (Facebook for the Enterprise), Salesforce is hoping to penetrate deeper into the customer base.

Exhibit 45

**SaaS: Striving for Ubiquity on Two Dimensions**



Source: Morgan Stanley Research

**Not all SaaS markets are created equal.** Our work points to specific markets like customer relationship management (CRM) and human resources (HR), as those where companies are more likely to consider on-demand environments for application software in the near-term, whereas enterprise resource planning (ERP) continues to be more challenged in terms of willingness to adopt a SaaS delivery model. Along these lines, we believe that Salesforce.com, SuccessFactors, and Taleo are likely to be the biggest beneficiaries as companies look for broader solutions addressing multiple areas of CRM and HR, while NetSuite is likely to be a laggard considering their heavy exposure to ERP.

Within CRM, sales force automation (SFA), championed by Salesforce.com, is the largest SaaS market today as companies continue to show a willingness to replace existing and less flexible on-premise SFA solutions. With more than 97,700 customers and 3M users, Salesforce should continue to be one of the largest beneficiaries of the cloud movement, as it is just at the beginning of further cross-selling its solutions beyond its core sales customer into areas like marketing (with its acquisition of Radian6) and even more broadly through Chatter, its collaboration tool.

Also within the CRM space, we appear to be in the early innings of the contact center replacement cycle. Because of this, many companies are choosing to adopt more cost-effective SaaS solutions that can tie into other areas of their

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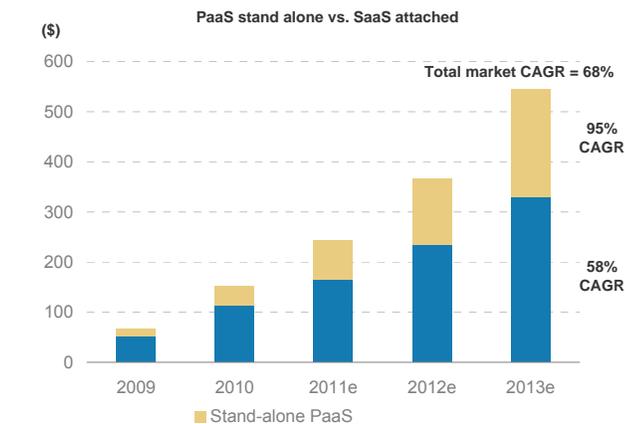
organization. Companies like RightNow and Salesforce are benefitting most directly, as seen in RightNow’s record new customer signings for its CX Suite in recent quarters and Salesforce’s Service Cloud showing considerable traction in the marketplace. However, we believe that RightNow’s more narrow opportunity set may ultimately prevent the type of long-term growth that we would expect from Salesforce.

On the other hand, we believe that ERP continues to be the most structurally challenged in gaining widespread SaaS adoption, as most companies have already invested significant amounts in expensive implementation and are unwilling to completely replace them, more often just willing to supplement through a two-tier ERP model. While NetSuite is benefitting from this type of secondary adoption, ultimately we think the opportunity is more limited and are more cautious on this area.

### Salesforce.com and Microsoft the Early Leaders in PaaS

To date, the majority of the demand for PaaS has been building out additional functionality around existing SaaS applications. The 451 Group estimates about 75% of PaaS spending today is for use cases attached to SaaS deployments. Thus, it is not surprising that many vendors offering SaaS solutions also offer PaaS (Salesforce and Microsoft most notably, but also NetSuite and Intuit).

Exhibit 46  
**PaaS Attached to the SaaS Application Dominates the Market Today**



e=Morgan Stanley Research estimates.  
Source: 451 Group, Morgan Stanley Research

However, the bigger opportunity long-term is the potential for PaaS to become the application development and deployment platform of choice for new standalone applications, as PaaS

can enable a much broader array of business processes to be automated via cloud-based applications, greatly expanding the applications market and addressing the long tail of application functionality. Traditional markets for application development and deployment tools exceed \$13 billion today, according to IDC; using a more expansive definition of what is potentially included as services in a PaaS platform, that number could exceed \$51 billion — illustrating why PaaS could be an extremely exciting opportunity.

Exhibit 47  
**PaaS Looking to Dip into a \$50 Billion Well**

	Market size
Application development	\$5,913
Application server middleware	\$6,032
Other app dev and deployment	\$1,393
<b>Addressed by core PaaS</b>	<b>\$13,338</b>
Integration and process automation	\$8,821
Data access, analysis and delivery	\$9,829
Structured data management	\$29,292
Quality and lifecycle tools	\$3,296
<b>Addressed by additional PaaS services</b>	<b>\$51,238</b>

Source: IDC, Morgan Stanley Research

### Race for Developers

Microsoft’s Azure and Salesforce’s Force.com are among the most established players in the PaaS space, along with Google’s AppEngine and Amazon’s Elastic Beanstock. Microsoft benefits from the ubiquity of the technology in enterprises and the availability of those same services on the Azure platform. Salesforce.com has well leveraged their dominant positioning in SaaS applications to attract developers to its Force.com platform, although the majority of activity has been in developing add-on functionality, in our view. As PaaS transitions from primarily being a development environment for add-on functionality attached to existing SaaS applications (analogous to software development kits in the on-premise world), to a standalone development and deployment platform for creating new standalone applications, the ability to attract developers will ultimately play a significant role in separating the winners from the losers.

Microsoft comes to the market with a significant advantage, with a near monopoly of the nearly 5 million developers utilizing the .Net frameworks. However, vendors like VMware and Red Hat have recently released new open-source oriented PaaS offerings, targeting the even larger J2EE developer base and offering the flexibility to utilize newer (and faster-growing) languages like PHP, Python, and Ruby.

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Salesforce.com has also moved to enable J2EE development on their platform (VMForce) and Ruby (Heroku).

Exhibit 48

**Next Leg of PaaS is a Race for Developers**

	Population
Java	9,007,346
C/C++	7,194,179
XML	7,194,179
C#	5,044,699
Visual Basic/Visual Basic .Net	4,913,098
Scripting Languages	10,425,711
Other	7,428,136

Note: Populations are not mutually exclusive  
 Source: Evans Data Corp

Microsoft’s Azure has taken a small, early lead in our view, as its core base of roughly 5 million .Net programmers provides the largest current installed base of the PaaS providers. In addition, Azure also has interoperability functionality, allowing for integration with apps developed in Java, Ruby, Python, or PHP. By having this strong base of .Net developers, though, Microsoft should be able to avoid the difficulties of Salesforce.com, as well as newer entrants like Red Hat and VMware all vying for Java developers. In a follow-up to our main survey, respondents noted they were most likely to use Azure as their PaaS for provisioning new workloads in a public cloud environment.

We believe Salesforce.com is currently a close second in the PaaS space and has recently been the most aggressive in expanding its developer community as it seeks to transition from its proprietary Apex language to a more open ecosystem. It started to accomplish this early last year by first collaborating with VMware on VMForce (for Java development) and then by acquiring Heroku (a Ruby on Rails platform). All told, the company believes these steps have increased its addressable market of potential developer for its platform to more than 6 million versus the roughly 340,000 it has today. However, we would note that VMForce continues to be in beta, and with VMware’s recent announcement of Cloud Foundry, it is now less clear how this relationship plays out; the company still has work to do in convincing other developers to program on the Force.com platform.

Red Hat is a more recent entrant to the PaaS market, with its initial offering, Cloud Foundations, launched only last June. Cloud Foundations was an open PaaS architecture, built on Enterprise Linux and JBoss, allowing customers to build private cloud environments with a streamlined and straight-

forward implementation process. In November, Red Hat acquired Makara to help accelerate its PaaS strategy and incorporated the technology into its platform. More significantly, in May of this year the company launched OpenShift, its next generation open source PaaS, initially hosted on Amazon’s EC2. OpenShift will support Java, Ruby, PHP, and Python, among others. While a promising offering, in an increasingly crowded space it is still too early to make conclusions.

In addition to its partnership with Salesforce on VMForce, VMware recently announced Cloud Foundry, the world’s first entirely open PaaS offering. Cloud Foundry provides a platform for building, deploying, and running cloud apps using Spring for Java developers, Rails and Sinatra for Ruby developers, Node.js and other Java Virtual Machine frameworks, including Grails. Essentially, VMware is opening its development environment to provide more ways to create and administer cloud-based applications, offering far more options for developers when it comes to variables like programming and storage.

Exhibit 49

**Summary of PaaS Vendor Offerings**

Company	Offering	Development Language	Model
CRM	Force.com, Heroku, VMForce	Apex, Ruby, Java	SaaS-attached / Stand-alone
MSFT	Azure	.Net	Stand-alone
RHT	OpenShift	Java, Ruby, PHP, Python	Open source
VMW	Cloud Foundry	Java, Ruby	Open source
INTU	QuickBase	N/A	SaaS-attached
N	SuiteCloud	SuiteScript	SaaS-attached
RNOW	CX Cloud Platform	CSS, JavaScript, PHP	SaaS-attached

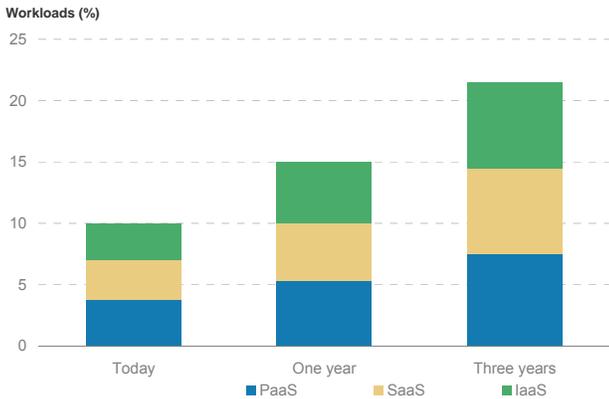
Source: Company data, Morgan Stanley Research

**Arms Dealers: Supporting the Build-Out of Public Clouds**

Our revised server model looks for server shipments into public cloud environments (SaaS, PaaS, and IaaS) to grow at a 53% CAGR through 2014 — indicative of the massive build-out of public cloud capacity we forecast with workloads shifting aggressively to public cloud environments. The performance and scale requirements for these public clouds are well ahead of most enterprises, but for the most part these service providers also have technical skills well above most enterprises. This means an increased willingness (and often need) to build out their own software for the implementation, management, and provisioning of these cloud environments — and a strong preference for open source solutions.

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Exhibit 50  
**Public Cloud Workloads Expected to Double Over Next Three Years...**



Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

Exhibit 51  
**... Driving a Massive Capacity Build Out**



e=Morgan Stanley Research estimates.  
 Source: Morgan Stanley Research

**Red Hat’s broad portfolio of open source infrastructure software positions the company to support the build-out cloud environments.** Specifically, several public cloud providers have adopted Red Hat’s Linux and Virtualization technologies as a foundation for the public cloud services. At Red Hat’s recent user conference, the company announced OpenShift, a PaaS platform based on technology acquired via the recent Makara acquisition and the company’s existing JBoss middleware technology. While Red Hat will be hosting an instance of OpenShift themselves — currently available for developer preview — the broader opportunity is to serve as the application development and run-time enablement technology on top of other cloud service providers infrastructure.

The first partner in this regard is Amazon Web Services. The mantra behind Red Hat’s OpenShift platform is “Open, Open, Open”—an open source environment, open to the choice of

development languages, open to a variety of development frameworks, and, eventually, open to a range of cloud deployment options. We believe Red Hat benefits from being an early entrant in this space and a key player in the open source community. Because of these two factors we believe that the company will be able to stay in front of the evolving needs and requirements of clouds vendors.

**VMware is leveraging its virtualization infrastructure dominance into the public cloud.** VMware’s Cloud Foundry is the key development in the company’s bid to expand its footprint in the public cloud. In mid-April, VMware announced Cloud Foundry, both an open source project and community to develop an open PaaS environment (CloudFoundry.org) and their own hosted instance of this PaaS environment (CloudFoundry.com). In this, VMware employs a strategy similar to what we described with Red Hat above. Also similar to Red Hat, Cloud Foundry offers developers a broad choice of frameworks, application infrastructure services, and deployment clouds. While open to developers now, Cloud Foundry is still in a beta mode, and the monetization model is still an open question. The open source nature of Cloud Foundry marks a major effort to gain mindshare in the public cloud, mindshare that could ultimately drive adoption of VMware’s paid products such as vSphere, vCloud, and vFabric in both public and hybrid clouds.

**Oracle’s products are behind many of the largest public cloud vendors.** Salesforce.com, SuccessFactors, Taleo, and NetSuite are all examples of companies running their own offerings on top of Oracle database software; NetSuite recently announced that it would become an Exadata customer; and other SaaS providers like Intralinks utilize Oracle servers. While we do believe public cloud providers will choose open source solutions whenever possible, Oracle’s core database technologies have scalability and performance characteristics that are unmatched by current open source technologies. Oracle has packaged a solution that they call “Oracle Platform for SaaS,” which includes database, grid, BI, SOA, app server, content management, virtualization, and identity management technologies for supporting SaaS cloud services. The company claims to have more than 250 SaaS and PaaS vendors utilizing this suite of technologies.

**Models in Flux**

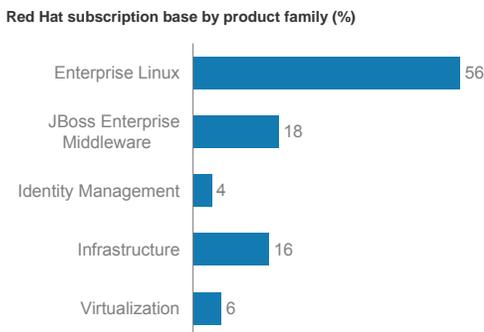
**Red Hat shifting into cloud gear.** New offerings like Open Shift and Cloud Formations put Red Hat in place to benefit from the build-out of the cloud environment, but its current subscriber base is heavily tied to on-premise

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server environments (about 70% of revenues) and application development and deployment in on-premise environments (about 20% of revenues).

There are several factors that should help smooth the transition towards a more cloud focused product strategy, we believe: 1) subscription model means the majority of billings derive from renewals; we estimate that less than 20% of Red Hat's billings are exposed to server shipment trends in any given year; 2) share gains in the server operating system market and the middleware markets; and 3) considerable base of free users to convert into paying subscribers for both their RHEL and JBoss product lines.

Exhibit 52  
**Red Hat's Current Subscription Base Very Focused on On-premise Server Environment**

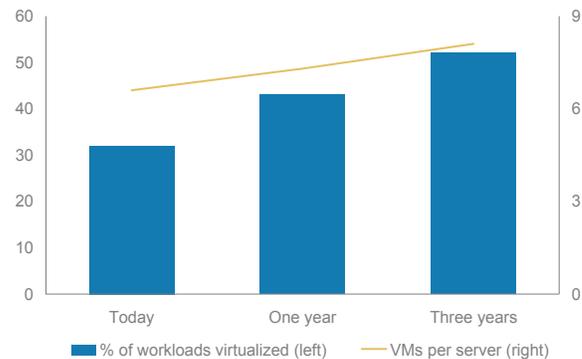


Source: Company data, Morgan Stanley Research

**If VM density increases, it weighs on virtualization growth.** While our survey suggests continue strong growth in the percentage of workloads being virtualized, going from 32% today to 52% in three years, the number of virtual machines (VM) running per physical server is rising as well. Perhaps a testament to the effectiveness of VMware's server virtualization technology: IDC expects VM density to increase at a 7% CAGR over the next three years. Our server model reflects a decelerating growth in virtualized servers shipping as VM density continues to weigh against workload penetration. Server focused licenses currently represent about 90% of total license revenues, but newer management technologies and virtual desktop represent two fast-growing opportunities building as a percentage of VMware's revenues. In addition, several factors can help smooth VMware's path to hybrid and public cloud opportunities ahead, in particular increasing ASPs as additional functionality is added to the core vSphere infrastructure and more mission-critical workloads require a more robust support infrastructure.

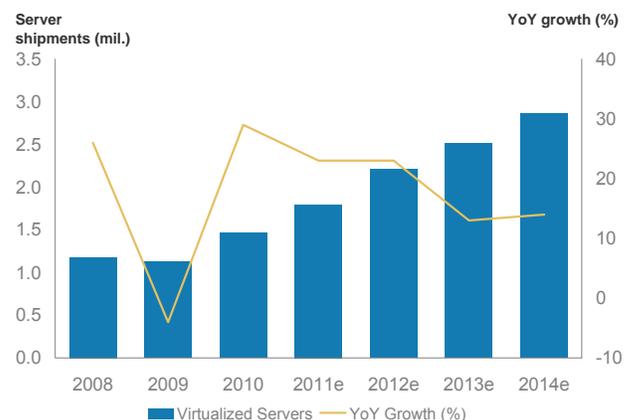
There is also some chance that IDC is wrong. We believe that the next leg of virtualization adoption will likely be driven by deeper penetration of tier-1 and tier-2 workloads, and our customer conversations suggest that these workloads tend to get consolidated at much lower levels than tier4 apps or pre-production apps. As such, we believe that workloads density could peak or even begin to decline. However, our model is based on the density increasing, and so it holds room for upside. For every 10 bps decline in workload density, virtualized server growth improved by 1.2%.

Exhibit 53  
**Percentage of Workloads to be Virtualized Growing at a 15% Three-Year CAGR**



Source: Company data, Morgan Stanley Research

Exhibit 54  
**Growth in Virtualized Servers Expected to Slow 2013-14**



e=Morgan Stanley Research estimates.  
 Source: Company data, Morgan Stanley Research

**Buying into the cloud.** Both VMware and Red Hat have made recent acquisitions to expand their cloud-focused technology portfolios. Red Hat's acquisition of Makara was a relatively straight-forward extension of its application development and deployment technologies into a public cloud

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environment. VMware’s acquisition activities have been both more extensive and broader in scope. Eight deals in the past two years have ranged from SaaS-based applications (Zimbra, SlideRocket) to development frameworks (SpringSource, WaveMaker) to SaaS-based security and identity/access management (TriCipher, NeoAccel). Additionally, VMware has signed a deal with EMC to take over the operations of its Mozy online backup service in order to gain real operational experience in large-scale public cloud environments.

Exhibit 55

**Buying Their Way into the Cloud**

Date	Acquired Company	Description
<b>Recent VMW acquisitions</b>		
11-Apr	SlideRocket	SaaS-based collaborative presentation solutions
11-Mar	WaveMaker	Graphical tool that enables non-technical developers to build spring apps
11-Jan	NeoAccel	Security for cloud computing
10-Aug	TriCipher	SaaS-based identity and access management security solutions
10-May	GemStone Systems	Provider of enterprise data management solutions
10-Apr	Rabbit Technologies	Open source enterprise messaging system solutions
10-Feb	lonix (from EMC)	IT management products, with improved management of servers
10-Jan	Zimbra	SaaS email and collaboration software
9-Aug	SpringSource	Provider of Java development environments like the Spring framework
<b>Recent RHT acquisitions</b>		
10-Nov	Makara	Developer of management/deployment solutions for applications in the cloud
8-Sep	Qumranet	KVM platform and VDI software provider
6-Apr	JBoss	Open source middleware software suite

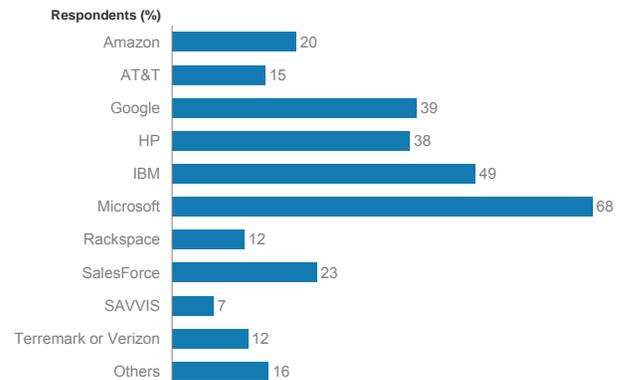
Source: Company data, Morgan Stanley Research

**Microsoft: So Much to Lose, So Much to Gain.** Microsoft has considerable revenue at risk from the shift towards cloud computing, with 24% of revenues derived from their server and tools division and 32% of revenue derived from the Microsoft Business Division (Office, Exchange, Dynamics), of which 25% is transactional license business sales, or 8% of total revenues. However, through Dynamics, hosted Exchange, Office 365, Xbox Live, Search, and Azure, Microsoft already has roughly \$5 billion in SaaS/cloud

revenue that we believe is growing in the range of 20% year over year. Microsoft’s cloud-based productivity application, Office 365, which was released in beta in April 2011, opens up significant opportunities in large enterprises to serve temporary, kiosk, and transitional workers (clerks, call center operators, attendants, retail, and food services employees), a segment that Microsoft applications have not yet tapped. Some of the biggest opportunities are in Azure, and Microsoft polled best in our survey in terms of vendors most likely to be used in cloud environments. We would note that a follow-up survey revealed that this includes both Dynamics SaaS and Azure PaaS spending intentions. Azure is currently a relatively small portion of Microsoft’s overall revenue, but we believe Azure is off to a very good start and could be material, on the order of \$1-2 billion in revenue within three years.

Exhibit 56

**Microsoft Polled Best in our Survey in Terms of Vendors Expected to be Used in the Cloud**



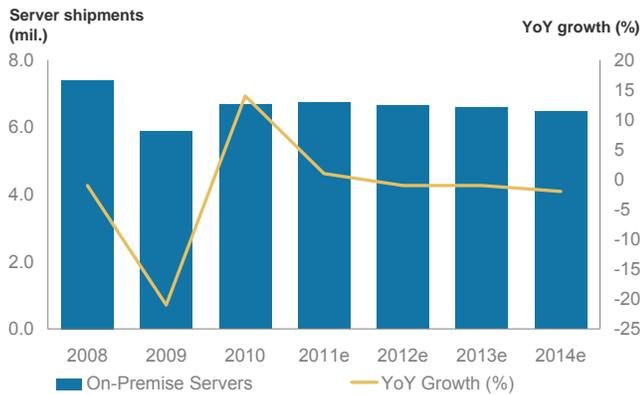
Source: Company data, Morgan Stanley Research

**Challenges Ahead for Vendors Tied to On-Premise Servers and Storage**

While Symantec does have a collection of 16 various SaaS services, and these will be a core part of the near-term growth story, the majority of the revenues are tied to more traditional on-premise computing resources. In particular, the storage and server management business, representing almost 38% of revenues in fiscal year 2010, is heavily tied to on-premise server shipments and the growth of storage devices. The migration of workloads and data to public cloud environments could prove a headwind to Symantec.

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Exhibit 57  
**On-Premise Server Shipments Expected to be Stagnant**



e=Morgan Stanley Research estimates.  
Source: Company data, Morgan Stanley Research

Exhibit 58  
**Over 50% Exposure to On-Premise Servers and Storage May Be a Headwind for Symantec**

Product Line Breakout	FY10 revs (\$)	% of revs
Security and Compliance	1,411	24
Endpoint Security	873	15 < at risk
Endpoint Mgmt and Virtualization	206	3
DLP and Compliance	178	3
SaaS	162	3
Storage and Server Mgmt	2,287	38 < at risk
<b>Backup &amp; Archiving (IMG)</b>	<b>1,399</b>	<b>23</b>
NetBackup	788	13
Backup Exec	410	7
Enterprise Vault	201	3
<b>Storage (SAMG)</b>	<b>876</b>	<b>15</b>
Storage Foundation	657	11
Cluster Server	219	4
Consumer	1,871	31
Services	416	7

Source: Company data, Morgan Stanley Research

**A European Perspective on the Cloud**

**We have not seen "pure-play" SaaS software players of any scale emerge in Europe.** Rather, the incumbent on-premise vendors are looking for ways to play in this market. European software is dominated by application software companies, and many of them focus on selling into specific industry verticals. We believe this deeper industry functionality is harder to replicate in the cloud, and so this partly explains the overall slower development of the cloud for the European vendors. However, we do have two major application software vendors that offer horizontal (as well as vertical) software — SAP AG and Sage. SAP offers a very broad suite of enterprise applications (covering ERP, CRM, supply chain

management, business intelligence, etc.), while Sage focuses on financial accounting software for small- and mid-sized companies.

**SAP was one of the first European vendors to announce a product in the SaaS space** when it launched a SaaS suite for mid-market customers that covered a broad range of functionality ( ERP, CRM, SCM, analytics) in 2007. Unfortunately, it was not successful, suffering from architecture and functionality issues. However, SAP re-launched Business by Design in 2010, and early feedback has been much more positive. SAP's challenge now is to find a route to market for the solution. SAP has also launched some SaaS functionality for its enterprise customers, principally around CRM and business intelligence. Initial feedback has been mixed but is becoming more positive, especially with the recently launched Sales OnDemand CRM offering.

We believe that SAP is focused on bringing more on-demand functionality to market for its enterprise customers and sees this area as a growth driver. As many enterprises are still reluctant to move away from on-premise (and in many cases there is no solution for them to move to), we believe that SAP has a window of opportunity to execute here. Certainly, while we believe SAP lags behind the best of breed vendors, it has such a broad installed base in the back-end of IT systems and deep IP across so many verticals that we still expect it to develop into a major player in the market long-term.

**Sage benefits from a massive installed base of small- and medium-sized business customers** and has made initial steps into cloud offerings, like Sage One in the UK. In addition to pure SaaS accounting products, Sage has also stated that it will launch "connected services," or specific solutions that are delivered via the cloud but that link to an on-premise accounting solution. Sage has indicated that while the SaaS market is growing strongly off a small base, demand for SaaS-based solutions from its small/mid-business customer base has still not hit the sweet spot because their customers prefer to keep software/data on premise. We also feel that Sage faces a more significant challenge than SAP as it has a significant number of products that are not integrated in each country. Potentially this means creating a large number of SaaS versions (one or two for each market) and also integrating each connected service to a large number of on-premise offerings.

**Autonomy has relatively larger exposure, but business is mostly hosted solutions.** In comparison, Autonomy has a relatively larger exposure to cloud as compared with its

European software peers. A large part of Autonomy's cloud exposure includes email and document archiving for its clients.

**Dassault Systemes' latest release of its software, V6, is web-based**, but we believe the sensitive nature of the R&D work that it is used for means implementations are likely to take place in private clouds—for example, an automotive OEM hosting the software for a supply chain. However, we expect Dassault to make SaaS versions of both CATIA and SolidWorks available in the short term and to use them to push into new verticals such as architecture/construction.

We do not see cloud as having a major impact on the rest of the sector. The vendors are either infrastructure vendors like Software AG or selling into verticals where there is little demand (Temenos is working with Wipro on an ASP version of its T24 product, but we would expect muted demand in the short to mid-term).

**Cloud exposures still small, but growing.** SaaS-based revenues at SAP and Sage are still a very small proportion of overall group revenues (we estimate them at approximately 5%). While Sage is still building out its SaaS offering across geographies and products, we do not estimate meaningful revenue contribution at the group level in the short/medium term. For SAP, we think a ramp in the BBD reseller network is likely to drive higher top-line growth and meaningful revenue contribution for the group. We estimate BBD revenues at €83 million in 2012e (less than 1% of group SSRS), reaching about €900 million in 2015e, or about 10% of group SSRS. Autonomy had approximately \$190 million of revenues (21.8% of group revenues) from SaaS/cloud in 2010, and we estimate that this will rise to about \$275 million, or 23.5% of group revenues by 2013e.

## Industry Takeaways: Telco Services

Simon Flannery

Edward Katz

We continue to see the adoption of centralized/shared IT infrastructure displacing internal corporate data center investment and the ownership of server infrastructure. Consistent with our quarterly CIO survey work, our AlphaWise survey suggested a significant share loss for on-premise/colocation environments over the next three years, in favor of significant managed hosting and IaaS adoption, along with strong growth for PaaS and SaaS. However, results also suggest that the telco cloud offerings continue to lag larger IT integrators and cloud specialists for mindshare among IT decision-makers. We see recent acquisitions as accelerating cloud growth and broadening the telco solution set to more fully encompass cloud-based offerings. Additionally, the survey provided further evidence of Rackspace's strong competitive position relative to Amazon and the larger telcos. Despite a significantly smaller sales force, shorter track record, and less recognizable brand, Rackspace appears firmly established among enterprise and small- and medium-sized business CIOs as a primary option for cloud deployment.

### Best-Positioned

- Rackspace
- Equinix's cloud ecosystem (cloud/IT service providers are only about 25% of revenue)
- CLECs/metro-fiber providers

### Models in Flux

- Traditional wireline enterprise revenue

### Potentially Challenged

- Legacy colocation business models that could migrate to a large public cloud.

**The large cap telco sector has prioritized cloud computing as a way to enhance wireline growth.** The traditional enterprise business model remains subject to significant price compression, macroeconomic headwinds, and share loss at the low-end of the market. We see the following as the key structural advantages for telcos developing cloud delivery models:

- Excess data center capacity in central offices and colocation facilities;
- Strong customer relationships with key IT decision makers; and
- The significant sunk cost of network infrastructure investment.

**Although the carriers face significant challenges, cloud connectivity needs can enhance the value of networks.**

Developing in-house or even integrating IaaS acquisitions requires telcos to develop new competencies. Complex IT solution-selling must become the centerpiece of new go-to-market strategies. Product development cycles must accelerate to respond to a more dynamic market. But of greater concern, perhaps, cloud capital spending requirements may increase at the same time that 4G wireless network deployment hits the peak investment stage.

Nevertheless, with an increasing degree of mission-critical and compliance-sensitive applications migrating to the cloud, a measure of incremental value should accrue to secure, scalable, and reliable networks. Larissa Herda, CEO of tw telecom inc., perhaps said it best on the first quarter 2011 earnings call: "There is no cloud and there are no data centers without the network or without connecting up fiber that begins and ends somewhere in the local arena."

We also see cloud connectivity requirements benefitting facilities-based metro fiber providers such as AboveNet and Zayo Group, among others.

**Organic growth focus versus M&A.** Each of the major carriers has pursued differentiated cloud strategies. Although AT&T has not ruled out inorganic opportunities to play in the IaaS space, we believe that the company largely views the cloud in the context of its extensive network assets. AT&T can bridge the gap between public and private cloud infrastructures to allow customers to realize the advantages of hybrid computing. Rather than competing head-on with larger public or private cloud providers, AT&T hopes to capitalize on its position as a "one-stop shop" for IT and connectivity needs. The company has said that it is already number two in hosting globally, with more than 2.5 million square feet of data center space (38 data centers, with 15 outside the US, primarily in Europe and Asia).

By contrast, Verizon announced the purchase of Terremark on January 27, 2011, at 20 times 2010E consensus EBITDA, excluding potential synergies. While the deal may only be slightly accretive, we believe this should improve Verizon's wireline revenue growth. Indeed, Terremark results have reflected accelerating revenue and EBITDA growth in fiscal third quarter 2011 and robust guidance for fiscal year 2012. Additionally, we understand that Verizon had already been reselling Terremark's vCloud Express product, aimed at the small- and medium-sized business sector. The product allows for access to compute power, storage, and bandwidth, with

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typical cloud computing characteristics of on-demand provisioning and usage based, credit-card-style billing. Verizon also plans to include its current portfolio of 220 data centers in 23 countries under the Terremark brand for more efficient management and enhanced revenue opportunities. However, we note that many of these facilities may be legacy MCI data centers and not comparable with those of AT&T.

Following Verizon’s lead, CenturyLink is also looking to buy cloud capability through the acquisition of SAVVIS for 11 times 2011E EBITDA (before synergies), announced on April 27, 2011. The SAVVIS deal reaffirms CenturyLink’s drive to reduce its exposure to regulatory and consumer voice revenues. If approved, the deal increases CenturyLink’s data centers from 16 to 48, with more than 1.9 million square feet of space. Similar to Verizon and Terremark, SAVVIS will incorporate all of the existing CenturyLink (and Qwest) data centers into its portfolio.

Other examples of an inorganic carrier cloud strategy include Time Warner Cable’s recent purchase of Navisite, Windstream’s acquisition of Hosted Solutions, and TDS Telecom’s purchase of VISI.

Exhibit 59  
**Recent Cloud/Data Center M&A Activity in the Telecom Space**

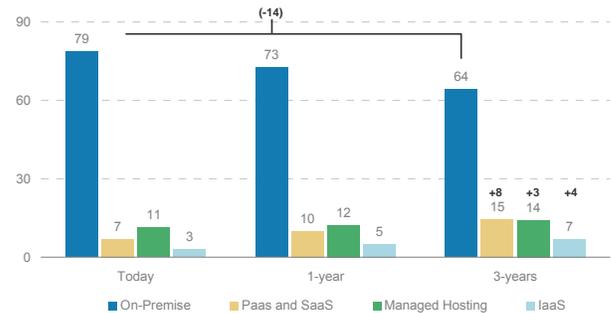
Strategic					
Target	Acquirer	Date Announced	Price (\$ (EV))	LTM EV / EBITDA Pre-Synergies	
SAVVIS	CenturyLink	Apr-11	3.20	10.9x	
Terremark	Verizon	Jan-11	1.86	21.0x	
Navisite	Time Warner Cable	Jan-11	0.34	11.4x	
Team Technologies	TDS	Dec-10	0.05	NA	
Hosted Solutions	Windstream	Nov-10	0.31	10.0x	
Fusepoint	SAVVIS	Jun-10	0.13	10.4x	
CyrusOne	Cincinnati Bell	May-10	0.53	12.5x	
Switch and Data	Equinix	Oct-09	0.87	11.4x	
IX Europe	Equinix	Jun-07	0.52	30.6x	
Data Return	Terremark	May-07	0.09	19.3x	
Private Equity					
Target	Acquirer	Date Announced	Price (EV)	LTM EV / EBITDA Pre-Synergies	
Peak 10	Welsh, Carson, Anderson & Stowe	Sep-10	0.40	NA	
Q9 Networks	ABRY Partners	Aug-08	CAD 0.3	18.8x	
Hosted Solutions	ABRY Partners	Apr-08	0.14	NA	

Source: Company data

**Survey takeaways.** Our AlphaWise survey reflected strong evidence of a shift away from owned IT infrastructure (either located on-premise or in a colocation environment), generally in line with the results of our quarterly CIO survey work. The projected growth for managed hosting and IaaS environments over the next year and three years underscores the trend towards less capital-intensive IT purchasing patterns. Over the past few years, more CIOs have become conscious of total cost of ownership savings associated with outsourcing servers and hardware components (in addition to the traditional focus on space, power, and access to bandwidth).

Managed hosting and cloud providers can provide the management of infrastructure down to the application layer.

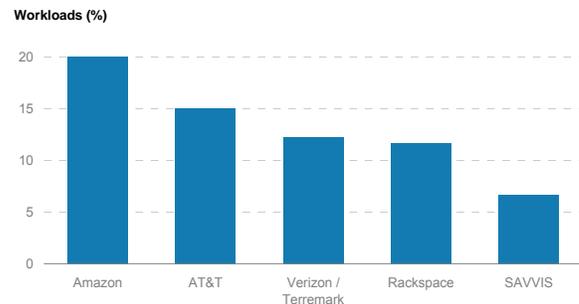
Exhibit 60  
**IaaS Adoption to More than Double in Three Years**



Note: Percentages may not add due to rounding.  
Source: Company data, AlphaWise<sup>SM</sup>, Morgan Stanley Research.

**Rackspace should benefit significantly.** As one of the only cloud pure plays remaining, given recent M&A activity, we see Rackspace gaining significant share in the growing managed hosting and IaaS markets. Enterprise growth via enhanced channel partnerships, continued cloud expansion, new product launches, and hybrid capabilities should lead to 29% EBITDA growth in 2011e with the cloud segment growth exceeding 40% through 2012e. Additionally, we see Rackspace potentially benefitting from its leadership in developing the open-source cloud standard Open Stack, which should enable new application development and deployment without vendor lock-in. Despite a market share disadvantage to Amazon of more than three to one, survey results suggested that Rackspace remained very competitive with Amazon for cloud take rates. Indeed, 12% of CIOs who expect to provision new workloads or move existing workloads to a managed hosting or cloud environment said that they would use Rackspace, compared with 20% for Amazon. With AT&T at 15% and Verizon/Terremark at just 12%, the survey suggested that among IT decision makers the large telcos remain behind for cloud mindshare.

Exhibit 61  
**Rackspace Well Positioned Relative to Competition**



Source: Company data, Morgan Stanley Research

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## Industry Takeaways: Networking Equipment

Ehud Gelblum

Kim Watkins

Patrick Standaert

We expect the data center Ethernet switch market to grow at a robust 10% CAGR through 2015 from \$7 billion in 2010 to \$11.4 billion by 2015, based on forecasts from Dell'Oro Group, far outpacing the growth in the much larger wiring closet switch market, which we expect to decline 1% over the same period. However, within that market, we expect the move to cloud to drive a shift towards higher- scale, off-premise data center switching equipment. We expect this market segment to grow at a much faster 21% CAGR over the same period, to \$3.5 billion in 2015 from \$1.3 billion in 2010. We expect this growth to take the off-premise data center cloud switching market to 15% of the total \$24 billion Ethernet switch market by 2015, up from just 7% in 2010.

Meanwhile, the much larger on-premise data center switching market, which in 2010 stood at 25% of the total Ethernet market at \$4.9 billion, grows at a far more subdued 5% rate over the same period as the drive to cloud shifts workloads away from the company premise. Along with the niche, high-performance compute segment, which we forecast to grow at a 20% CAGR over this period, we expect total data center switching to account for 48% of the market by 2015, up from 35% in 2010.

We expect increased adoption of cloud architectures to exacerbate the already bifurcated Ethernet switch market, encouraging vendors to not only develop data center-class switches that are distinct from wiring closet switches, but also to introduce flat architectures tailored specifically for higher-capacity, off-premise cloud deployments where penetration of server virtualization is nearly 100%, versus just 17% in on-premise data centers. Therefore, we believe networking vendors best positioned for cloud adoption are those with highly scalable flat architectures tailored for large data center deployments.

**As more enterprises are outsourcing at least a part of their data center needs to cloud providers, we see third-party cloud providers emerging as a new class of service provider in the market for Ethernet switching equipment.** With the needs of cloud providers, social networking companies, large Internet content providers, and traditional service providers all being similar in scale needed to support a cloud architecture, we see a natural dividing line bifurcating

### Best-Positioned

- **Juniper Networks.** With one of the only truly flat data center architectures today, QFabric arms Juniper with a first-to-market advantage for large-scale data center and enterprise cloud build-outs.

### Models in Flux

- **Alcatel-Lucent.** Alcatel-Lucent recently introduced a new top-of-rack data center switch, the OS6900, to compete with Cisco, Juniper, Arista, Force10, and Brocade, but currently the company lacks the scale and partner channel to be a major global player.
- **Cisco.** Cisco's portfolio lacks a flat architecture for large-scale cloud deployments, as its approach has been to tweak its enterprise data center architecture for cloud. With an estimated 80% data center share today, according to Dell'Oro, dominating the on-premise data center market, we believe Cisco remains in a defensive position.
- **Brocade.** Brocade offers a competitive fabric-based strategy, but its ability to execute and penetrate large accounts remains a concern.

### Potentially Challenged

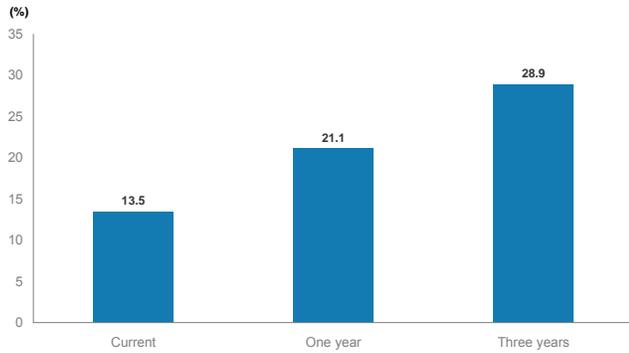
- **Hewlett-Packard.** Hewlett-Packard lacks a definable cloud strategy. Its success since the 3Com acquisition has been in traditional data center environments, where it continues to gain share, and we do not believe this changes with the introduction of its new FlexNetwork architecture and A10500 switch.

the data center and wiring closet markets as data center switches become increasingly specialized and take increased share. According to our AlphaWise survey, over the next three years CIOs expect 36% of workloads to move to the cloud up from 21% today. In addition, 29% of respondents expect to be using IaaS up from 14% today, driving a 33% CAGR for IaaS over the next three years and having a profound impact on the Ethernet switching landscape as described below.

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Exhibit 62

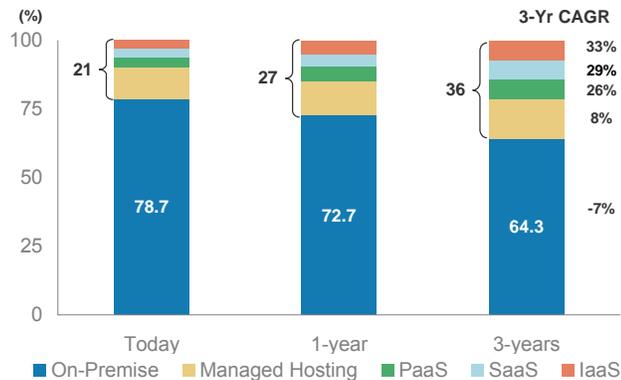
**Percentage of Respondents Using IaaS**



Source: Company data, AlphaWise<sup>SM</sup>, Morgan Stanley Research

Exhibit 63

**Percentage of Workloads in Cloud Up to 36% in Three Years**



Source: Company data, AlphaWise<sup>SM</sup>, Morgan Stanley Research

**According to our survey, networking fares the best over the next three years among servers, storage, and networking equipment** as a result of enterprises moving workloads into the cloud. We also expect total networking spending to remain essentially constant, as opposed to material declines for servers and storage. In addition, while we expect the move to cloud to drive growth in off-premise data center switching, we also expect it to create downward pressure on the more standard enterprise wiring closet network switch market, which we are forecasting declines at a 1% CAGR from 2010-15 as enterprises extend their upgrade cycles.

Overall, we expect data center switching to represent roughly 48% of the total Ethernet switching market by 2015, up from 35% in 2010. As a result, total data center switching is likely to grow at a 10% CAGR over this period into an \$11.4 billion market, from \$7 billion in 2010, based on forecasts from Dell'Oro Group. Note that while we are forecasting wiring

closet switching to decline by 1% over this same period, the market remains a respectable \$12.2 billion size by 2015, just a hair larger than our estimated \$11.4 billion data center switching market.

Exhibit 64

**Data Center Switching Grows to 50% of Ethernet Market by 2015**



e=Morgan Stanley Research estimates.  
Source: Company data, Morgan Stanley Research, Dell'Oro Group

**We believe adoption of private or public cloud architectures has profound implications for the data center switching market**, as the greater scale required in a cloud data center and the increased use of server virtualization changes traffic patterns, and therefore has implications for the switching architecture. Traditionally, data center switching architectures have had three layers: a top of rack switch, an end of row switch, and a core switch, which all feed into one another. However, with the increased adoption of server virtualization, the dominant traffic patterns have changed from a “north-south” direction (i.e., into and out of the server) to an “east-west” direction (i.e., directly between servers within the same data center). This results in the gradual flattening of the network architecture from three layers to two layers because the use of an end-of-row switch now slows the traffic flow. We believe the architecture eventually results in a complete flattening of the data center to just one layer, in line with Juniper’s QFabric vision, to provide any-to-any connectivity no longer defined by physical location, essentially providing a pool of connectivity resources that can scale to support much higher switching capacities than existing data centers.

**With the shift to cloud architectures, we forecast off-premise data center switching will grow to 30% of the data center switching market by 2015 from 19% in 2010**, or at a 21% CAGR on an absolute basis to \$3.5 billion in 2015 from \$1.3 billion in 2011.

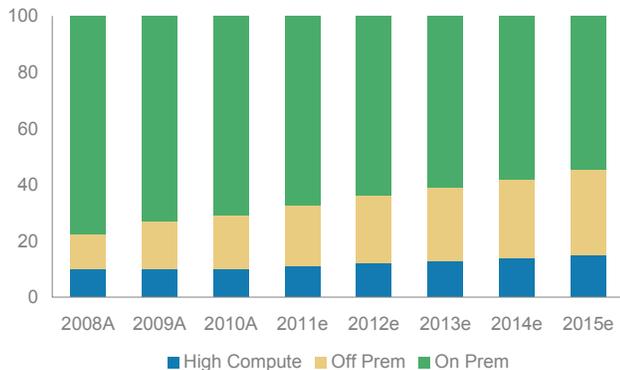
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Exhibit 65  
**Off-Premise Data Center Switching Grows to 30% of Market by 2015**



e=Morgan Stanley Research estimates.  
 Source: Company data, AlphaWiseSM, Morgan Stanley Research, Dell'Oro Group

Exhibit 66  
**Data center Switching Breakdown: Off-Premises Taking Increasing Share**



e=Morgan Stanley Research estimates.  
 Source: Company data, Morgan Stanley Research, Dell'Oro Group

**The high-performance compute market should grow at a 20% rate through 2015, similar to rate of the off-premise market, despite being an on-premise application.** We have distinguished between the on-premise data center switching market and the high performance computing market. While both markets are technically on-premise, the high performance compute market is a niche application used in industries that require ultra low latency (measured in nanoseconds versus microseconds), combined with high capacity—10GigE, and eventually 40GigE and 100GigE. These switches are used to support applications where low latency is critical, such as chemical compound research in the pharmaceuticals industry, high frequency trading in the financial services industry, and/or three-dimension rendering for exploration in the oil and gas industry. Products targeting this segment of the market include Cisco's Nexus 3000, Juniper's QFX3500, Brocade's VCX, and Arista's 7000 series.

**Historically, traditional data center architectures have been made up of isolated pods of switching resources lacking true scalability, interoperability, and flexibility.** As a result, these architectures have been unable to pool resources efficiently within and across the entire data center. Traditional builds involve combining disparate, "best-of-breed" vendor solutions, and equipment providers have traditionally developed the same box for both the wiring closet and data center (such as Cisco's Catalyst 6500) and made just minor adjustments to hardware and/or software to differentiate these products relative to their wiring closet offerings. This practice greatly limits the scalability, pooling, and cost efficiencies ideally suited for large-scale deployments.

**Consequently, equipment vendors have begun developing separate purpose-built switches** designed to support the differing needs of both the data center and the wiring closets—particularly as servers within the data center more and more often are connected via links of 10GigE and above, while wiring closet switches connect at just 1GigE. Cisco's Nexus 7000 is an example of a purpose-built data center switch.

**Today, the needs of the two domains have diverged to the point where many of the new features launched are often applicable to only one of the two application markets and not the other.** For instance, Juniper's QFabric runs a distributed software architecture unifying all of the switches in a data center. This unified architecture enables scalability and greater pooling efficiencies but would not only be completely inapplicable in a wiring closet environment but a gross overkill. Furthermore, we expect architectures to be specifically developed for off-premise data center deployments (i.e., public clouds), which are completely flat architectures that pool resources and would, for example, enable a customer to move virtual machines across servers or between data centers on the fly, providing any-to-any connectivity. Other key differentiating switching features include:

- **Data center.** Support for data center bridging and Converged Enhanced Ethernet to support Fibre Channel over Ethernet (FCoE), lossless fabrics, high scale and throughput, non-blocking and flattened architectures with 1 or 2 layers; and
- **Wiring closet.** Multiprotocol support, integrated firewall support, quality of service, support for Power over Ethernet (PoE), and IP PBX and voice functionality.

**In addition, wiring closet switches tend to be more flexible**—they can be connected to any of a variety of different types of Ethernet devices, such as PCs, printers, home media players, enterprise PBXs, IP phones, WLAN access points, etc. Conversely, data center switches are connected just to servers and so do not need support for those other types of devices; they have dramatically greater scale. In short, while the guts of a wiring closet Ethernet switch and a data center top-of-rack Ethernet switch look the same, the feature set, scale, flexibility, and control software sitting on top of that switch engine are becoming increasingly more different.

**We therefore expect network vendors that have a comprehensive switching solution specifically tailored to the needs of the data center** to be those who benefit most from the move to the cloud. These best-positioned vendors would emphasize key features such as:

- Non-blocking, low-latency connectivity to provide wire-speed performance;
- Flat architecture, collapsed from the traditional three-layer enterprise architecture (end-of-row, top-of-rack, core) eventually to one layer to support changing traffic patterns with the increased use of virtualization;
- Scalability, to support more than 1,000 servers in a cluster at speeds of 10 GigE and up;
- Linear cost and power scaling; and
- Support for a variety of storage protocols (FCoE, iSCSI, etc) to integrate storage over the switching architecture.

## Juniper Takes Early Lead

**We believe the QFabric architecture unveiled February 23 elevates Juniper to best positioned for the large-scale cloud environment.** QFabric has the only true data-center-centric solution targeted at large-scale cloud providers and enterprise deployments by providing highly scalable performance through pooling resources at a single layer managed as a single logical device, resulting in both operational and capex efficiencies. We expect the combination of Juniper's first-to-market lead and its existing service provider incumbent relationships to provide clout in displacing existing solutions currently utilized within data center, which we believe attempt to leverage existing standardized switching technologies and architectures not optimized and scalable within the data center environment.

While Juniper is currently only shipping the first of the three elements of its QFabric solution (the top-of-rack/high

availability QFX 3500), its QFabric Interconnect and Directors are scheduled to begin shipping in third quarter 2011, putting Juniper well ahead of its competitors in gaining mind share in the interim. Furthermore, since about 25 large-scale cloud customers account for approximately 25% of data center share—companies such as Amazon, Facebook, Google, etc.—each customer win among these top customers could equal 1% data center share, creating a quicker path to share scale than Juniper has amassed to date in the enterprise switching market.

## Alcatel-Lucent in mid-size business

**Alcatel-Lucent recently announced its OmniSwitch 6900 and 10K modular boxes, which will enable it to compete more successfully in the high-end data center next-generation boxes market against more established players like Juniper, Brocade, and Cisco.** Alcatel-Lucent's new data center switching solution blueprint for enterprises allows virtualization of the network with an innovative "mesh" architecture design to optimize server-to-server traffic while striving to reduce costs. The portfolio includes a modular LAN Chassis (OS10K), the Virtual Network Profile (VNP) for enabling the management of applications as services with automated controls, and a LAN switch (OS6900). The OS6900 is a high-density, 10GigE switch that can be positioned as a top-of-rack or end-of-row switch in a data center. It can also be deployed as either a small network core switch or as a traditional aggregation switch. Its modular design provides readiness to support 40GigE uplinks and Fibre Channel interface modules. As a result, the OS6900 can deliver a highly dense solution without relying on a core switch to carry server-to-server traffic.

While Alcatel-Lucent is trying to make a bigger splash in the data center market with the OS6900, we believe the company's small and stagnant market share (at about 1% for the past seven years) and focus on midsize businesses in Europe puts them at a disadvantage in the data center as workloads move into the cloud.

## Hewlett-Packard Plays Catch-up in Cloud

**While we view Hewlett-Packard as a formidable competitor in the wiring closet and the traditional, on-premise data center market, we believe HP still lacks a definable data center cloud strategy,** more than a year after closing its 3Com acquisition in April 2010. Hewlett-Packard continues to attack Cisco in wiring closet switching, with a win rate at 15% of bake-offs in the past one to two years, according to our CIO survey. This rate is down from 24% in

January survey but still above its 11% market share. Even so, Hewlett-Packard has yet to unveil a single-layer data center offering. We believe this gap in Hewlett-Packard's switch portfolio, therefore, limits its ability to compete effectively for cloud RFPs.

Hewlett-Packard's recently announced FlexNetwork architecture improves the company's competitive position in the on-premise data center market by introducing its first switch supporting 10GigE, which puts the company in a vastly improved competitive position relative to Cisco's Catalyst 6500. However, Hewlett-Packard is still lacking a solution for broad-scale cloud deployments, keeping the company in a catch-up position in the off-premise data center market.

### Brocade Struggles with Distribution/ Salesforce

**We believe Brocade's fabric-based switch solutions are strong enough to eventually become competitive in the cloud data center market, but we need to see evidence of more consistent execution.** The Brocade One strategy is focused on providing a new network architecture that simplifies cloud data centers. While Brocade's new VDX switch is currently a fixed switch, we expect a modular box to follow in 2012. More importantly, we believe Brocade needs to demonstrate its ability to execute on its vision for Ethernet-fabrics, given its mixed execution since the Foundry acquisition. We believe Brocade needs to develop a high-end switching sales force to compete for cloud RFPs, as it uses in FC SAN switches.

### Cisco Defending Data Center Share

**Cisco is currently the leading data center switching vendor, holding an estimated 80% share of the data center switching market,** according to Dell'Oro. While Cisco has come to market with solutions tailored to the data center, including its FabricPath solution, we believe such offerings lack true scalability and the flat architecture needed in large-scale cloud deployments. Although Cisco's marketing machine claims it supports a single-layer architecture, in actuality FabricPath is made up of two layers connecting two sets of Nexus 5K and 7Ks but acting virtually as one layer, which results in lower scale. While this is good enough for enterprise data center deployments today, we believe Cisco's current offering is not ideally suited for large cloud and off-premise data center deployments. According to blogs, Cisco is purportedly working on a new single-tier data center platform of its own, nicknamed "Jawbreaker"; assuming the information is correct, the new platform is not scheduled to be unveiled for another 18 months. In the meantime, we expect Cisco to operate from a defensive position as it is inclined to lose share as competitors emerge and attempt to chip away at some of Cisco's 80% market share.

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## Industry Takeaways: Semiconductors

Sanjay Devgan

Atif Malik

Within the semiconductor industry, the transition from on-premise to cloud-based server environments will affect many device manufacturers across the compute, storage networking, infrastructure, and security end-markets. Best-positioned silicon vendors have the broadest exposure, a high degree of integration, and an ability to reduce the total cost of ownership. Device manufacturers that either lack exposure to cloud-based server environments or are limited in terms of their ability to deliver low-power devices that can reduce total cost of ownership for cloud service-providers face secular challenges.

### Best Positioned

- **Broadcom.** The migration from custom/ASIC solutions to merchant offerings positions by OEMs positions Broadcom as a key beneficiary. Broadcom is particularly well positioned in the area of switching, where the company's Trident switch solutions are leveraged by multiple tier-1 OEMs.
- **Cavium Networks.** As data centers migrate to cloud-based environments, security will be a key focus. Cavium's Nitrox and Nitrox-based network interface controller (NIC) cards position the company to benefit as data center managers weigh the costs and benefits of deploying additional servers to enable encryption and decryption.
- **SanDisk.** Enterprise solid-state drives (SSDs) enable higher IOPS performance and lower power consumption in servers and storage for the cloud. As a pure play on NAND flash, SanDisk stands to benefit from favorable demand and pricing dynamics in NAND with the rapid adoption of enterprise SSDs on the server side.

### Potentially Challenged

- **Advanced Micro Devices (not covered).** Outside of the initial Opteron product cycle in 2005-06, the company has trailed Intel in processors for server applications. Advanced Micro's share in the server market is roughly 20% (versus Intel's 80%). The migration to cloud-based server environments will result in a need for even better performing CPUs, and Advanced Micro historically has trailed Intel in terms of server CPU performance.

### Models in Flux

- **Intel (not covered).** The move to cloud-based server environments will drive the need for higher core count processors (the vast majority of servers are shipped with dual-core processors). While the migration to higher-core count processors should result in increased ASPs and profitability for Intel, the drawback is a decrease in the total aggregate number of servers shipped annually.
- **Micron Technology.** Cloud computing drives higher DRAM content and performance in servers and storage hardware to support multiple processor cores, faster speeds, and lower power consumption. However, given Micron's 20% exposure to PC DRAM, less-demanding DRAM specifications on the client side potentially offset server strength.

## Silicon Requirements Increase with Transition to Cloud-Based Servers

**Mixed outlook for server CPU vendors.** With the migration from on-premise server environments to cloud-based server environments, the number of virtualized servers in use increases.

Processor vendors such as Intel should benefit from the implementation of more multi-core processors (beyond dual-core), which are needed to meet the increased use of virtualized servers. We note that multi-core offerings from CPU vendors like Intel are more profitable than single- and dual-core server CPU offerings and that the profitability of server CPUs in general exceeds by far the profitability of client-side CPUs.

Intel's total (both client and server) CPU shipments in 2010 were approximately 320 million units; server MPU shipments made up approximately 5% of this 320 million. However, from a profitability standpoint, server CPU shipments contributed approximately 30-40% to Intel's total profitability in 2010.

Despite the improved profitability from multi-core server CPUs, the offset comes from the fact that virtualized servers imply more fully utilized servers. Consequently, despite the increased profitability of each individual server, we believe that the aggregate number of servers expected to ship as a result of the transition to cloud-based server environments will actually decrease.

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**Multi-core CPUs drive need for memory buffers**

While processing power continues to increase in accordance with Moore's Law, the rate of improvements has not kept pace on the memory side. Consequently, servers are limited by input/output (I/O) bottlenecks that occur between the host processor and associated on-board memory. Memory buffers help ease these bottlenecks by allowing the processor and memory to act independently, without being affected by differences in operation; a piece of data is sent to the memory buffer and can either be used by the processor or stored in the main memory. Thus the migration to multi-core CPUs serves to increase the number of memory buffers needed per server.

**Greater demand for storage networking**

**Broadcom, LSI Corp., and PMC-Sierra (not covered) are best positioned.** According to IDC, in 2009 roughly 1.2 zettabytes (1 followed by 21 zeros) of digital information were created globally and subsequently needed to be stored. This figure represents a 50-100% increase for content that enterprises must maintain on a yearly basis. With the transition environments from on-premise server to cloud-based servers, the rate of content growth in the form of voice, video, and data is expected to continue to increase, particularly as individual users have access to greater compute resources (i.e., services like Amazon's Elastic Compute Cloud).

From a storage silicon perspective, there are many different enterprise storage models, including networked-attached storage, server-side storage, and storage area networks (SAN). For our purposes of this discussion, we will focus only on opportunities within SAN.

**Fibre Channel: fabric of choice for SAN**

According to Webopedia, Fibre Channel is a serial data transfer architecture that was developed by a consortium of computer and mass storage device manufacturers and has been standardized by the American National Standards Institute (ANSI). Relative to other interconnect fabrics, and despite Fibre Channel's higher costs, the fabric's benefits include faster transmission speeds (8 gigabits per second), longer distances (in support of external storage architectures such as NAS and SAN), and improved system reliability.

**Fibre Channel Components in SAN**

**Protocol controller.** The Fibre Channel protocol controller contains the primary intelligence for assembling and

disassembling Fibre Channel frames and managing exchanges. It is typically integrated into host bus adaptors and routers/bridges. These chips are usually digital-only chips and are manufactured on mainstream CMOS submicron process technologies.

**Port bypass controller (PBC).** A port bypass controller is a physical layer chip that routes Fibre Channel signals to hard disk drives (HDDs). PBCs are used to keep a loop operating when a port on the loop is physically removed or becomes inoperative. The signals are routed past the port and the loop continues to function. PBCs can also be used as repeaters in order to improve signal quality.

**Loop switches.** Loop switches provide point-to-point connectivity to HDDs in storage arrays. Loop switches typically contain an array of intelligent port management features that reduce system costs and downtime. Currently, loop switches are being used to replace port bypass controllers.

**Translator/bridge chips.** A bridge chip is basically a discrete "interface translator" chip that converts signals between differing storage interconnect protocols. In typical SAN environments, low-end SAS/SATA disk arrays are attached to Fibre Channel SANs via a bridge chip that converts the Fibre Channel signals to SAS/SATA.

**iSCSI provides an emerging opportunity**

iSCSI is gaining traction in the enterprise storage market as a cheaper alternative to Fibre Channel SANs. Unlike typical Fibre Channel SANs that are geared to large enterprise environments, iSCSI allows users to take advantage of the utilization and centralization benefits of SANs at reduced cost points relative to Fibre Channel by utilizing ethernet. Consequently, iSCSI is well suited to small- and medium-sized businesses that would like to pursue SAN storage options. However, we note the market for iSCSI-based solutions is still in its infancy.

**Data center evolution**

Silicon vendors like Broadcom and Marvell Technology Group are best positioned to take advantage of the migration to 10/40/100 Gigabit Ethernet (GbE).

Data center evolution is driving changes to enterprise requirements for switches, making Ethernet connectivity—specifically 10Gb connectivity—the data center protocol of choice, replacing slower, more costly links. However, the

WAN — in stark contrast to data center consolidation — is getting larger and the network edge is blurring. Demand for corporate data and applications is growing rapidly as a diverse and growing group of constituents (remote workers, partners, customers, etc.) from multiple points in the network seek faster and more responsive access to the data center.

While there are many implications for enterprise switching and routing due to data center evolution, we think three key requirements are driving decision making today: higher density, greater bandwidth, and enhanced reliability and resiliency. Moreover, with the shift to cloud-based server environments, servers are being upgraded to gigabit connections. Consequently, 10GbE is becoming more prevalent in high-end cloud-based data centers; 10GbE enables the aggregation of large numbers of gigabit ports in the datacenter in a cost-effective way, allowing users access to vast amounts of data. Further, 10GbE links are being used to aggregate connections between grids or clusters of servers, enabling a new wave of computing power in a much smaller and cost-effective footprint.

**The OEM transition from ASICs to merchant solutions will also benefit semiconductor device manufacturers.** Historically, tier-1 networking vendors such as Cisco Systems have differentiated their product offerings through the use of custom ASIC solutions. However, more recently, due to the emergence of advanced merchant solutions that exceed the performance specs of custom solutions from device manufacturers such as Broadcom, OEMs are foregoing the use of their own ASICs in lieu of merchant solutions. Moreover, the decision to migrate to merchant offerings is rather straightforward when one takes into account the increased cadence of innovation tied to product introductions as well as the cost and time to develop custom chips.

## Greater security needs

**Cavium Networks is best positioned.** The move to cloud-based server environments from on-site server environments brings with it the need for additional security, regarding both encryption/decryption and the ability to drive deep packet inspection (DPI).

**Longer encryption/decryption key codes drive new opportunities for silicon vendors.** The National Institute of Standards and Technology (NIST) has recommended that as of December 31, 2010, 1024-bit RSA keys should be pulled from use and instead, the minimum key size should be 2048-bit

RSA. We believe the transition was made to mitigate the risk of hacking/intrusion into data centers and cloud environments via “brute force” methods as servers have become more sophisticated and services like Amazon’s Elastic Compute Cloud provide greater compute power for individual users.

To become compliant with the NIST standards, existing and new server systems will have to support the 2048-bit standard. Existing data center/cloud compute environments currently support the 1024-bit standard by running encryption software on servers or using dedicated load-balancers to run the encryption algorithms. At the server level, we believe individual servers will be challenged to support the 2048-bit standard given the exponential increase in processing power needed to support larger encryption keys. At a minimum, we believe the transition to 2048-bit keys will require a 10-fold increase in compute power to run encryption software on servers. Therefore, we believe it is more likely that data center architects will off-load the encryption functionality to separate co-processors or network interface cards and utilize the core CPU to support client interactions.

**Deep packet inspection increases with the migration to cloud-based servers.** While the concept of deep packet inspection has been around for several years, the migration to cloud-based server environments will accelerate the deployment of DPI as the need for content awareness (voice, video, or data) and security requirements increase.

Within advanced networking systems, there exist seven major networking layers into which network activities, equipment, and protocols are divided. Previous generations of networking equipment routed and switched data based solely on its source and destination address (layers 1-3), which is contained in the packet header. Current generations of networking equipment, however, are capable of DPI, or routing data based upon application, content, and security services (layers 4–7). The ability to effectively route data based on application, content, and security services is necessary given the explosion of network traffic due to the adoption of applications such as VoIP, video over broadband, file sharing, and the proliferation of personal content over the web. Consequently, the processing requirements needed by the telecom equipment providers to meet increased network demand have also increased and network processors, from semiconductor companies such as Cavium, which are capable of providing DPI capabilities are required.

## Industry Takeaways: IT Services

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**Masaharu Miyachi**

The economics of the cloud are forcing CIOs to ask fundamental questions about the technology architectures employed within the enterprise. As a result, we expect two near-term outcomes: 1) Consulting demand will increase due to the need for cloud-related technology assessments and for revamped IT strategies; and 2) infrastructure outsourcing (ITO) bookings are likely to face near-term challenges, since CIOs will be less likely to sign multi-year outsourcing contracts until they are comfortable that their cloud assessment/IT strategy activities are rigorous and complete. Despite potential near-term ITO bookings challenges, we think that the cloud creates more opportunities than risks for the IT services space overall, since significant technology waves typically generate considerable demand as corporations invest for change.

### Best-Positioned

- **Accenture.** The company's consulting history, industry/domain expertise, and deep client relationships position it as a "trusted advisor" to capture near-term cloud-related consulting demand. Longer term, we think that Accenture will aggressively target new opportunities afforded by "as a service" operating models, which will provide new sources of revenue growth.
- **Infosys.** Infosys is using the cloud to further enhance its non-linear revenue initiatives, which will help to differentiate its consulting services, in our view. Its software as a service platform has also helped its banking product – Finacle – to increase revenues (47% year over year in fiscal year 2011) and to expand its customer base by reducing the infrastructure requirements for its clients. Internally, its projects have already adopted the internal enterprise cloud that can host over 3,000 virtual machines and it maintains a 90% utilization of the virtual instances.
- **Cognizant Technology Solutions.** The cloud is a positive for Cognizant, in our view, as its investments in skilled onsite resources should help the company gain cloud-related consulting and assessment opportunities. However, since Cognizant Business Consulting's more than 2,500 professionals represent 2-3% of the total company's workforce, we think that cloud advisory activities

will primarily expand and deepen the company's most important existing client relationships in the near term. Longer-term, more complex enterprise architectures associated with the cloud and the advent of remote infrastructure monitoring (RIM) will enable Cognizant to continue to gain market share, in our view.

- **TCS.** Its cloud platform for small and medium businesses appears to be the most promising to us. In our view, TCS is likely to use the consulting and operational takeaways from its cloud initiative for small and medium businesses in India to roll out the offering for its global clients as well, thus creating a new revenue line for its services. Overall, we believe, this new platform could drive an improvement in revenue and EBIT per employee for the company as it gains scale over the coming years.

### Models in Flux

- **Computer Sciences Corp.** If cloud strategy assessments slow outsourcing bookings in the near term (as we expect), then we think that shares will remain range-bound until Computer Sciences can show signs of accelerating growth. However, Computer Sciences has developed several "as a service" offerings and now incorporates the cloud into all of its new ITO pursuits, which is a positive and will be critical to the company's long-term success, in our view.
- **Capgemini.** With about half of its outsourcing business (20% of total business) coming from ITO, we see potential for short-term headwinds. However, its strong balance sheet should allow the company to adapt its portfolio and offer innovative solutions to capitalize on this major industry trend.

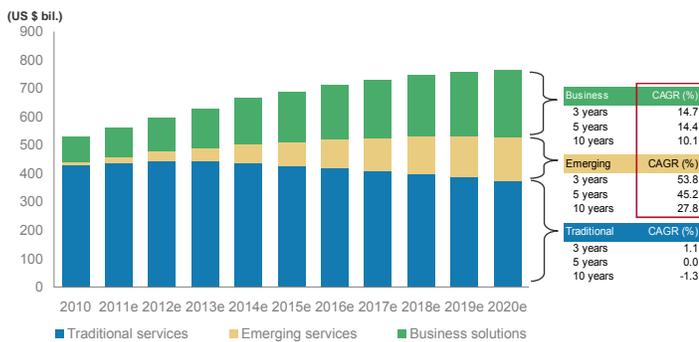
### Potentially Challenged

- **Atos Origin.** With about 40% of its sales derived from the ITO, we see the company facing material booking/revenue challenges in the near term. The company's lack of international scale could also weigh on its competitiveness, in our view.

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**The cloud creates more opportunities than risks.** The cloud will create turbulence for portions of the IT services stack that are both amenable to standardization, and dependent on large, up-front capital expenditures. However, we see more potential opportunities than risks for the services space overall, as demand for emerging services offerings is likely to drive considerable new spending.

Exhibit 67  
**New Cloud-Based Offerings Are Likely to Drive Continued Growth in the IT Services Market**



Note: As defined by Forrester Research and CSC, business solutions includes business services and vertical software (or leveraged BPO); emerging services includes consulting and implementation, service orchestration, software/platform as a service, security as a service, and infrastructure as a service; and traditional services includes IT consulting, systems integration, and outsourcing.  
 e=Company estimates.  
 Source: Forrester Research, Inc.; CSC Research

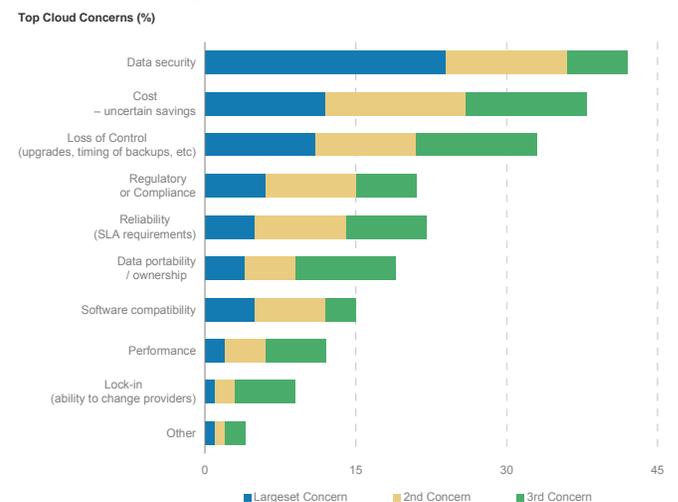
We expect the cloud to shift spending priorities away from some traditional services, while increasing demand for services in aggregate. This view is supported by history, as significant IT waves have often exposed some traditional services that are related to legacy technologies to the risk of displacement. These waves have also often increased demand for IT services in aggregate, however, due to the complexities involved in implementing new and less well-understood technologies. This was the case with the prior enterprise resource planning (ERP) wave, which encroached on some custom applications development work at the time but ultimately drove significant demand for implementation services, and ERP still generates healthy applications maintenance revenues today.

When drawing parallels between the impact of ERP and the cloud on IT trends, it is important to note differences that will cause spending patterns to vary between the two. While ERP developed and implemented a core system at the heart of a company's processing architecture, cloud technologies seem to approach the enterprise environment from the outside in. We think that the cloud will be used primarily to replace applications and infrastructure at the periphery of a company's business processes to achieve economies of scale

through standardization and remote hosting. Therefore, we note that companies are unlikely to replace the core solutions and services that make up the foundation of many IT services revenue streams with new cloud-based solutions (excluding ITO).

**Established relationships are more important than new technological vogue.** Companies are likely to turn to their trusted advisors to help them navigate cloud projects, in our view, and we doubt that the cloud (or new and unproven vendors) will supplant the existing IT services industry leaders, as some have argued. The bottom line is that the cloud is a new set of services that vendors will be able to pitch to their clients, and as with all services businesses, relationships and tenure matter. The IT services industry largely proved itself during the ERP wave, which gives its executives relatively more credibility to fill the trusted advisor role. Further, through their existing relationships, many IT services companies have also demonstrated their ability to address many of the top concerns that CIOs have about the cloud.

Exhibit 68  
**Experience Matters: IT Services Companies Have Tools to Manage CIOs' Top Cloud Concerns**



Source: Morgan Stanley Research

**Implications of the cloud vary by service line,** with consulting most likely to benefit and infrastructure outsourcing facing the most challenging dynamics. Within the five major service areas, we think that the cloud will be a net positive for consulting, business process outsourcing (BPO), and applications development and systems integration; neutral for applications outsourcing; and a net negative for infrastructure outsourcing. We first ranked each service line in the order that we perceive them to benefit from the cloud (with 1 being most

avored) and then reviewed the near-term and long-term outlook. Below we also include the key positives and negatives of the cloud associated with each service line:

1. **Consulting will enjoy increased demand, from which Accenture and Cognizant are positioned to benefit.** Given the relative novelty of cloud technologies, most CIOs will look to their trusted advisors for knowledge and experience when considering alternatives in the cloud. In our view, this will generate considerable consulting demand as cloud technologies move up the adoption curve. High-value, consulting-led solutions are a competitive differentiator for Accenture, and we think this bodes well for continued strong consulting bookings at the company. Our channel checks indicate that the India-based companies are also doing a good job of providing technical consulting capabilities to help their customers get ready for the cloud. Therefore, we think that Cognizant's leadership among the offshore providers in deploying onsite program management and consulting expertise also positions the company for continued above-market growth.

We see the following possible positive developments for the consulting market:

- Near-term assessments and IT strategy projects will generate demand;
- Consulting demand will continue to increase with cloud adoption and as related technologies evolve; and
- Once a company establishes a consulting relationship, it is more likely to win follow-on applications development, systems integration, and/or outsourcing work.

Among the negative developments for the companies: We believe that new niche or specialty cloud-focused consulting firms will emerge to compete in this space, much like the internet consultancies of the late 1990s.

2. **BPO could work well in the cloud.** Once companies move to standardized SaaS applications, a natural next step may be to outsource the related business processes (e.g., human resources or contact center/customer support), especially if these processes are now considered less differentiated or "non-core."

The cloud also opens up entirely new business models that could drive BPO penetration higher. New offerings could resemble the "leveraged BPO" approach that many processors employ by wrapping customizable features

around a core "as a service" technology solution. The core could inexpensively address common industry or horizontal functionality, while the front-end wrap could enable customization to meet specific client requirements. In this manner, we think that IT services companies could use leveraged BPO to expand into new areas where business process outsourcing adoption is currently low.

We see the following possible positive developments for the BPO market:

- Cloud-based offerings could increase BPO adoption/penetration;
- Transaction-based pricing afforded by leveraged BPO solutions would break the linearity between headcount and revenues that puts a theoretical limit on revenue growth today;
- As new solutions reach scale, they also offer the prospect of higher, more processor-like operating margins; and
- Multi-tenant platforms allow almost infinite scalability, potentially opening up the small- and mid-sized market to the major services vendors for the first time in a meaningful way.

Among the possible negative developments, we think that increased automation and declining headcount associated with cloud-based solutions may reduce BPO's perceived returns from process improvement and wage-arbitrage.

3. **Applications development and systems integration are likely to benefit from new complexities and shorter project timelines in the cloud.** On-premise applications are often designed to be tightly joined to their underlying data, but as companies move toward "as a service" models, the integration architecture has to evolve to support a distributed/decoupled data layer to link offsite applications with onsite data stores or vice versa. Securely porting data to the cloud also creates added complexity that will require highly skilled and more experienced professionals to accomplish successfully, which we think is positive for both the overall demand and pricing levels that service providers will enjoy.

While cloud projects are more likely to be shorter engagements that generate less revenue per project, we expect a relatively faster adoption rate to more than offset this smaller size. In contrast with the long and complex sales cycles for ERP implementations, our channel checks confirm that the cloud increases the propensity for clients

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to undertake new projects. Once they have embraced the concept, clients perceive cloud-based projects to be lower risk because of their smaller size and lower up-front investments, which in turn reduces the number of required sign-offs and shortens the sales cycle.

The positives for the applications development/systems integration markets include:

- Shorter sales cycles and smaller implementation expenditures may lead to more projects, particularly if clients begin to re-platform legacy applications for the cloud that they would not have upgraded otherwise;
- Increased complexity requires more experienced, higher-priced resources;
- Faster project timelines may increase service providers' ability to move their best developers more quickly between clients; and
- Cloud computing does not fundamentally change any of the rigor or discipline involved in installing a software application (beyond the delivery model/economics).

The negatives we see include:

- Smaller/faster engagements are likely to result in less revenue per project; and
  - If service providers cannot sell enough new projects to offset the shorter engagement timelines, then revenue growth and utilization/margin levels could suffer.
4. **Application outsourcing will feel negligible effects from the cloud in the near term, and we think that the longer-term trade-offs are a net neutral.** Since most successful SaaS solutions target areas that are peripheral to core enterprise applications, we see limited impact on many existing application maintenance contracts. As the market gradually experiences more overlap between software as a service offerings and apps outsourcing, we expect a natural division of labor to evolve, creating an environment for SaaS developers to provide routine application-specific management tasks and for outsourcers to focus increasingly on client-specific activities that fall outside the purview of core software maintenance. Higher-value activities that we expect application outsourcing providers to retain include application configuration, performing regular data feeds, adding/removing users, and managing the impact of SaaS updates on downstream integration points and business processes, etc.

Positives for the applications outsourcing market include:

- SaaS solutions typically do not address the core systems that many applications outsourcing engagements support today; and
- The off-premise nature of the SaaS model is consistent with and reinforces client decisions to outsource their application maintenance responsibilities to an offshore services provider.

Negatives for the applications outsourcing market include:

- SaaS developers are likely to take on routine application upgrade and patch management activities for their own software, which will take away some potential work from applications outsourcers.
5. **Infrastructure outsourcing (ITO) faces the most challenging dynamics, and CSC's ability to gain traction with its new "as a service" offerings will therefore be critical to its success.** The primary benefits of IaaS/PaaS include its flexibility and ability to convert capital expenditures into scalable operating expenses. Meanwhile, ITO contracts are often multi-year arrangements that normally incorporate minimum volume commitments and require large up-front investments. Therefore, we believe that infrastructure outsourcers will feel increasing pressure to adapt to the flexibility and economics of "as a service" models over time.

In the near term, we think that the adoption of cloud computing will create headwinds for ITO bookings. To sign an outsourcing contract, we think that CIOs will feel compelled to have a clear understanding of their companies' IT strategies and future computing needs. However, the advent of server virtualization and cloud computing has the potential to materially alter the utilization of IT resources, which has profound implications for agreeing to minimum volume commitments or static multi-year ITO agreements. Our channel checks suggest that many CIOs are currently undertaking assessments and updating their IT strategies to help them get a handle on these potential changes, but we believe that it will be less likely for a CIO to enter into an ITO relationship before gaining comfort that these assessment/IT strategy activities are both rigorous and complete.

Over the long term, we think that IaaS/PaaS will enable new competitors to selectively enter the ITO space, including hardware, software and internet providers, telcos, and other services companies that have traditionally shied away from making the large asset purchases that are often associated with ITO. While existing client

relationships, vertical/domain expertise, and the ability to manage end-to-end infrastructure solutions that span the range of on-premise to private/public/hybrid clouds will give many existing outsourcers a natural advantage, increasing competition often leads to pricing compression and market fragmentation. Therefore, we think that the ITO industry will face ongoing revenue and margin headwinds if IaaS/PaaS adoption continues to increase.

The positives we see for the infrastructure outsourcing market include:

- Existing client relationships and vertical/domain expertise of many outsourcers position them to participate in up-front technology assessments/IT strategy projects and to defend their incumbent positions;
- Outsourcers are more capable of managing end-to-end solutions that encompass both on-premise as well as public/private/hybrid cloud components; and
- Given the long-term nature of most ITO arrangements, the outsourcers are often deeply entrenched in their clients.

The negatives we see for the infrastructure outsourcing market include:

- In the near term, we think that ITO bookings will face headwinds as CIOs work to crystallize their cloud strategies;
- IaaS/PaaS will enable new competitors to selectively enter the ITO space, which could create on-going revenue and margin headwinds; and
- Infrastructure outsourcers are likely to feel increasing pressure to adapt to the flexibility and economics of “as a service” models over time.

#### Early Movers in India Vendors Likely Beneficiaries

India IT vendors are using cloud computing to expand service offerings and increase presence in small- and medium-sized businesses. Among the large India IT vendors that we see as likely beneficiaries of an early mover advantage are Infosys, TCS, and Wipro.

TCS has launched a subscription-based cloud service for small and medium businesses. It currently has more than 150 customers and looks to achieve revenues of \$1 billion within five years; the company plans to sign up about 1,000 customers in the first year itself. TCS estimates that in India total small- and medium-sized business spending on IT could

be about \$12 billion in 2010 and expects this number to grow five-fold, to about \$49 billion by 2015. TCS, with about 10% of revenues from the India IT market, is using the cloud model to expand its presence among the emerging businesses in the country. If the model is successful in the domestic market, we expect TCS to launch the offerings for the international market as well.

#### IT as a service to small- and medium-sized businesses.

TCS charges an initial sign-up fee and monthly subscription fees, which can be either a fixed amount or a fixed percentage of clients' revenues. TCS owns the applications and infrastructure and clients pay only for the usage of the services. The company plans to offer the solutions across industry verticals and currently offers a 24/7 helpline for its clients.

#### Cloud computing initiatives should help move to non-linear revenue models.

Today, India IT vendors are providing services that encompass all cloud computing platform providers, like Microsoft, Amazon, Google, and Salesforce.com. The vendors deliver these solutions as a service and through a variety of new revenue models, like pay-per-use, outcome-based pricing, or service-level agreements. These initiatives could help improve the revenue per employee for the IT services vendors and at the same time enable them to retain any productivity benefits on the projects. Currently, non-linear revenues accounts for only about 8% of revenues for large IT companies. Over the next five to seven years, though, large IT companies expect them to account for as much as 30-35% of revenues.

For its non-linear revenue initiatives (to keep upfront investments productive), Infosys prefers to develop platforms for clients with existing needs. The company also holds platform roll-outs until clients have been won for its existing platforms in a given segment.

Wipro offers cloud-computing services via the Internet, either as SaaS or IaaS. In this way clients can order and pay for services based on need, without making any fixed investment. Wipro provides a SaaS model for various business applications on a pay-per-use model; these applications are either developed/owned by Wipro or are partner-owned.

#### Japanese IT Services Companies May Suffer Longer Term

In March 2009, we argued that the spread of cloud computing presented more risk than opportunity for Japanese companies. Our view is unchanged two years on. Here are the reasons for our concerns:

- Since the primary objective for many Japanese client companies in introducing cloud computing is to cut costs, the existing market (for individual pieces of hardware and services) is likely to shrink;
- Most Japanese IT services companies specialize in the domestic market and the difficulty of securing scale dampens their competitiveness; and
- In the age of cloud computing, we would expect clients to prefer to do business with highly competitive service vendors with a global reach.

Nevertheless, the Japanese IT market has a strong tendency to lag the US market in development, and we think it will be

two to three years before cloud computing starts to take off there in earnest. The question of what approach to take until then is a critical one for all IT service companies.

Steps that Japanese firms can take to improve their standing are: 1) accelerate globalization, 2) concentrate on core systems unlikely to be implicated in cloud computing, and 3) bolster the ability to introduce and support key technologies from overseas.

Based on these measures, we think some of the better-positioned candidates according to the attributes mentioned above are: 1) Fujitsu and NTT Data; 2) NS Solutions and Nomura Research Institute; and 3) Otsuka Corporation, Oracle Japan, and Itochu Techno-Solutions.

Cloud Computing  
**Cloud Computing Primer**

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Cloud Computing Takes Off

# Cloud Computing Primer

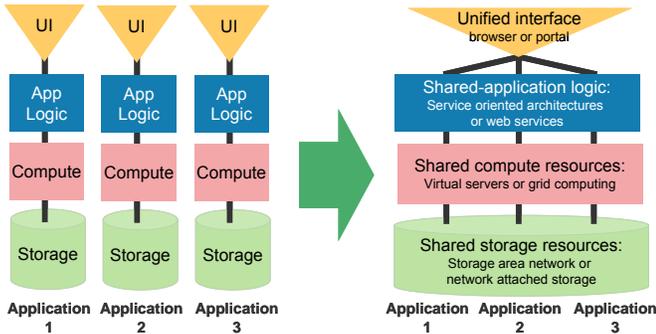
## What Is Cloud Computing?

Over the past five years, most companies in the technology space have come to incorporate some element of a “cloud story” into their product strategy and marketing. During that period, the definition of cloud computing has been stretched and pulled to cover a wide swath of technologies, delivery models, and pricing mechanisms. Before analyzing the effects of the movement of workloads to cloud environments, we thought it necessary to define what we call “cloud computing.” Conceptually, the National Institute of Standards and Technology (NIST) defines cloud computing as:

“A model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.”

(For source information, visit the NIST website at <http://csrc.nist.gov/groups/SNS/cloud-computing/>.)

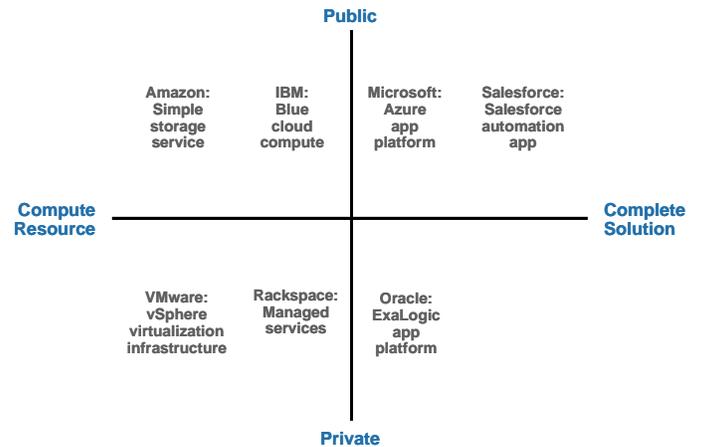
Exhibit 69  
**Evolving to a Shared-Capacity Compute Paradigm**



Source: Morgan Stanley Research

To apply this cloud computing definition practically to the solutions we see in the marketplace, one needs to add two dimensions to the definition. First, service level — what is the range of computing resources being made available, or what is the completeness of the solution being offered; and second, the deployment model — what is the model by which these shared resources are being made available to the end user. In this study we look at two deployment models: 1) private clouds, which are operated for a specific organization but may reside either within their own data centers or be hosted by a third party (managed hosting), and 2) public clouds, where the given services are generally available to the public and hosted externally from the end-customer.

Exhibit 70  
**Broad Spectrum of Technologies and Deployment Models under the Cloud Banner**



Source: Morgan Stanley Research

Some of the key characteristic that this cloud computing model should embody include:

- **Resource pooling.** Cloud computing generally makes use of various software functionalities or architectures to aggregate multiple underlying compute resources into a single pool that can be easily provisioned and expanded. Within public cloud environments, this is often achieved using a multi-tenant architecture, where multiple users leverage a common application that spans multiple servers and data is logically segregated behind the application. In private cloud environments server virtualization or grid computing software are common technologies for resource pooling.
- **Rapid elasticity.** The compute capabilities within cloud computing environments can be rapidly provisioned and scaled to all sizes of workloads. For example, within a public cloud environment this means a single application like SuccessFactors can be quickly provisioned to either 10 users in a small business or 500,000 users at Siemens. In a private cloud, a risk arbitrage application can take over additional compute resources overnight to run complex calculations, then scale back by morning to allow other workloads to run.
- **Broad network access.** Cloud computing resources are easily available over either public networks (internet) or private networks (WAN or LAN). This ubiquitous network access also makes it easier to utilize non-traditional

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compute devices (tablets, smartphones) to access these computing resources.

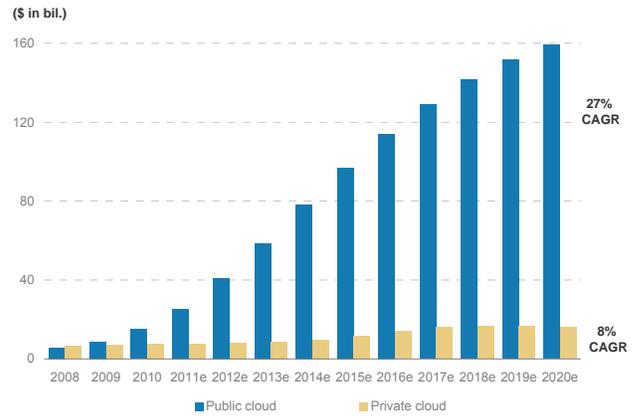
- **Measured service.** The ability to measure the amount of cloud service being used is critical to both optimizing cloud computing environments and enabling the pay-for-use models often found in cloud business models.

**Expanding spectrum of service levels.** The delineations of service level are most distinct in the public cloud environment. Over the past several years, a spectrum of offerings has emerged for moving compute workloads out of a company's data center, ranging from:

- **Infrastructure as a Service (IaaS).** Infrastructure service can be thought of as pools of basic resources, such as compute power and storage, that are delivered as a service over the internet. An example would be Amazon's Enterprise Compute Cloud (EC2).
- **Platform as a Service (PaaS)** are on-demand development platforms on which to build new application functionality. PaaS is targeted at developers and simplifies the application development and deployment process. Examples of PaaS are Microsoft's Azure, Salesforce's Force.com, and Google's AppEngine.
- **Software as a Service (SaaS)** delivers complete, functional applications as a service over the internet. Examples are Salesforce.com Sales Force Automation applications, SuccessFactors' performance management applications, Taleo talent management applications, Citrix's Online for Collaboration and web conferencing, and office productivity applications like Zoho, Google Apps.

Forrester Research projects that these three segments will drive total public cloud revenues from \$15 billion in 2010 to nearly \$160 billion in 2020, which would represent 27% annualized growth. SaaS represents the majority of these revenues and should grow from \$13 billion today to \$133 billion in 2020, for annualized growth of 26%. In contrast, Forrester expects total revenues from the private cloud to grow from \$8 billion today to only \$16 billion in 2020, representing an 8% annualized growth rate.

Exhibit 71  
**Forrester Expects Public Cloud (SaaS/PaaS/IaaS) to Reach Nearly \$160 Billion by 2020**

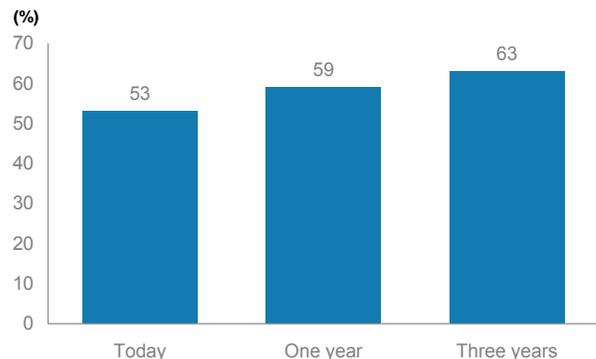


e=Forrester estimates.  
 Source: Forrester Research

## Drivers of the Migration to Cloud Computing

**Back to the future.** Expensive hardware and limited connectivity spurred a move towards more distributed computing systems over the past 20 years — but now the commoditization of hardware and expansive connectivity offered by the internet and mobile computing have mitigated those concerns. Today the high cost of implementing, running, and managing those distributed systems is the high priority issue for IT managers. As a result, the pendulum has begun swinging the other way, towards more consolidated computing environments — but this time by sharing pooled resources of commodity hardware — whether in your own data center (private clouds) or hosted by a third party (public clouds).

Exhibit 72  
**Cloud Expected to Drive Average Server Utilization 1,000bps Higher Over the Next Three Years**



e=Morgan Stanley Research estimates.  
 Source: AlphaWise<sup>SM</sup>, April 2011 survey; Morgan Stanley Research

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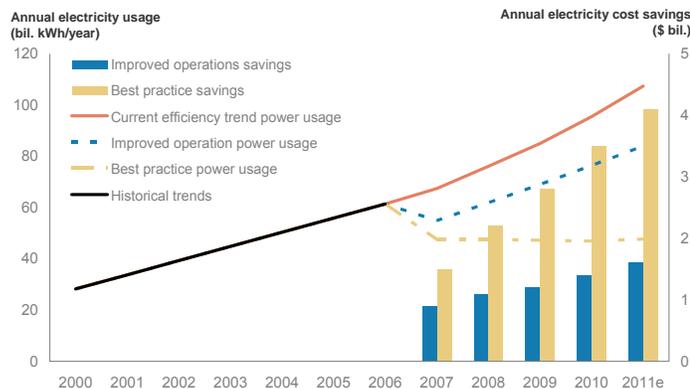
We believe IT managers will increasingly look to new shared computing models to:

- **Reduce hardware costs.** Increasing utilization rates means lower capex spending on the underlying hardware. Reduced hardware costs was the number one benefit (57% of respondents) cited in a recent government survey of 605 federal IT managers on cloud computing – increased flexibility in provisioning services was number four with 33% of respondents.
- **Reduce power, cooling, and space costs.** IT managers expect to reduce these costs by running either higher utilization rates on fewer servers within their own data centers or pushing out workloads to utilize third- party external clouds.
- **Reduce management costs.** Consolidating workloads onto fewer boxes and a homogeneous operating environment (e.g., hypervisor layer) reduce the complexity of the physical infrastructure and should help reduce costs of management.
- **Increase flexibility.** Shared resource pools increase the flexibility for IT managers in terms of where to run workloads, enabling more dynamic compute environments. Additionally, public cloud environments greatly reduce time to market for new application workloads.
- **Better response to workloads.** With their rise in popularity, mobile, web-based, and on-demand applications are seeing larger user bases—in turn resulting in bigger peaks and valleys of workloads. Flexibility to manage these loads optimally without over-provisioning is critical.

**Attractive economics causes IT dollars to migrate to the cloud.** A recent white paper from Microsoft highlights three key economic drivers that are likely to accelerate cloud computing adoption. These include:

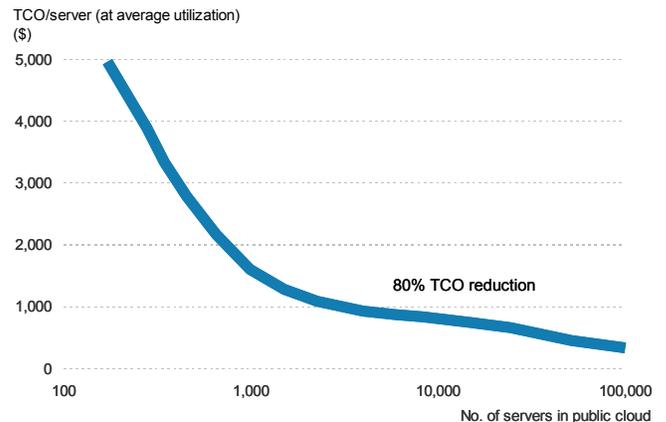
- A significant improvement in supply-side economies of scale as the cost of each additional server is amortized across a larger user base;
- Improved demand-side economics as the aggregation of multiple-user workloads creates lower utilization variability and allows for greater demand management; and;
- Economies of scale derived from the amortization of administrative and run-time costs across multiple customers. The exhibit shows that a 100K-server datacenter can have an 80% lower total cost of ownership (TCO) compared with a 1K-server datacenter.

Exhibit 73  
**Efficiency Measures Can Drive More Than \$4 Billion in Annual Savings in US Alone**



e=US EPA estimates.  
 Source: US EPA, Report to Congress on Server and Data Center Energy Efficiency, August 2007.

Exhibit 74  
**Microsoft: 100-Server Data Center Has 80% Lower Total Cost of Ownership vs. 1K-Server Data Center**



Source: Microsoft

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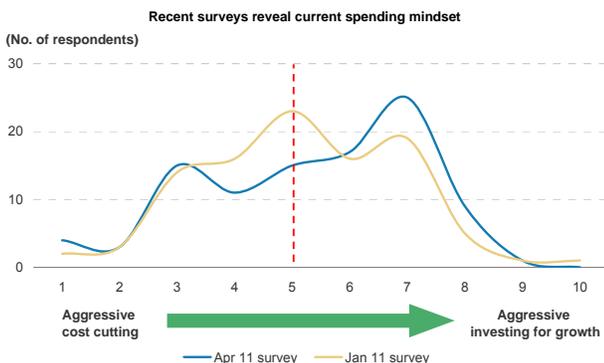
## Macro Drivers of Move to the Cloud

Besides the operational efficiencies that IT managers look to accrue from moving towards cloud computing, we would highlight several macro drivers.

- Consumerization of the enterprise.** For years, the quality of home-based computing has been evolving at a faster pace than that of enterprise computing, and cloud-based connectivity has become so pervasive that enterprises are finally being forced to play catch-up. Bottom line, employees are expecting the application services provided at the office to be as effective and efficient as what they are using at home.
- Wireless device adoption.** Smartphone and tablet adoption has empowered consumers to expect (and demand) high-speed wireless connectivity and cloud-based application services consumable on these devices. The iPad in particular has catalyzed a top-down demand driver for connectivity in enterprise business systems, and we believe cloud computing offers IT managers the flexibility to work with the plethora of devices coming into the workplace.
- Application cycle.** After the very weak IT spending environment of 2008-09, enterprises have become more aggressive in their spending on IT for growth. As enterprises look to further automate business processes and derive more actionable information from the vast amounts of data being collected by existing systems, we believe the industry stands at the beginning of a strong application cycle. Cloud computing environments will likely be the primary beneficiary of business users and IT managers looking to source, develop, or deploy this new application functionality.

Exhibit 75

### Shift toward Investing for Growth Should Disproportionately Benefit Cloud Computing



Source: Morgan Stanley Research, April 2011 CIO Survey

## The Consumerization of the Enterprise

Since cloud computing environments enable greater collaboration, integration, and flexibility than traditional on-premise applications, enterprises have more options for the ways that they interact with their customers. At the same time, since customers now engage with enterprises through the same medium that they use to access consumer applications in their personal lives, there has been a growing expectation that enterprises be able to offer experiences similar to those of consumer-based services.

### Enterprise Apps More Like Consumer Apps

The growing use of consumer applications is setting the bar for user expectations and driving the evaluation of enterprise applications in the cloud; the rise of social networks in particular is creating demand for increased collaboration and communication capabilities. From the perspective of an application provider, the gains derived from having more consumer-like interfaces and functionality are better access to customers showing the most usage, broader markets, and potentially larger revenue opportunities.

### Dynamic User Interfaces (UIs) Expand User Bases

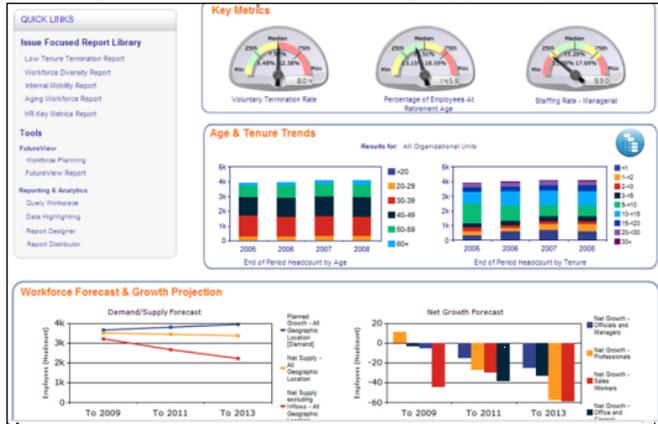
Successful consumer applications are distinguished by their dynamic, visually appealing, and intuitive user interfaces, bringing them mass-market appeal and allowing for broad-based user adoption. Over the past few years, enterprise-focused SaaS providers have recognized the success of the consumer applications' UI model and have spearheaded the migration of enterprise apps to more dynamic and consumer-like interfaces.

Enterprise apps, such as SuccessFactors' recently acquired analytics platform from Inform, generally have UIs that are reminiscent of popular consumer apps, with the idea that enhanced familiarity and ease-of-use help to facilitate faster uptake of products, broader distribution, and application accessibility to a greater number of users across the enterprise.

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Exhibit 76

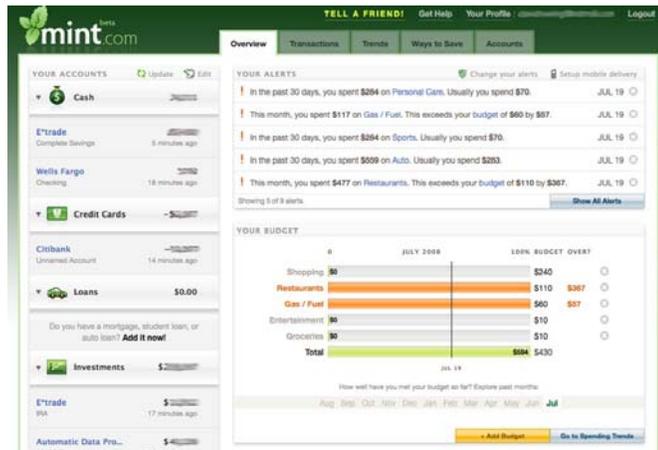
**UIs for SaaS-based Apps Like SFSF Analytics (Inform) are Intuitive and Visually Appealing...**



Source: SuccessFactors

Exhibit 77

**...Much Like Popular Consumer Apps Such as Intuit's Mint.com**



Source: Intuit Mint.com

**Increasingly, Enterprises Engage Customers Through Consumer-Based Technologies**

While enterprise apps are moving closer in appearance and functionality to consumer applications, enterprises are also increasingly using consumer-based technologies to deepen their customer interactions. Enterprises are striving to engage with their customers through more interactive websites – including video content and user-targeted banners – and by going directly to the websites that consumers use the most, such as Twitter and YouTube. A growing number of corporations have established fan pages and Twitter IDs, where customers can learn about and discuss new products, services, and company initiatives, and where they can provide real-time user feedback. This trend has opened a more direct line of communication between companies and their

customers, while product differentiation accelerates. Salesforce.com’s service cloud is a clear example of real-time, web-based collaboration changing the paradigm for customer service.

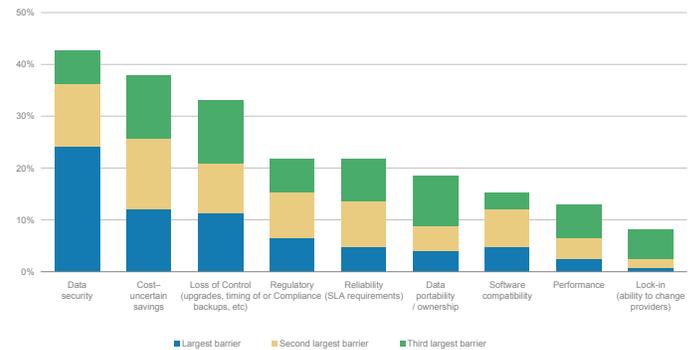
**Cloud Challenges**

While a broad range of concerns still exist in the marketplace for enterprises contemplating moving workloads to cloud environments, three key challenges have emerged in our survey work and conversations with industry participants: 1) security; 2) uncertain cost benefits; and 3) integration challenges.

**Securing the cloud.** For the move to the public cloud, ensuring the security of sensitive information moving out of a company’s own environment into a third-party’s data center consistently ranks at the top of the list of cloud challenges. Within our survey, data security was the cited as the biggest obstacle to moving towards the cloud by 24% of respondents, twice as many as the next largest challenge — uncertain cost benefits, at 12%. Overall, 43% of respondents cited data security as one of the top three barriers to cloud adoption. The security issue is made more complex by the interplay of both actual information security concerns (“Will my information be stolen?”) with regulatory concerns (“How will I show my auditors my data is secure?”).

Exhibit 78

**Data Security a Top Three Barrier to Moving to the Cloud for 43% of Those Surveyed**



Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

Within more mature segments of the public cloud market (like SaaS), larger vendors have gained a certain level of trust in the security of their data centers. The security spending by Salesforce.com to secure their Sales Force Automation applications far outstrips what all but their largest customers spend to secure their entire environments. Additionally, these larger SaaS vendors are able to attain regulatory security

certifications such as ISO 27001/2 or SAS 70, which small and mid-sized companies would be unlikely to attain on their own.

So, what are people afraid of? The worst security issues in technology have traditionally come from unknown avenues; with the deployment of new architectures, the concern comes from what we do not yet know about these very dynamic environments. Multi-tenant and shared public cloud architectures represent new potential threat vectors for malicious activity, and server virtualization brings down some of the physical barriers between workloads, which may enable the spread of malicious code from one virtual machine to the next. While technologies such as advanced authentication and provisioning, virtual firewalls and IPS, and encryption can help extend the existing security policies and practices into the cloud environment, the larger risk is likely threats that have yet to emerge or be countered.

Intimately tied to the information security challenge is the regulatory challenge. Compliance and regulatory concerns ranked fourth in our survey, with 22% of IT managers citing it as a top-three obstacle to cloud deployments – although this was a significantly higher concern for enterprises (26%) than small- and medium-sized businesses (16%). (Stricter data regulations are often cited for Europe's relative lag in cloud adoption relative to the US and the Asia-Pacific region.)

A major concern of many compliance regimes is the ability to track changes in systems and maintain strict controls over data. This is especially difficult to achieve, however, within the dynamic cloud architecture environment. Longer-term, increasing demand for cloud computing is likely to drive resolution of these issues, in our view, through closer cooperation between the regulatory bodies and the cloud vendors.

**Uncertain cost benefits.** The ability to both cut capex costs upfront, plus realize the promise of lower operating expenses over time, is core to the customer value proposition for cloud computing. However, in our survey 38% of respondents cited "uncertain cost benefits" as the second most troubling obstacle for moving workloads to the cloud. Interestingly, the dynamic between larger enterprise customers and small- and medium-sized businesses was the mirror image of security, with 45% of the latter citing uncertain cost savings versus just 33% of enterprises.

Just what is it that these companies are uncertain about? While the upfront capex savings are easy to see, cloud computing models very often utilize pay-as-you-go subscription pricing. SaaS-based applications often price on a per-user basis, while PaaS and IaaS pricing can be much more complex – based on CPU cycles, network traffic, and storage volumes. In short, companies' lack of knowledge about the utilization characteristics of the application workloads that they are moving to the cloud creates a good deal of uncertainty about the cloud's cost profile.

**Integration challenges.** Many IT managers remember the creation of islands of information on new x86 base computing stacks during the migration to distributed client-server computing in the 1990 — and the subsequent expense of integrating all that information. The experience stands as a cautionary tale for new compute architectures and delivery models. The lack of industry standards across the various cloud computing vendors and types makes the potential threat of creating new islands of information (this time in third-party data centers) very real.

IT research organization The 451 Group projects a \$100 million market today for the broader platform management space, which includes the integration of cloud computing environments as a service. The group expects the market to grow at a CAGR of 68% to reach nearly \$400 million over the next three years. Customers realize that these dollars are adding to the overall expense of the cloud. Thus, challenges from integration are leading to a strong push from within the industry for more open standards around cloud-computing interfaces and a desire from customers to see vendors provide a broader suite of offerings on one cloud platform. In our view, these challenges are likely to benefit the larger vendors in the space.

The above represents some of the most-often-cited challenges to the adoption of cloud computing, but by no means all. Reliability and the ability to meet service level agreements was cited as the number-one obstacle to moving workloads to a cloud environment by just 7% of respondents in our survey. However, the recent major outage of Amazon's web services platform, bringing down popular web sites such as Yelp and Four Square, may bring performance concerns to the forefront again.

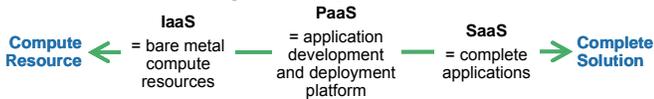
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## The Spectrum of Public Cloud Solutions: SaaS, PaaS, IaaS

Public cloud delivers computing services from an external provider to the end-user over the internet. The services delivered range from simple compute resources, like storage space available via Amazon's Simple Storage Service, to complete complex application suites, like NetSuite's OneWorld. It is the shared (multi-tenant) architecture of the vendors' compute resources and broad network access that differentiates today's cloud computing solutions from application service providers (ASPs) or service bureaus seen in prior generations of outsourced computing models. While there have been a plethora of solution types described along this service level spectrum, we focus on the three most prevalent: 1) software as a service (SaaS), 2) platform as a service (PaaS); and 3) infrastructure as a service (IaaS).

Exhibit 79

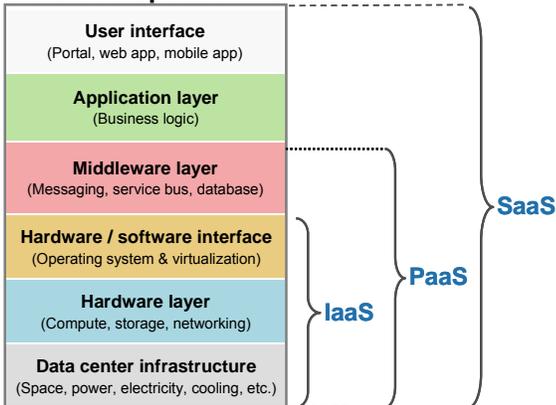
### Public Cloud Spectrum: Simple Compute Resources to Complete Applications



Source: Morgan Stanley Research

Exhibit 80

### Public Cloud Spectrum: Stack View



Source: Morgan Stanley Research

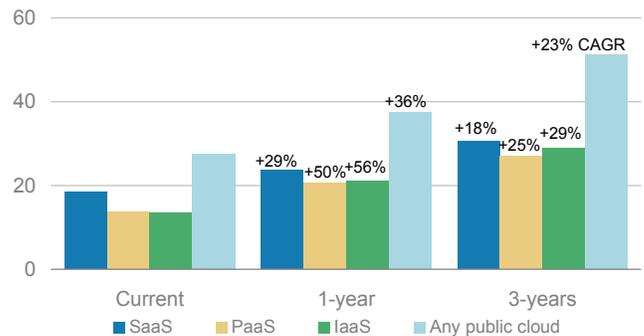
**Public cloud likely to see continued strong adoption.** Our survey of over 300 IT managers suggests strong adoption of public cloud computing over the next three years. Based on the responses, the number of IT managers' who expect to adopt public cloud solutions in either a SaaS, PaaS, or IaaS environment will grow at a CAGR of more than 23% over the next three years, from 28% of companies today to 51%. SaaS is the most popular cloud environment, used by 18% of our

survey respondents today, with IaaS used by 13% and PaaS by 14%. Over the next three years, we expect the adoption rate for IaaS and PaaS to be faster than that for SaaS, with a CAGR of 29% for IaaS and of 25% for PaaS. Thus the adoption gap with SaaS will close somewhat, with an expected growth rate of company adoption for SaaS coming in at a robust 18%.

Exhibit 81

### Customer Adoption of Public Cloud Solutions Expected to Grow Rapidly over Next Three Years...

Respondents using the public cloud (%)

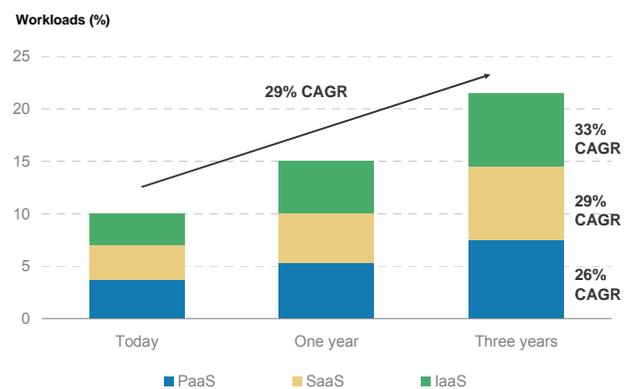


Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

We expect the total number of workloads migrating to public cloud environments to rise even more quickly, at a 29% CAGR, from 10% of workloads today to 22% in the next three years, and we expect that all the public cloud environments will see workload growth of more than 25% during the same time.

Exhibit 82

### ...Number of Workloads Migrating to Public Cloud Expected to Grow Even More Rapidly



Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

## SaaS: Applications in the Cloud

Software as a service, or SaaS, is the delivery of complete applications from a third-party data center over the Internet. Where SaaS differs from older outsourced or application service provider (ASP) models is in the architecture of the applications being delivered.

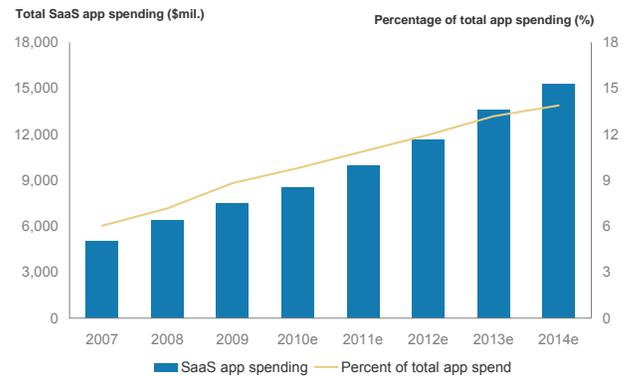
SaaS applications are built to be shared by multiple users simultaneously, an architecture known as multi-tenancy, versus an ASP model, where the same applications built for on-premise use is hosted and managed by a third party for a single customers. With the application functionality being delivered as a service, most SaaS-based application models have adopted subscription-based pricing models. The combination of virtually no capex or requirements, plus the lower-risk, subscription-based pricing model, has enabled SaaS vendors to sell much more effectively to business users (versus IT), helping to catalyze the rapid penetration of SaaS-based applications. SaaS is by far the most mature of the public cloud environments, with research firm Gartner estimating a market of about \$9 billion today.

### App Spending Continues to Migrate to SaaS

We believe that applications delivered as a service will remain one of the fastest-growing areas of software over the next three to five years. Applications as a whole have seen increased investment as CIOs refocus on revenue-generating activities; SaaS applications continue to gain share against traditional on-premise solutions as organizations look to speed up deployment times and reduce the up-front implementation and long-term overhead costs associated with traditional applications. However, we also think that some applications are more likely than others to make the move to the cloud. Applications that are fairly standard across organizations, like e-mail and sales force automation, are easier to move into the cloud than applications that require a lot of customization and integration with other applications, like supply chain management. As a result, we expect certain areas of the SaaS market to see a greater growth rate and more adoption than others.

Exhibit 83

### SaaS App Spending 9% of 2009 Total, May Hit 14% in 2014



e=Gartner estimates.

Source: Gartner, Morgan Stanley Research

### Multi-Tenant vs. Single-Tenant Architecture

One of the key value propositions of the SaaS, multi-tenant, model is that it allows multiple users to share underlying resources and infrastructure. While customer data is usually held in a shared database, each “tenant” maintains its own application instance walled-off from others around it. This allows the provider to pool its total resources and allocate or balance them as needed by each of the underlying tenants, effectively increasing overall utilization. While this model does offer significant benefits, ranging from easier provisioning of new users to improved resource utilization, it does have some limitations when compared with single-tenant architecture, where each customer has a separate database and a dedicated technology stack that can have customer configurations, though at a higher cost. In this way, single-tenant architecture is actually quite similar to a managed-hosting environment in terms of the benefits a customer can derive.

### SaaS versus On-Premise Applications

Traditional client/server applications are designed for deployment within an organization’s own data center (on premise) and run within an organization’s firewall. Deploying an application on premise typically requires a good deal of up-front consulting and implementation work, which can cost four to five times as much as the application license itself and take months, if not years, to complete. The organization is also responsible for purchasing the underlying hardware and infrastructure software supporting the new application; the purchaser also must manage the application once it is

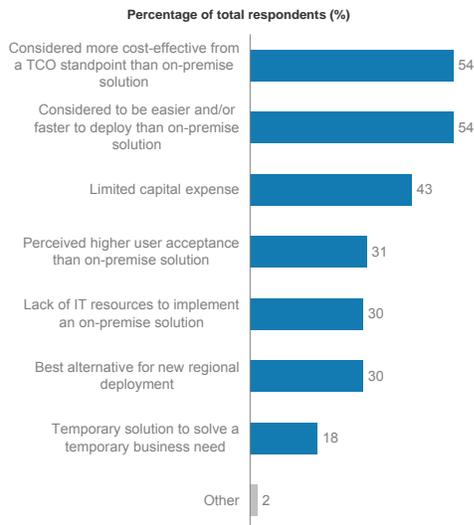
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deployed. This management includes applying regular patches and updates, tracking down the source of performance problems, and making customizations to the software as needed, adding to the operational overhead associated with the application. Most on-premise applications are sold via a one-time up-front license sale, plus an annual maintenance fee for support services, which normally runs 18-23% of the initial license fee.

With SaaS, by the software provider hosts the application externally and delivers it over the Internet. The supporting infrastructure (and the associated cost) is shared across all users of the service. The software provider usually charges customers on a subscription basis, rather than requiring a large up-front fee. This approach offers a number of benefits. First, by delivering the software over the Internet and charging for it on a subscription basis, SaaS providers reduce much of the up-front cost associated with a new software implementation. Second, the SaaS provider is responsible for maintaining the software, which further reduces the ownership costs for the customer. Third, Internet-based delivery shortens deployment times by eliminating the need to install the system on premise. And finally, SaaS deployments make it easy to scale up the number of users in a short period of time as the supporting infrastructure is already in place at the host's site.

We believe these benefits are helping SaaS to take share from traditional on-premise deployments and tap into new opportunities in the small- and medium-business space. Traditional on-premise vendors often cannot make the most of these opportunities because of the high costs and level of complexity associated with traditional solutions.

Exhibit 84  
**SaaS Apps Offer Major Benefits Over On-Premise**



Source: Gartner, Morgan Stanley Research

**Mobile Devices Favor Internet-Based Delivery**

While many drivers of SaaS are generally understood (like lower cost of ownership and limited up-front costs), we believe the adoption of tablet-devices in the enterprise is a new emerging driver for SaaS adoption. The iPad paved the way, with the popularity of the new devices causing IT managers to consider how the iPad or other tablet devices could be incorporated into the enterprise IT environment.

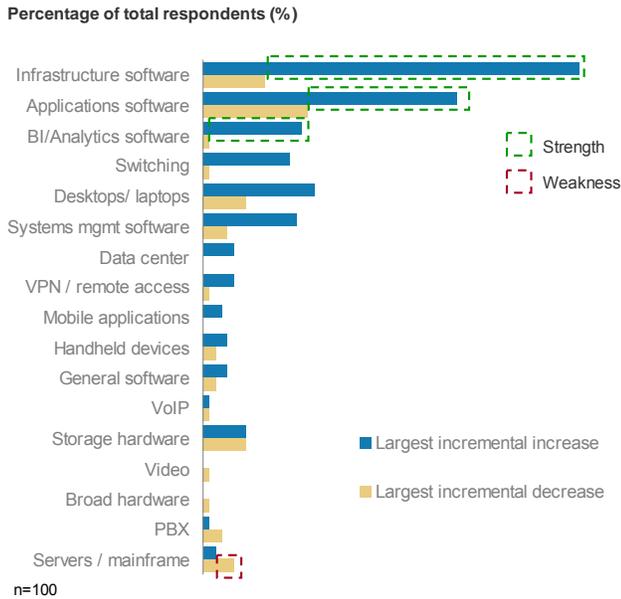
Gartner recently surveyed a number of CIOs and discovered that 85% have been getting requests to support the iPhone, iPod, or iPad within the corporate environment. Only 15% are supporting iPads today, but this number is expected to move materially higher over the next few years. We believe this trend is significant for two reasons. First, the growth of iPads or other tablet devices in the enterprise means that more users will want to access their applications from those devices. Second, because the early leaders in the tablet market are non-Windows devices, installing Windows-based enterprise applications directly onto an iPad or Android device will not be an option. While there are a variety of ways to access enterprise applications on an iPad—Citrix Receiver, for one—we believe the easiest is method to allow users to access those applications via their browser, a trend that favors SaaS.

**App Spend, SaaS Remain Top Spending Priorities**

We think that we are at the cusp of a multi-year application spending cycle, which should benefit providers of both on-premise and hosted application functionality. Many large IT projects were put on hold in 2008 and 2009 as overall budgets came under pressure, but we believe that these projects started to move forward again in 2010 as companies started to re-invest in growth initiatives. As the same time, client/server systems that were put in place at the turn of the millennium are starting to show signs of age and lack many of the bells and whistles in terms of usability that employees have come to expect from consumer-oriented applications like Facebook. As a result, we think that many organizations are looking to refresh their applications over the next few years. This belief is supported by Morgan Stanley's January 2011 CIO survey, which shows applications as a top spending priority for 2011.

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Exhibit 85  
**52% of CIOs Expect Apps to See Largest Spending Increase in 2011**



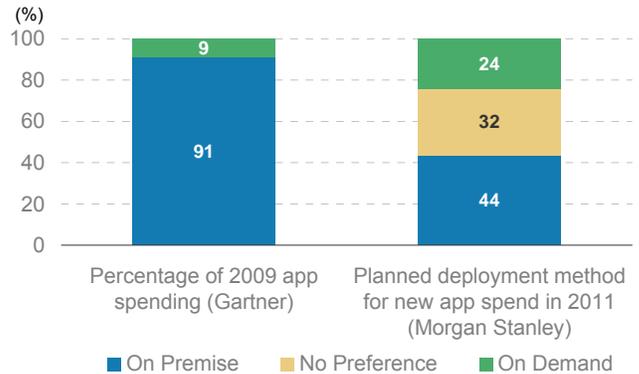
Source: Morgan Stanley, January 2011 CIO Survey

**SaaS Gaining Share, With More Room to Grow**

We expect an uptick in application spending to benefit both on-premise and SaaS application providers, but we also see an ongoing migration away from on premise applications to SaaS. Gartner estimates that spending on SaaS applications accounted for only 9% of application spending in 2009, while our own CIO survey shows 24% of CIOs preferring SaaS for new applications, and 32% have no preference between SaaS or on premise.

We believe the growth rate for SaaS spending will continue to outpace the growth of application spending overall as enterprises choose SaaS deployment models for new application functionality. SaaS also gives apps vendors access to market segments that have offered them only limited opportunities in the past—such as the small- and medium-sized business market—because of limited financial means and narrow IT expertise. This new access will also help to boost application spending overall.

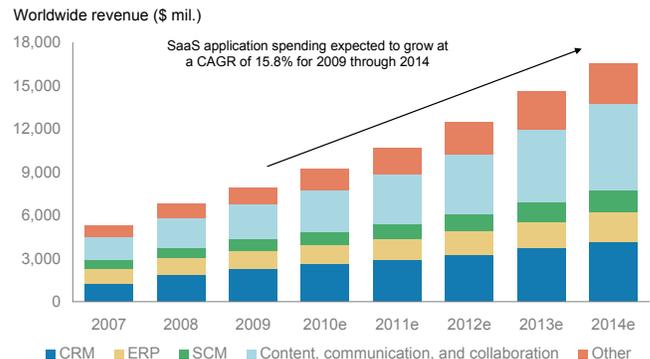
Exhibit 86  
**SaaS Gaining Share vs. Traditional On-Premise Apps, with Room to Grow**



Source: Gartner, Morgan Stanley Research

As a result, SaaS applications are expected to see some of the strongest secular growth in technology over the next three to five years, with Gartner estimating that spending on SaaS applications will grow at a five-year CAGR of 15.8% for 2009-14. Within that time frame, Gartner anticipates the fastest growth in areas like customer relationship management (automation for sales force, customer support, and marketing) and content, communication, and collaboration (e-mail, e-learning, social apps, and team collaboration). On the flip side, enterprise resource planning (software for enterprise asset management, manufacturing and operations) and supply chain management (planning for supply chain and service parts) are expected to exhibit slower rates of growth, although certain areas within enterprise resource planning, like human capital management, are expected to show solid growth as well.

Exhibit 87  
**SaaS Expected to Show Some of the Fastest Secular Growth in Technology...**



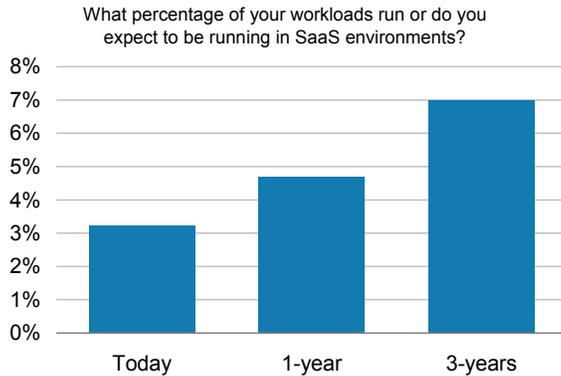
e= Gartner estimates  
Source: Gartner, Morgan Stanley Research estimates

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Exhibit 88

### ...While our Survey Indicates a 29% CAGR in SaaS Workloads Over the Next Three Years

Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

### SaaS Moving from Niche to Mainstream

SaaS has shown dramatic growth over the past three years, with spending on SaaS apps expected to grow at a CAGR of 16% from 2009-14. While we expect strong growth to continue, we also anticipate growing competition between vendors as leaders in point solutions look to expand their total addressable market and move into adjacent market opportunities. We expect to see an increased focus on suite offerings over the next three to five years, with the companies that are best able to bridge the gap from point to suite solution showing the greatest momentum going forward.

We see certain vendors such as SuccessFactors, IntraLinks, and Salesforce.com as well positioned to benefit from the ongoing shift of applications online. Other vendors, like NetSuite and DemandTec may be more challenged due to smaller addressable market opportunities or exposure to markets that have shown reluctance to move to SaaS. We

also anticipate ongoing investments back into distribution, sales, and R&D, which, while they may put pressure on margins and cash flow in the near-term, are also likely to yield dividends over time as today's costly, new-customer wins become tomorrow's highly profitable renewal customer base. As a result, while valuations for some of the fastest-growth companies may look steep today, in some cases those valuations will likely look fair in hindsight as the business matures and after years of strong growth and regular improvements in profitability. The key to stock performance will be ongoing "beat and raise" quarters, with numbers moving steadily higher—movement that should support premium valuations.

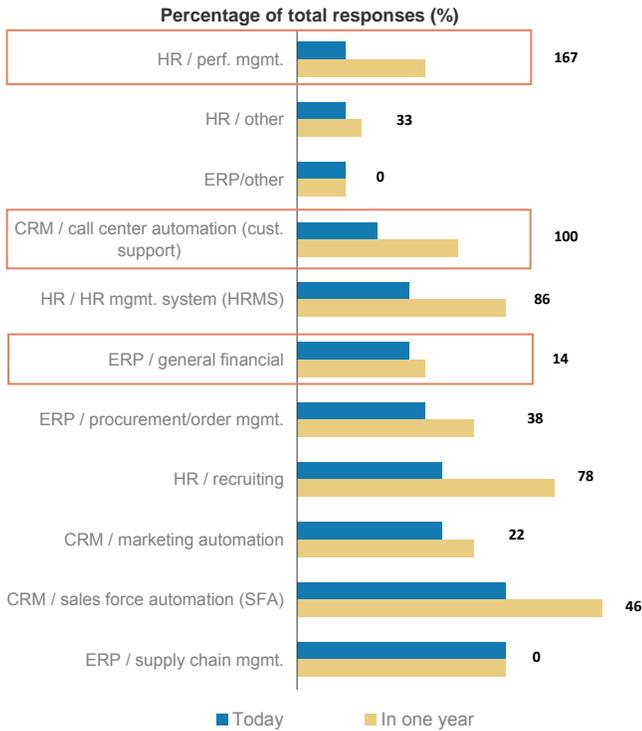
### Not All End-Markets Are Created Equal

We see some applications sub-markets as offering greater prospects for growth than others, a view that is supported by Morgan Stanley's April 2011 CIO Survey. When asked which types of applications they got via a SaaS provider today and what they expect to get via a SaaS model one year from now, respondents demonstrated strong interest in areas like call center automation and performance management, while general financials and other enterprise resource planning showed more modest demand. While the market has tended to view SaaS as a comprehensive group benefitting from a strong trend, we expect to see increasing differentiation between the companies in the most attractive markets, like SuccessFactors and Taleo in performance management, Salesforce.com and RightNow Technologies in call center automation, and vendors in more challenging markets like NetSuite and DemandTec. We believe that certain markets are better suited to SaaS than others, given differing customer needs, and we expect the differences in growth rates to persist over time.

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Exhibit 89

**Performance Management and Call Center Automation Have Most Room for Upside**

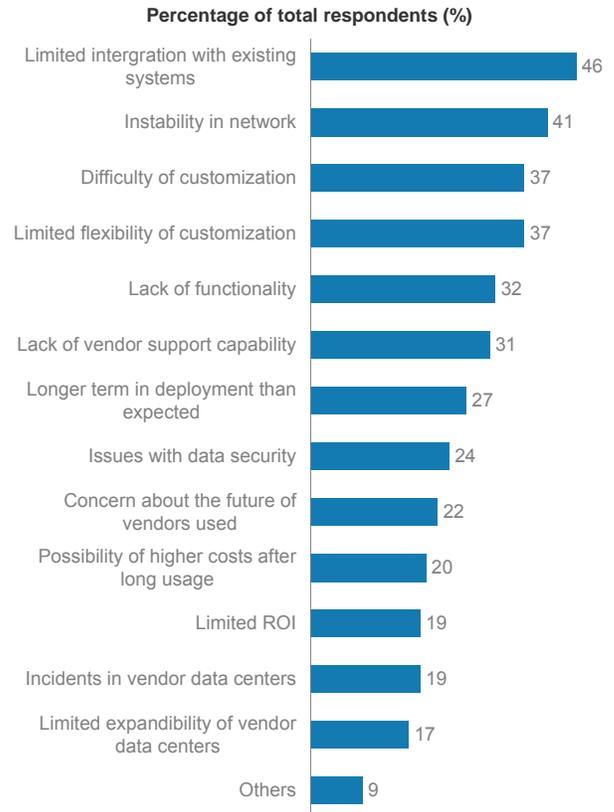


Source: Morgan Stanley, October 2010 CIO Survey

The limitations of SaaS deployments help explain why industry analysts expect growth rates to vary across different subsegments of the market. The advantage of SaaS is that all customers share one common instance of the software, which reduces the cost of creating, integrating, deploying, and maintaining a highly customized version of the application. However, some applications require a fair amount of customization and integration with adjacent systems, making SaaS a less attractive option in these situations. Gartner recently surveyed 172 IT professionals on their use of SaaS, and 34% reported issues with their most recent SaaS deployment. When asked to describe the issues encountered, 46% cited limited integration with existing systems, while 37% cites limited customization as a problem.

Exhibit 90

**SaaS Limits Customization**



Source: Gartner, Morgan Stanley Research

As a result, we believe that applications that are largely horizontal with little variation across organizations (like recruiting) are best-suited for SaaS deployments, while applications that require a high degree of customization between industries or a fair amount of integration with other back-end systems may be less suited for a hosted model. We see SaaS reaching as much of 50% of the market in areas like sales force automation and recruiting, fueling strong growth, while markets like supply chain management may see less than 20% adopt SaaS solutions. These expectations regarding penetration rates within various submarkets guides our top-down model for the SaaS market and the SaaS names under coverage, based on end-market exposures.

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Exhibit 91

### Performance Management, Customer Service and Support, and Collaboration Are Most Attractive Market Segments for Growth

	Total SaaS rev. (\$ mil.)		SaaS as % of market		SaaS rev. CAGR	Leading beneficiaries	Emerging beneficiaries
	2010	2015e	2010	2015e	2010-2015e		
<b>Customer Relationship Management</b>							
Sales force automation	1,959	3,333	44	50	11	Salesforce	MSFT, N, ORCL
Marketing automation	237	458	11	14	14	ADBE, CTCT	RNOW, CRM
Customer service and support	418	898	12	20	17	RNOW, Salesforce	
<b>Total CRM SaaS</b>	<b>2,614</b>	<b>4,689</b>	<b>26</b>	<b>32</b>	<b>12</b>		
<b>Human Capital Management</b>							
Performance management	232	548	37	63	19	SFSF	TLEO, KNXA, CSOD
E-recruiting	346	563	56	70	10	TLEO, KNXA	SFSF
E-learning	153	229	21	26	8	TLEO, CSOD, SFSF (Plateau)	SABA
Other SaaS HCM	149	337	3	6	18	SFSF, TLEO	ULTI
<b>Total HCM SaaS</b>	<b>879</b>	<b>1,677</b>	<b>14</b>	<b>21</b>	<b>14</b>		
<b>Enterprise Resource Planning</b>							
Financial management systems	427	687	5	6	10	N, INTU	SAP, MSFT
Other ERP	62	82	1	1	6	N, INTU	SAP
<b>Total ERP SaaS</b>	<b>489</b>	<b>769</b>	<b>3</b>	<b>4</b>	<b>9</b>		
<b>Other Markets</b>							
Content, communication and collaboration	2,855	7,003	33	46	20	IL, ADBE, MSFT	
Supply chain management	912	1,535	14	16	11	DMAN	

e=Morgan Stanley Research estimates.

Source: Gartner, IDC, Company data, Morgan Stanley Research

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## PaaS: Application Development and Deployment Platform in the Cloud

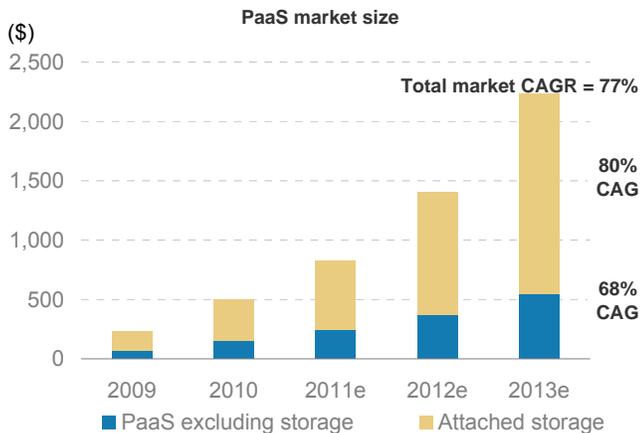
Platform as a service, or PaaS, is an application development and deployment environment hosted in a third-party data center. PaaS environments generally have tools and services that enable application developers to rapidly build new application functionality to run in the cloud.

### PaaS Gains Momentum in 2011

While the expansion of SaaS applications into new markets will continue to be a powerful growth driver within the cloud, we believe this year will also see an acceleration in adoption of the application development and deployment layer of the cloud. As new large players enter the market (Microsoft, Red Hat, VMware) and existing players expand the breadth of their offerings (Salesforce.com, Amazon, Google), PaaS revenues should see accelerating growth in 2011 and a push towards mainstream adoption.

Exhibit 92

### PaaS a Small but Rapidly Expanding Market



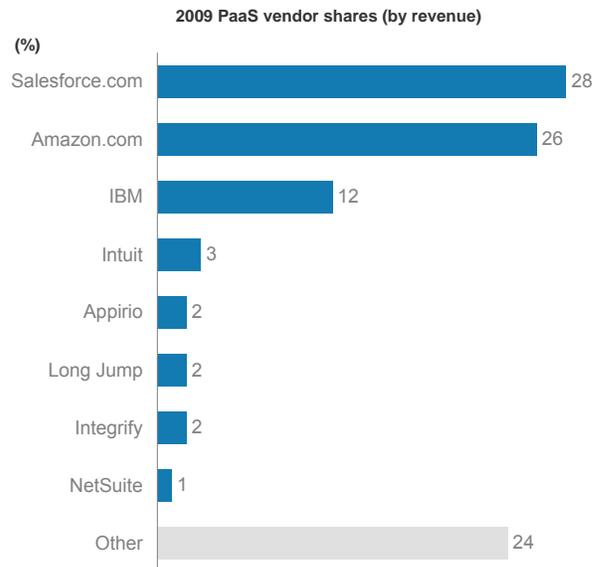
e=451 Group estimates  
Source: 451 Group, Morgan Stanley Research

At present, the PaaS market is still nascent and shifting, with mounting competition and no one vendor or strategy emerging as a clear leader. The latest market share data available from IDC (as of 2009) shows Salesforce.com in the lead as the first-place PaaS vendor in terms of revenue, and Amazon close behind as the second-place vendor. The third largest market share “vendor” is the “other” category, which includes multiple vendors that make up less than 1% of the market individually. The lack of a clear third-place vendor shows that the PaaS market is still evolving and highly competitive. Microsoft was not included in this data because

its Azure platform did not formally arrive until 2010; our survey work indicates a strong initial ramp for Microsoft in the PaaS space. Medium term, platform leaders will be defined by performance and scalability, breadth of tool sets and stack offerings, and the ability to leverage existing customer relationships for cross-selling opportunities.

Exhibit 93

### Salesforce Topped PaaS Market Share by Revenue in 2009



Source: IDC, Morgan Stanley Research

### Commonalities among Top PaaS Offerings

PaaS solutions allow independent software vendors (ISVs) or other organizations to develop, deploy, and integrate new application functionality in a public cloud environment. The advantage of these PaaS services to users are rapid time to market for new application development, easier to use developer tools, regularly upgraded architecture with new platform features at no cost to the user, and very limited capex required for the deployment of new application functionality. In short, application development becomes an operational expense rather than capex cost (and can therefore be allocated from the operating budget). However, this is where most of the similarities end, with PaaS vendors providing a wide variety of offerings that differ in terms of pricing, scripting languages, and technical functionalities, among others.

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### Development Toolkit for SaaS, or New Application Breeding Ground

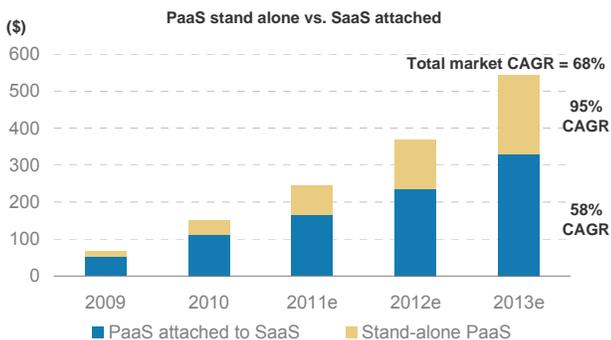
Enterprise-level application software suites generally have development tool kits that end-users can use to develop add-on or additional functionality around the core application processes in the suite. These are often used to create functionality and workflows specific to a company or industry. To-date, the majority of the demand for PaaS has been in a similar role for SaaS-based application suites, a development tool kit used to build out additional functionality around existing SaaS applications. The 451 Group estimates that about 75% of PaaS spending today is for use cases attached to SaaS deployments. Given the expected growth in SaaS, this in of itself is a robust market opportunity and one expected to grow at a CAGR of 58% through 2013.

However, the more game-changing use case is the potential for PaaS to become the application development and deployment platform of choice for new standalone applications. Two primary reasons why we find this such an exciting prospect:

- Dollars spent on building and deploying custom software still exceed the packaged applications market; and
- The low capex requirements, robust cloud enablement, and rapidly improving developer toolsets are significantly lowering the barriers to entry for new application development – both in terms of cost and time to market.

In short, PaaS can enable a much broader swath of business processes to be automated via cloud-based applications, greatly expanding the applications market.

### Exhibit 94 PaaS Attached to the SaaS Application Dominates the Market Today



e=451 Group estimates  
Source: 451 Group, Morgan Stanley Research

### PaaS Pricing Models Run the Gamut

Pricing models among PaaS vendors vary widely, from free offerings to pay-per-use to traditional licensing and everything in between. Microsoft offers the most extensive range of pricing options for its Windows Azure PaaS solutions, with pricing models that include licensing, pay-as-you-go, advertising-based, and subscription-based. Google and Amazon, in contrast, have one primary pricing model, which is based on capacity and essentially charges on underlying resources utilized. Both have similar pricing for storage and bandwidth, with Amazon charging for EC2 instances and Google charging for CPU hours. Salesforce.com offers a free version of Force.com for a limited number of users and beyond that charges on a per-user, per-month basis.

### Exhibit 95 Pricing Models Vary Among the Top PaaS Vendors

Company	PaaS pricing model	Pricing
Windows Azure	Multiple options include: license, subscription, per-use, advertising-based	Various: \$0.05-\$0.96/hour depending on instance size; Storage: \$0.15/GB/month; Bandwidth: \$0.10/GB in, \$0.15/GB out (NA/Europe), \$0.20/GB out (APAC)
force.com	Charges customers on a per-user, per-month basis. Also charges a fee per live app on its AppExchange portal	Enterprise: \$50/user/month - 20MB storage/user; Unlimited: \$75/user/month - 120MB/user; Both come with 40GB bandwidth/day, 60 server hours/day
Google	Charges customers' on a per core-hour basis and per GB for associated bandwidth	Processing: \$0.10 per CPU core-hour; Storage: \$0.15/GB; Bandwidth: \$0.10/GB in, \$0.12/GB out
amazon web services	Charges on a per core-hour basis and per GB for associated bandwidth	EC2: \$0.02/hour/instance, Load Balancer: \$0.025/hour, Processing: \$0.008/GB, Block Store: \$0.10/GB, S3 Storage, \$0.14/GB, Bandwidth: \$0.10/GB in, \$0.15/GB out

Source: Company data, Morgan Stanley Research

### Developer Base Will Be a Key Differentiator

The speed and ease with which users can develop and deploy applications and the quality of the underlying platform – which is reflected in application performance — are what differentiate vendors. Development tools and scripting languages are important factors here because a PaaS solution either needs to be available in a programming language, or languages, that are widely known and appeal to the widest range of developers or very intuitive and easy-to-use, if the development tools are based on something other than a well-known language.

We believe the most successful vendor strategies related to developer languages will involve the widest range of programming options to gain access to the greatest number of developers possible. Of late, companies have seemed to embrace this concept in their acquisitions, partnerships, and new offerings. For instance, Salesforce.com has made moves over the last 12 months to open its platform; its platform used

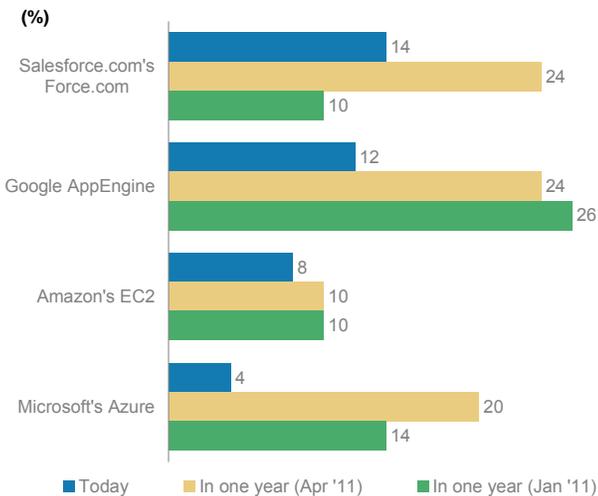
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to support only its proprietary Apex meta-language but now the company has brought in Java and Ruby developers via its partnership with VMware (VMForce) and its acquisition of Heroku. Likewise, VMware just launched a beta version of what it calls the industry's first fully open PaaS with Cloud Foundry, and Red Hat acquired Makara, a mostly open source PaaS, and re-branded it OpenShift. Microsoft continues to support a platform with a wide potential audience, as its .NET framework already has a significant potential development group; and Eclipse allows for Java, PHP, and Ruby interoperability with Azure.

**Large Vendors with Broad Distribution Have Clear Advantage**

While pricing, language flexibility, and functionality are all critical in establishing best-placed and potentially challenged players in the highly competitive PaaS market, ultimately success might rest with the quantity and quality of distribution and partnerships that each vendor has access to. As a result, the four largest PaaS vendors – Microsoft, Google, Salesforce, and Amazon – will likely take the greatest share over time, and smaller niche vendors will become acquisition targets as the market begins to consolidate. Our recent CIO Survey suggests that a growing percentage of CIOs are already using or planning to use PaaS products within the next year, which supports our belief that PaaS is growing in importance in the enterprise and that the larger vendors will drive the market trajectory over the next several years. Microsoft, Salesforce, and Amazon all showed strong adoption trends in our April CIO survey, while Microsoft put in the strongest showing in our cloud survey.

Exhibit 96  
**More CIOs Planning to Use PaaS in One Year**



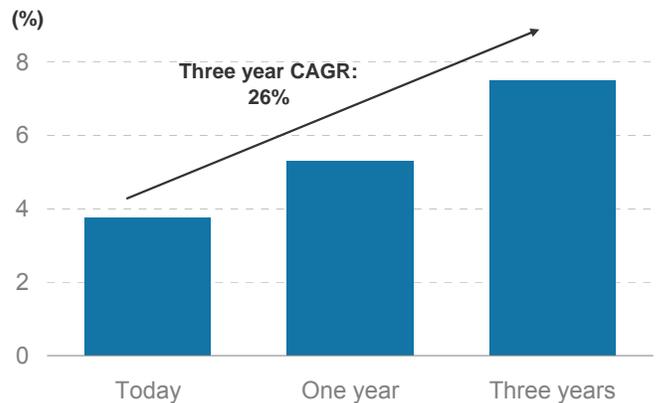
Source: Morgan Stanley, April 2011 CIO Survey

Exhibit 97  
**Key Vendors in PaaS**

Vendor	PaaS offering	SaaS attached?
Adobe	LiveCycle ES2	Yes
Engine Yard	Cloud Services Platform	No
Google	AppEngine	Yes
IBM	Rational Application Developer	No
Intuit	Partner Platform	Yes
Joyent	SmartPlatform	No
Microsoft	Azure	No
Netsuite	SuiteCloud	Yes
Pegasystems	BPM PaaS	No
RedHat (Makara)	Cloud Application Platform	No
Salesforce.com	Force.com	Yes
Salesforce.com	VMForce	No
Salesforce.com/Heroku	Heroku	No
SAP	Coghead	Yes
Software AG	ARlalign	No
VMware	Cloud Foundry	No
VMware	SpringSource	No

Source: Company data, Morgan Stanley Research

Exhibit 98  
**Respondents Expect 26% CAGR in Percentage of Workloads Run in PaaS Environments**



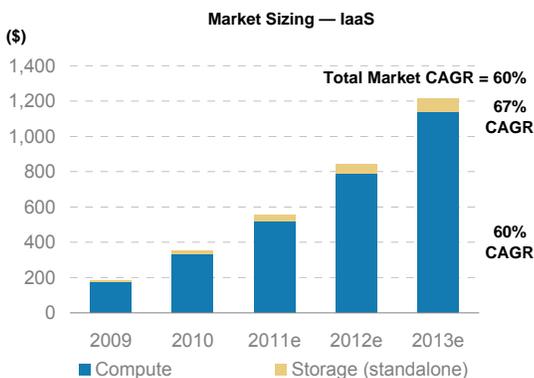
Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

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## IaaS: Infrastructure in the Cloud

Infrastructure as a service, or IaaS, represents the most basic level public cloud offering – raw compute resources managed in third-party data centers, running customer workloads or storing customer data. IaaS differs from managed hosting services because the vendor is offering on-demand compute capacity from a shared resource pool rather than third-party management of dedicated, individual servers. Therefore, IaaS services reflect significantly higher granularity for both the amount and time of compute or storage consumed by the customer. With about 50% of IT budgets dedicated to infrastructure acquisition and management, IaaS could represent a significant source of savings if economies of scale are realized in the cloud.

Exhibit 99  
**IaaS has the Highest Forecasted CAGR in the Public Cloud**



Note: For more information see reports by The 451 Group, *Cloud Heavyweights Shape the IaaS Landscape*, August 2010, and *Cloud Computing: As-A-Service Market Sizing*, October 2010.  
 e=The 451 Group estimates.  
 Source: The 451 Group, Morgan Stanley Research.

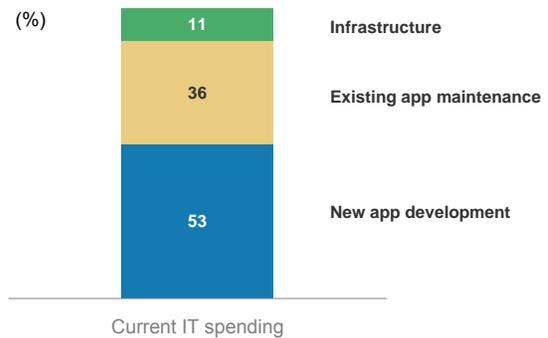
Most of an average organization's IT budget goes toward infrastructure-related costs. Since the migration of customer applications and services to the cloud substantially reduces these expenses, the economics of cloud computing are doubly beneficial to the cloud customer.

Exhibit 100  
**Key Vendors in IaaS**

Vendor	Compute offering	Storage offering
Amazon	Enterprise Compute Cloud (EC2)	Simple Storage Service (S3)
AT&T	Synaptic Compute Cloud	Synaptic Storage
British Telecom	Virtual Data Service	
CSC	Trusted Cloud	CloudExchange
EMC		Mozy
Google		AppEngine & Big Table
HP (EDS)	EDS	Smart Business Storage Cloud
IBM	Blue Cloud	
Joyent	SmartMachines & SmartDataCenter	
Microsoft		Azure & SSDS
NTT	NTT America Cloud	Cloud Files
Oracle	Cloud Compute	CloudFiles
Rackspace	Cloud Servers & Cloud Sites	Force.com / Database.com
Salesforce.com		Project Spirit
Savvis	Savvis Cloud Compute	
SunGard	Hesling365	
Terremark (Verizon)	Cloud Express / Enterprise Cloud	
Verizon Business	Cloud Compute	Cloud Storage
Wipro	The Wipro Cloud	Cloud Storage

Source: Company data, Morgan Stanley Research

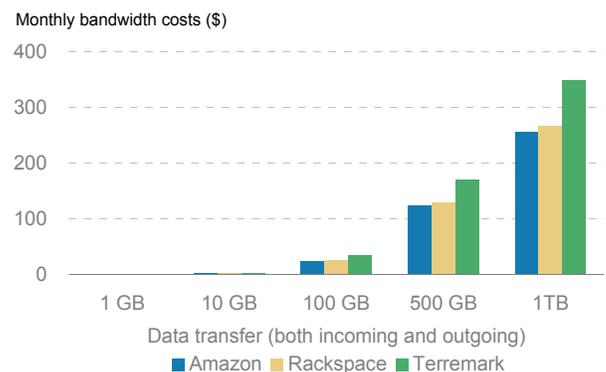
Exhibit 101  
**Infrastructure Costs Account for About 50% of IT Budgets Today**



Source: Microsoft

**Pay for play computing.** IaaS pricing characteristics are based on a pay-for-consumption business model, which allows customers to scale operating expenses as the business requires instead of undertaking capital-intensive data center build-outs. This model is ideally suited for non-mission-critical workloads, small- and medium-sized businesses, and customers with spiky demand or usage patterns. IaaS providers use flexible pricing models that typically charge an hourly rate based on the CPU size and memory requirements of the compute resources requested. Additionally, there is usually a separate bandwidth fee for data transfer, which is often one of the more expensive elements of IaaS. For example, the Rackspace Cloud Server price model is based on an hourly rate per cloud server (virtual instance), plus additional fees for bandwidth and managed service levels.

Exhibit 102  
**Bandwidth Costs Can Represent a Significant Cost**



Source: Company data, Morgan Stanley Research.

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Exhibit 103  
**Example IaaS Cloud Pricing Models (Servers)**



	1 Core, 1 EC2 Unit	2 Cores, 1 EC2 Unit	4 Cores, 2 EC2 Units
CPU			
Storage (GB)	160	850	1690
Memory (GB)	1.7	7.5	15
Platform (Bit)	32	64	64
Linux Usage / Hr (\$)	0.085	0.340	0.680
Windows Usage / Hr (\$)	0.120	0.480	0.960



	10	20	40	80
Storage (GB)				
Memory (MB)	256	512	1,024	2,048
Linux Usage / Hr <sup>1</sup> (\$)	0.015	0.030	0.060	0.120
Windows Usage / Hr (\$)	NA	NA	0.080	0.160
Storage (GB)		160	320	620
Memory (MB)		4,096	8,192	15,872
Linux Usage / Hr <sup>1</sup> (\$)		0.240	0.480	0.960
Windows Usage / Hr (\$)		0.320	0.580	1.080

Managed Service Level<sup>2</sup> \$0.12 per hour (+ \$100 / mo)

<sup>1</sup> In addition to the hourly charge, a \$20 flat, monthly fee will be charged per server, calculated based on the maximum number of RHEL cloud servers active at any point in time during the billing cycle. These fees will not be pro-rated based on usage.

<sup>2</sup> In addition to the hourly service fee of 12¢/hour per server, a \$100 flat, monthly account fee will be assessed when at least one server on the account is active. The account fee is not reflected in the above pricing as it is not a per-server charge but an overall account fee, no matter how many servers are active on the account.

Source: Company websites



**Unlicensed server prices (\$)**

Virtual processors	1 VPU	2 VPU	4 VPU	8 VPU
<b>Memory</b>				
0.5 GB	0.035	0.040	0.045	0.049
1 GB	0.060	0.070	0.080	0.100
1.5 GB	0.090	0.105	0.120	0.135
2 GB	0.120	0.141	0.161	0.200
4 GB	0.217	0.271	0.301	0.359
8 GB	0.401	0.482	0.567	0.634
12 GB	0.602	0.686	0.762	0.824
16 GB	0.803	0.844	0.899	0.932

**Licensed windows servers (web, standard, or enterprise editions) prices (\$)**

Virtual processors	1 VPU	2 VPU	4 VPU	8 VPU
<b>Memory</b>				
0.5 GB	0.042	0.048	0.054	0.059
1 GB	0.072	0.084	0.096	0.120
1.5 GB	0.108	0.126	0.144	0.162
2 GB	0.144	0.170	0.194	0.240
4 GB	0.261	0.326	0.362	0.431
8 GB	0.482	0.579	0.681	0.761
12 GB	0.723	0.824	0.915	0.989
16 GB	0.964	1.013	1.079	1.119

Source: Morgan Stanley Research.

**Other Pricing Models / Discounts**

**Spot instances.** Amazon's spot instances represent evidence of the continued evolution of pricing strategy for IaaS. Rather than accept set prices, customers can "bid" on unused capacity and consume compute resources for applications as long as bids are higher than the spot prices. Prices vary with supply and demand.

On its website, Amazon writes: "To use Spot Instances, you place a Spot Instance request, specifying the instance type, the region desired, the number of Spot Instances you want to run, and the maximum price you are willing to pay per instance hour. To determine how that maximum price compares to past Spot Prices, the Spot Price history is available via the Amazon EC2 API and the AWS Management Console. If your maximum price bid exceeds the current Spot Price, your request is fulfilled and your instances will run until either you choose to terminate them or the Spot Price increases above your maximum price (whichever is sooner)."

Exhibit 104  
**Amazon On-Demand Instances Pricing**



Source: Amazon, SpotHistory.com, Morgan Stanley Research

**Reserved instances.** Rather than make usage-based payments on a monthly basis, Amazon customers can reserve a server instance with a prepayment and receive a discount on the per-hour usage charge. Amazon offers one- and three-year terms, with the pre-paid fee per instance non-refundable.

**Free usage tier.** Amazon is also offering limited free usage to new customers for one year. According to Amazon, the free monthly compute resources include:

- 750 hours of EC2 running Linux/Unix Micro instance usage;
- 750 hours of elastic load balancing (ELB) plus 15-gigabyte data processing;

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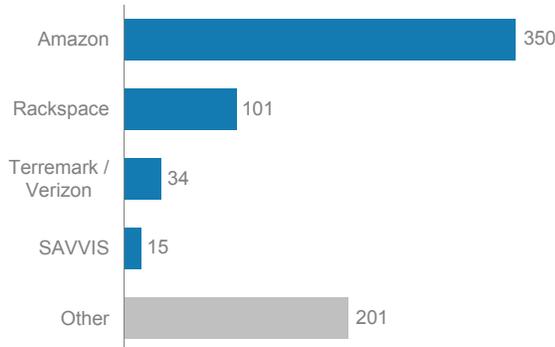
- 10 gigabytes of Amazon elastic block storage (EBS) plus 1 million input/outputs, 1-gigabyte snapshot storage, 10,000 snapshot Get Requests, and 1,000 snapshot Put Requests; and
- 15 gigabytes of bandwidth in and 15 gigabytes of bandwidth out, aggregated across all Amazon web services (AWS).

## Market Share and Product Analysis

Exhibit 105

### IaaS Market Share, 2010

2010 IaaS market share by revenue (\$ mil.)



Note: For more information see reports by The 451 Group, *Cloud Heavyweights Shape the IaaS Landscape*, August 2010, and *Cloud Computing: As-A-Service Market Sizing*, October 2010.

Source: Company data, Morgan Stanley Research

**Amazon still the clear leader.** Recent data continues to suggest that AWS remains the largest player in the IaaS space, with nearly a 60% market share of compute-as-a-service and storage-as-a-service as defined by tier 1 research (we estimate 48% market share of total IaaS revenue). Amazon was the first provider to launch a mass-market cloud platform with its elastic computing (EC2) offering in August of 2006, well ahead of other competitors. Application testing and development made up the vast majority of early cloud use cases, enabling Amazon to take significant share with its highly scalable capacity, automated resource deployment, and tools to manage cloud apps. Additionally, Amazon has become known as a price leader in the space, given its strong balance sheet and the highly cash-generative characteristics of the traditional online business.

**Fanatical support and the hybrid approach should solidify Rackspace at number two.** Rackspace has seen strong growth for the cloud segment over the past three years, as the share of cloud revenues has increased from 3% as of fourth quarter 2007 to 16% as of first quarter 2011. The Rackspace Cloud product set is divided into three groups: Hosted E-mail and Apps (SaaS), Cloud Files (Storage-as-a-Service), Cloud Sites (PaaS), and Cloud Servers (IaaS).

The cloud computing business is largely usage based, and at the IaaS level, becoming somewhat commoditized, as we have seen numerous instances of pricing compression at AWS in the past year. Nevertheless, we believe that take rates should continue to outpace pricing pressure in the near term, while there remains the potential for higher service levels to differentiate the offering and enhance average revenue per customer and server profiles. Rackspace also allows customers to integrate their dedicated infrastructure with the cloud, which is ideal for workloads with both unpredictable usage characteristics and sensitivities to compliance issues.

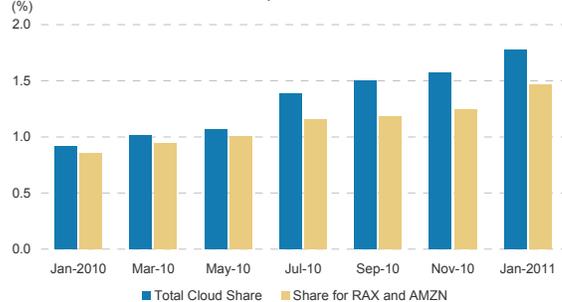
Consistent with our expectations, the cloud expansion to Europe, RackConnect (hybrid-hosting) adoption, and the increased service levels associated with managed cloud continued to fuel the top-line momentum in first quarter for Rackspace. We note that managed cloud now has 1,100 customers (as of the end of April), up from 160 customers as of year-end 2010. Additionally, 20% of Rackspace's customers with dedicated infrastructure are now using the cloud (this is up from about 5% as of fourth-quarter earnings).

**Market share by frequently visited websites.** Websites and web-centric applications are often the first to migrate to a cloud environment. JackofAllClouds.com tracks which IaaS providers host the greatest share of the 500,000 most popular sites on the web (as determined by QuantCast), investigating each site to determine if it is hosted on a cloud provider and, if so, which one. As a percentage of total websites, both Amazon and Rackspace have a meager 1.5% share, with the total cloud share at just under 2%. However, we note that there has been a two-fold increase in cloud share from January 2010 to January 2011. Additionally, other players (Joyent, GoGrid, OpSource, and Linode) have continued to show steady growth as Rackspace and Amazon, while still the representing the largest portion of the overall market, claims a significantly smaller portion today than it did in early 2010.

Exhibit 106

### Cloud Providers' Share of Top 500,000 Websites Continues to Increase

Time series of cloud market share of top 500,000 websites (%)



Source: Company data, JackofAllClouds.com, Morgan Stanley Research

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Exhibit 107

Amazon Web Services Products

COMPUTE	
Amazon Elastic Compute Cloud (EC2)	Scalable, pay-as-you-go compute capacity in the cloud
Amazon Elastic MapReduce	Enables cost-effectively processing of vast amounts of data
Auto Scaling	Automatically scale capacity up and down according user defined requirements
CONTENT DELIVERY	
Amazon CloudFront	Distribution of content with low latency via global edge network
DATABASE	
Amazon SimpleDB	Runs queries on structured data in real time
Amazon Relational Database Service (RDS)	Facilitates working with relational databases in the cloud
DEPLOYMENT AND MANAGEMENT	
AWS Elastic Beanstalk	Handles capacity provisioning, load balancing, auto-scaling, and health-monitoring for apps
AWS CloudFormation	Enables provisioning of AWS resources in an orderly and predictable fashion
E-COMMERCE	
Amazon Fulfillment Web Service (FWS)	Allows merchants to deliver products using Amazon.com's fulfillment capabilities
MESSAGING	
Amazon Simple Queue Service (SQS)	Provides a hosted queue of messages as they travel between computers, allowing for an automated workflow among web services
Amazon Simple Notification Service (SNS)	Allows for facilitation of setting up notifications from the cloud
Amazon Simple E-mail Service (SES)	Scalable and cost-effective bulk and transactional e-mail sending service for the cloud
MONITORING	
Amazon CloudWatch	Monitoring for cloud resources (starting with EC2)
NETWORKING	
Amazon Route 53	Highly available and scalable Domain Name System (DNS) web service
Amazon Virtual Private Cloud (VPC)	Via a virtual private network, Amazon VPC enables customers to connect existing infrastructure to a set of isolated AWS compute resources
Elastic Load Balancing	Distributes and manages incoming traffic across multiple EC2 instances
PAYMENTS AND BILLING	
Amazon Flexible Payments Service (FPS)	Facilitates the digital transfer of money between any two entities
Amazon DevPay	Billing and account management service, enables developers to collect payment for their AWS applications
STORAGE	
Amazon Simple Storage Service (S3)	Redundant data storage infrastructure for storing and retrieving any amount of data, at any time, from anywhere on the Web
Amazon Elastic Block Storage (EBS)	Block level storage for use with EC2 instances; Amazon EBS volumes are off-instance storage that persists independently from life of any instance
AWS Import / Export	Accelerates moving large amounts of data into and out of AWS using portable storage devices for transport
SUPPORT	
AWS Premium Support	Support channel to help build and run applications on AWS Infrastructure Services
WEB TRAFFIC	
Alexa Web Information Service	Repository of data about structure and traffic patterns on the Web available to developers
Alexa Top Sites	Global website traffic data as it is continuously collected
WORKFORCE	
Amazon Mechanical Turk	Access thousands of global workers on demand and programmatically integrate their work into various business processes

Source: Company data, Amazon, Morgan Stanley Research

Amazon launched its SimpleDB service in December 2007 as a means of streamlining real-time database lookups and structured queries. At the three-year anniversary of the launch of EC2, Amazon introduced Virtual Private Cloud (VPC), which allows for a connection between on-premise compute resources and those existing in the AWS cloud over a virtual private network. More recently, Amazon has increased its focus on service with four different support levels (bronze, silver, gold, and platinum). Amazon has also continued to expand the geographic presence of its cloud offering, adding presence in Europe in December 2008 and Asia/Pacific in late April 2010.

Exhibit 108

Rackspace Cloud Servers Offers More Affordable Support Levels

	Features	Fastest guaranteed response	Named contacts	Architecture support	Price (monthly)
<b>Bronze</b>	Access to community forums, resolution of AWS-owned issues, local business hours, one-on-one support, client side diagnostic tools, best practice guidance	12 hours	1	Building blocks	\$49.00
<b>Silver</b>	Access to community forums, resolution of AWS-owned issues, local business hours, one-on-one support, client side diagnostic tools, best practice guidance	4 hours	2	Service reviews	Greater of \$100 - or - 5% of monthly AWS usage
<b>Gold</b>	Access to community forums, resolution of AWS-owned issues, local business hours, one-on-one support, client side diagnostic tools, best practice guidance, always available 24/7/365, one-on-one phone support	1 hour	3	Use case guidance	Greater of \$400 - or - 10% of monthly AWS usage for the first \$0-\$10K 7% of monthly AWS usage from \$10K-\$80K 5% of monthly AWS usage from \$80K+
<b>Platinum</b>	Access to community forums, resolution of AWS-owned issues, local business hours, one-on-one support, client side diagnostic tools, best practice guidance, always available 24/7/365, one-on-one phone support, direct access to technical account manager, white-glove case routing, management business reviews	15 minutes	Unlimited	Application architecture	Greater of \$15K - or - 10% of monthly AWS usage

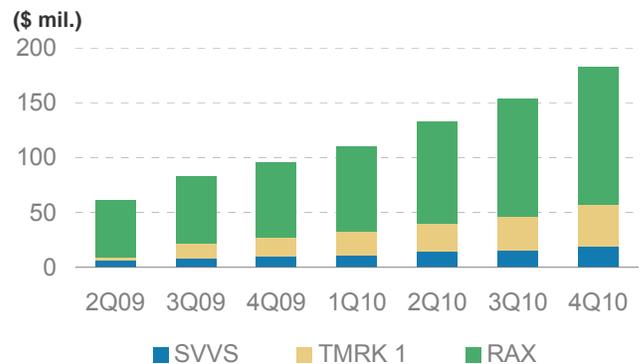
	Features	Price (monthly)
<b>Cloud Servers</b>	24/7/365 chat/phone/ticket support, control panel, virtualization layer, server provisioning on-demand, 100% network uptime guarantee, data center (100% HVAC/Power uptime guarantee), standard image backups (using snapshots - 1 daily/1 weekly)	Standard usage-based pricing
<b>Cloud Servers with Managed Service Level</b>	24/7/365 chat/phone/ticket support, control panel, virtualization layer, server provisioning on-demand, 100% network uptime guarantee, data center (100% HVAC/Power uptime guarantee), migrations (3-hour migrations for server host degradation), expanded backups (using snapshots - 1 per day, 14 day retention), server OS and Apps infrastructure support (includes updates/patches) 24/7/365 monitoring response and resolution (URL content, Port, Ping) technical guidance, account team	\$0.12 per hour per server plus a flat \$100/month account fee

<sup>1</sup> In addition to the hourly service fee of 12¢/hour per server, a \$100 flat, monthly account fee will be assessed when at least one server on the account is active. The account fee is not reflected in the above pricing as it is not a per-server charge but an overall account fee, no matter how many servers are active on the account.

Source: Company data, Rackspace, Amazon, Morgan Stanley Research

Exhibit 109

Cloud Revenue Distribution, 2Q2009– 4Q2010



<sup>1</sup> Cloud run-rate or total annual revenue under contract.  
Source: Company data, Morgan Stanley Research

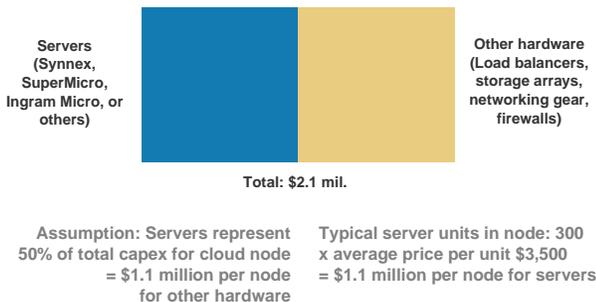
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## Public Cloud Build-Out and Operating Cost Analysis

The build-out of public cloud deployments differs from the construction of traditional enterprise data center space on three levels, as detailed below. We note that the total cost of ownership savings inherent in a public cloud provider’s environment relative to that of a traditional enterprise data center may be as high as 60%. While public cloud build-outs are far from homogenous, publicly traded Rackspace gives a higher level of detail than most other vendors—and we use these data points extensively below. We believe many of the trends indicated in Rackspace’s data points may be indicative of the emerging economics for the broader public cloud space.

- More prevalent use of commodity servers.** Our checks with various public cloud providers suggest that commodity (or white-box servers) have become the standard means of deployment for large, multi-tenant cloud nodes. Vendors include Synnex and SuperMicro among others. Importantly, however, we estimate that only about 50% of capital spending is related to servers for cloud build-outs, with the balance split between networking gear, load balancers, storage arrays, and firewalls. We understand that 70–80% of Rackspace’s server spending was with Dell two years ago, whereas today’s capital spending with Dell has come down to 50% as the cloud segment continues to grow at near triple digit rates.

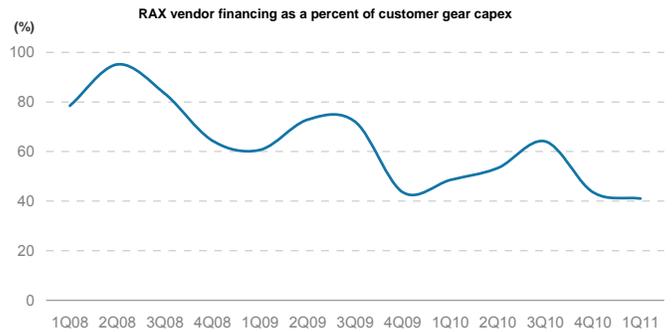
Exhibit 110  
**Example Cloud Build-Out Scenario**



Source: Company data, Morgan Stanley Research

We understand that white-box servers are priced 10–50% below that of branded servers from Dell or HP. Additionally, we note that IaaS vendors typically pay white box server vendors with cash, rather than enter into vendor financing relationships as is common with Dell or HP. As a percentage of total customer gear capex for Rackspace, vendor financing has declined from an average of 80% during 2008 to an average of 52% in 2010, suggesting an increasing reliance upon white-box vendors for the cloud build-out.

Exhibit 111  
**Cash Capex Suggests White Box Vendor Spend on the Rise**

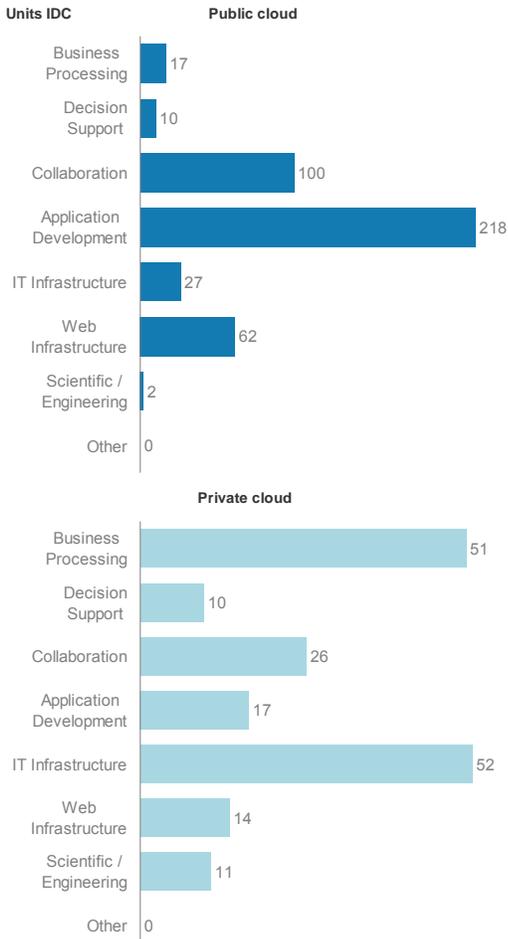


Source: Company data, Morgan Stanley Research

However, the more mission-critical the infrastructure under management, the more likely it is to see branded servers in a private, rather than public, cloud. Given that many larger corporations have a marriage to a hardware vendor, complex, compliance-sensitive, or security-sensitive applications often still reside in a branded server box in a virtualized, single-tenant environment. This is reflected in the IDC data that compare workloads for private-cloud server shipments relative to shipments of public-cloud servers.

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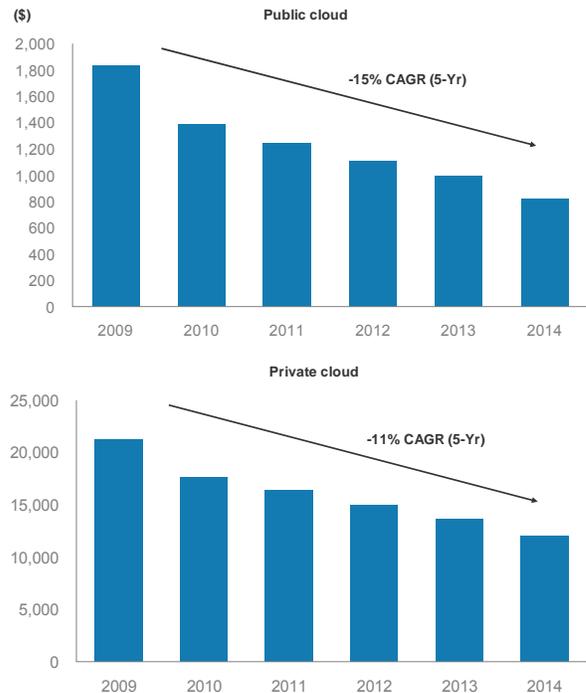
Exhibit 112  
**Shipments by Workload: Public vs. Private Cloud**



Source: Company data, IDC, Morgan Stanley Research

For those applications that are the least managed or monitored (such as e-mail, test and development, promotional, or public websites), the shared nature of the public cloud environment creates a significant efficiency advantage without the offsetting risk of data loss or operational failure. Additionally, there are already higher average server utilizations inherent in enterprise resource planning and other mission-critical applications. IDC data suggests that average selling prices for public-cloud server shipments should decline significantly more than private-cloud servers given the reliance upon more commoditized gear in IaaS cloud deployments. While the IDC data suggests average selling prices for cloud servers of \$1,386 today, we have heard from cloud providers that customized servers with higher-end chips, RAM densities, and disk storage typically run as high as \$3,000-4,000, even coming from white box vendors.

Exhibit 113  
**Average Selling Price Decline Comparison: Public vs. Private Cloud Server Shipments**



Source: Company data, IDC, Morgan Stanley Research

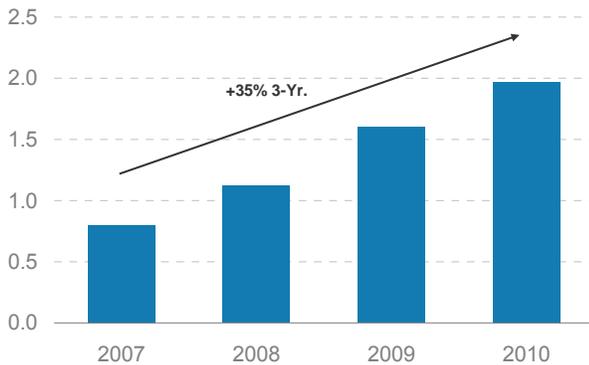
- Significantly higher server utilizations.** We have heard that a typical enterprise data center has historically seen utilization rates in the high single digits to the 20% range, depending on the degree of virtualization and scale. However, with 5,000–10,000 applications often running on many different platforms, there may only be a small number (perhaps 20–30%) of the applications that represent low-hanging fruit for a relatively smooth migration to a multi-tenant cloud environment, leaving large database servers and ERP systems behind, with maximum utilizations in the 40–50% range.

In contrast, a public cloud provider can immediately realize operational efficiencies with power, cooling, bandwidth, and other redundancy/security costs, and savings from the virtualization of the entire server infrastructure. This may represent a cost savings of 20–30%, before any shared tenancy or “cloud” characteristics in the server infrastructure itself. With virtual machine isolation, the ability to evenly distribute workloads across virtualized servers, rapid VM provisioning times, and elasticity of provisioning, server utilization rates can go as high as 60-70%. We note that there is some controversy about whether utilization rates can sustain 80% levels in a revenue-generating IaaS environment.

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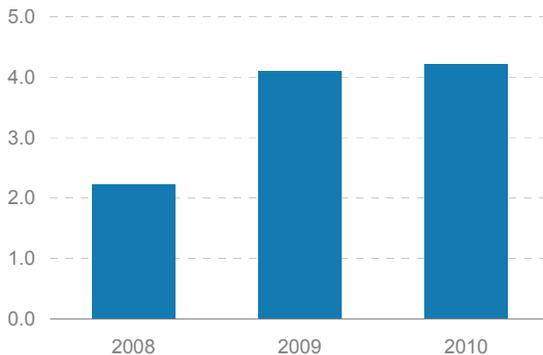
One way of measuring public cloud efficiency is by comparing customer-to-server ratios. We note that Salesforce.com has said that its 92,300 customers are running on about 3,000 servers, suggesting a customer-to-server ratio of over 31. However, as a SaaS provider, the company is not providing on-demand compute resources for computationally heavy applications. Although not a perfect comparison (since likely more than half of Rackspace's servers are in the dedicated hosting segment), we note that the customer-to-server ratio has increased from 0.80 in fourth quarter 2007 (at the start of the cloud business) to 2.02 as of first quarter 2011, an increase of more than two-fold.

Exhibit 114  
**Rackspace: Customers per Server on the Rise**



Source: Company data, Morgan Stanley Research

Exhibit 115  
**Rackspace: Incremental Customers per Server Even Higher**

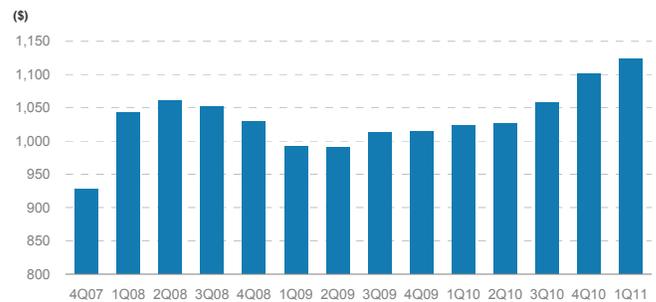


Source: Company data, Morgan Stanley Research

As IaaS has become a more significant percentage of Rackspace's overall revenue, we have also seen further capital efficiency gains for servers per square feet of data

center space and revenue per server. Square feet needed to support one server has dropped from 3.1 in fourth quarter 2007 to 2.6 as of first quarter 2011. During that time, revenue-per-server has increased to \$1,123 as of first quarter 2011 from \$928 as of fourth quarter 2007.

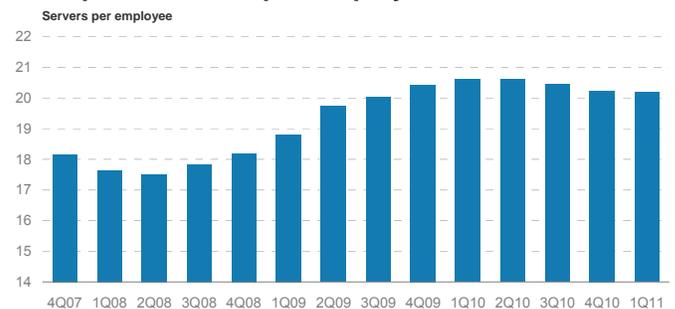
Exhibit 116  
**Rackspace: Average Monthly Revenue per Server**



Source: Company data, Morgan Stanley Research

- Significantly lower administrator-to-server ratios.** With a relatively homogenous environment in a public cloud setting, operating costs are significantly more scalable than in a traditional enterprise data center. Whereas administrator-to-server ratios of 1:10 are common in internal data center facilities, we understand that an IaaS provider may realize ratios of 1:1,000 (or more) at the high end, although ratios of 1:100–1:250 are likely more reasonable. We note that there is a significant degree of automation invested in building large provisioning systems, with little manual scripting work to access a virtual machine or troubleshoot an application. Additionally, there is generally better insight into systems to work around problems in an aggregated way. Additionally, IaaS providers have control over the software stack on which customer applications are running.

Exhibit 117  
**Rackspace: Servers per Employee**



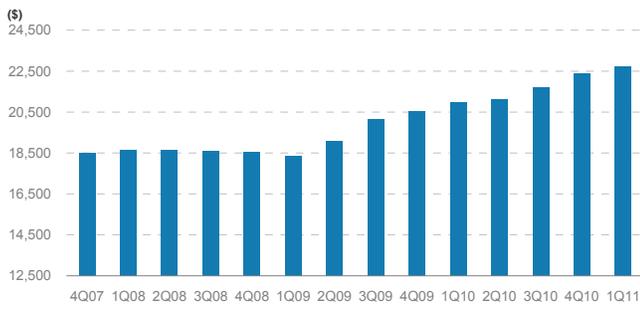
Source: Company data, Morgan Stanley Research

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Exhibit 118

### Rackspace: Average Monthly Revenue per Employee



Source: Company data, Morgan Stanley Research

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## Private Clouds: Sharing on the Inside

The concept of gathering computing resources (servers, storage, applications) into a shared pool and delivering these resources or application functionalities as a service within an organization is the core idea of private cloud computing. In short, similar functional characteristics to the compute environments being built out in the public cloud, but built, owned, and maintained by an individual enterprise for the sole use of that enterprise.

The concept is actually not new, first described by Douglas Parkhill in his 1966 book, *The Challenge of the Computer Utility*, the idea of delivering a "private computer utility" within an organization — in a similar shared service model like other utilities (electricity, gas, or water) — has been the goal of IT departments for some time. What is most often described as private cloud computing today is the latest step on an evolutionary path IT has been on; relatively recent incarnations have included utility computing and software as a service. The key catalyst now accelerating the adoption of private cloud computing within organizations is the maturation on x86 architectures of two fundamental infrastructure technologies supporting the shared compute model: virtualization and grid computing.

**Two key factors define private clouds.** Our definition of private clouds considers two factors: 1) the usage profile of the computing resources (internal vs. external), and 2) the inclusion of key technologies that enable compute resource-sharing in the data center architecture. By our definition, private clouds do not share computing resources outside the organization *and* make use of virtualization or grid computing technologies.

Exhibit 119

	Usage model	
	Public use	Internal use
Not using virtualization or grid technologies	Non-cloud data center	Non-cloud data center
Use virtualization or grid technologies	Public cloud	Private cloud

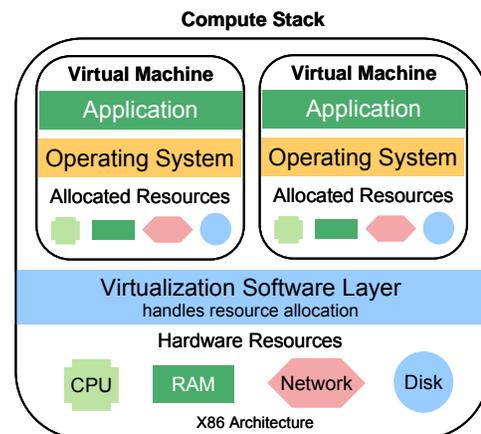
Source: Morgan Stanley Research

**Key enabling technologies: Server virtualization and grid computing.** Virtualization and grid computing are both concepts aimed at improving the economics of computing by pooling computing assets and improving utilization rates. Whereas virtualization enables companies to more effectively scale up servers (to run more workloads on bigger servers), grid computing enables for scale out (to run large workloads on multiple smaller servers)

**Virtualization.** According to VMware, virtualization is the concept of "separating a resource or request for a service from the underlying physical delivery of that service." Virtualization software creates a layer of abstraction between the computing hardware and applications running on top of it. By doing so, multiple application workloads and operating systems (together called a virtual machine, or VM) can run on a single physical server, thereby improving utilization. The virtualization software layer handles the allocation of compute resources to each VM, ensuring each workload gets the CPU, memory, and bandwidth required. Importantly, the virtualization software layer ensures that if the compute requirements of one VM spikes, the other VMs running on that physical server will not be starved of resources — correcting a significant shortcoming seen in some popular server operating systems that led to the ubiquitous deployment of one workload per server historically.

Exhibit 120

### Virtualization Layer Allows Multiple Workloads to Efficiently Run on One Server

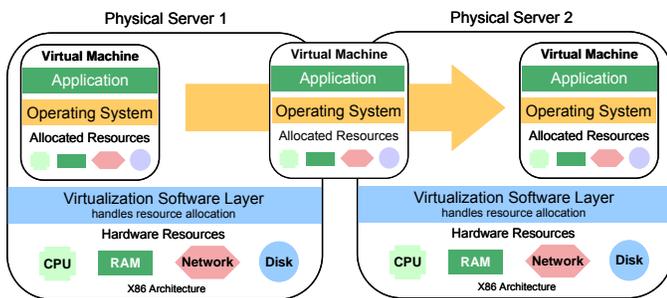


Source: Morgan Stanley Research

When a customer has a homogenous virtualization software layer across multiple servers, the VMs can be rapidly provisioned to any of these physical servers and dynamically migrated from one server to another — thus creating the shared compute resource pool described above. Storage and networking resources have to be similarly virtualized to allow them to follow the now dynamic location of application workloads or VMs.

Exhibit 121

**Homogenous Virtualization Software Layer across Servers Allows for More Dynamic Workloads**

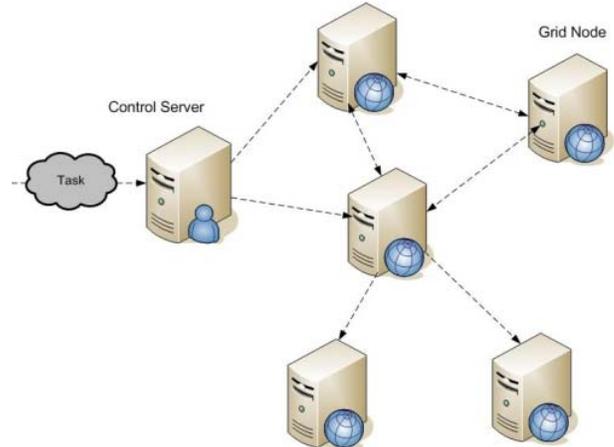


Source: Morgan Stanley Research

**Grid computing.** The concept of grid computing refers to a network of compute resources combined together to perform a computing task. In a grid computing environment, the resources of each computer in the network are shared by every other computer in the network, providing a large aggregate pool of processing power. Grid computing can be as simple as combining similar compute resources running the same operating system (OS) or as complex as a heterogeneous mix of resources across various networks. Grid computing is a form of distributed computing, which through the use of middleware, divides computing tasks into many smaller tasks, which are then solved by a subset of the computers in the grid. By combining commodity hardware (servers) over a network, grid computing can create computing power similar to a supercomputer, but at a lower cost.

Exhibit 122

**Grid Computing**



Source: Scaleoutsoftware.com, Morgan Stanley Research

**Grid Computing Use Cases**

The number of users and amount of data requests are key variables that help determine whether grid computing or virtualization is more appropriate. Grid computing is ideal in environments with large data sets and a small number of users who infrequently access the data. Put another way, grid computing is well suited for computational intensive tasks that produce a small set of results. On the other hand, virtualization is more appropriate in environments with a large number of users who only request relatively small amounts of data. Virtualization helps improve asset utilization by consolidating resources of traditional application environments.

High performance computing (HPC), or computational and data-intensive workloads, are commonly performed in grid environments. For example, Morgan Stanley uses a grid computing environment, which consists of thousands of low-cost servers networked together to form a large aggregate pool of compute resources, to perform economic forecasting and risk analysis. In each of these use cases, a large data set is analyzed and produces a specific result that is viewed by a small set of users.

Many scientific and government organizations use grid or distributed computing because it is a low-cost method that provides access to large amount of compute resources. Many of these use cases fall outside our definition of private cloud, given the use of compute power from outside resources.

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**Grid Vendors**

Grid computing is constructed using middleware software to manage a resource pool. Some of the major providers of grid computing middleware are DataSynapse (TIBCO), Oracle Grid Engine, Platform Computing, ScaleOut Software, Avaki, GridIron, Ejasent (Veritas), Enigmatel, IBM, HP, RightScale, and GoGrid (hosted private cloud). There are also several open source solutions, including Globus Toolkit, gLite, UNICORE, and GridGain.

Apache Hadoop is a popular open-source software framework for distributed/grid-computing environments that enable applications to analyze large data sets. MapReduce, first introduced by Google in 2004, is one of the more popular subprojects within the Hadoop framework. MapReduce consists of two functions – Map and Reduce. Map takes large computational problems, breaks them down into smaller sub-problems and distributes those to worker nodes, which solve the problem and pass the answer back to the master node. The Reduce function consolidates the answers from the Map function to produce the final output. Search algorithms (public cloud) are often designed in this fashion. In fact, Yahoo! is one of the largest contributors to the open-source Hadoop project.

Exhibit 123  
**Hadoop Use Cases: Gartner**

Financial services	Discover fraud patterns based on multi-years worth of credit card transactions and in a time scale that does not allow new patterns to accumulate significant losses. Measure transaction processing latency across many business processes by processing and correlating system log data.
Internet retailer	Discover fraud patterns in Internet retailing by mining Web click logs. Assess risk by product type and session/Internet Protocol (IP) address activity.
Retailers	Perform sentiment analysis by analyzing social media data.
Drug discovery	Perform large-scale text analytics on publicly available information sources.
Healthcare	Analyze medical insurance claims data for financial analysis, fraud detection, and preferred patient treatment plans. Analyze patient electronic health records for evaluation of patient care regimes and drug safety.
Mobile telecom	Discover mobile phone churn patterns based on analysis of CDRs and correlation with activity in subscribers' networks of callers.
IT technical support	Perform large-scale text analytics on help desk support data and publicly available support forums to correlate system failures with known problems.
Scientific research	Analyze scientific data to extract features (e.g., identify celestial objects from telescope imagery).
Internet travel	Improve product ranking (e.g., of hotels) by analysis of multi-years worth of Web click logs.

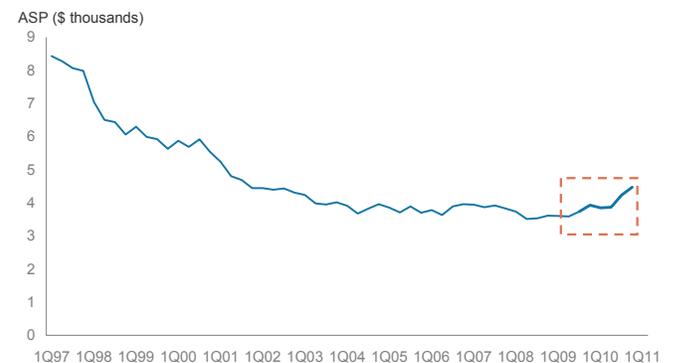
Source: Gartner, Morgan Stanley Research

**Server characteristics: scale-up vs. scale-out**

To scale up means to add resources vertically to a single node in a system and to scale out refers to the process of

horizontally adding more nodes to a system. Grid computing is an example of scaling out, given that it typically involves a network of low-cost, commodity servers with minimal extra features and that users are only interested raw microprocessing power. Conversely, higher-server configurations (more cores or CPUs) are used in virtualized environments because multiple programs and users will effectively access the same server. As a result, server ASPs (x86 servers) have started to increase on a year-over-year basis during the ramp-up of server virtualization.

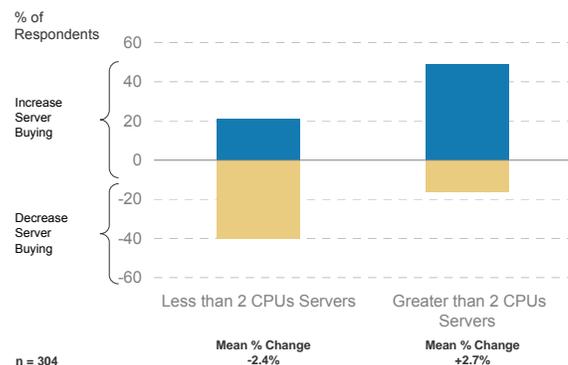
Exhibit 124  
**Increasing x86 Server Average Selling Prices due to Virtualization**



e= IDC estimates  
Source: IDC, Morgan Stanley Research

Responses from our survey of over 300 IT decision makers indicate server ASPs should continue to rise. Over three next years, 50% of IT decision makers plan to purchase servers with two or more CPUs, while 40% plan to decrease spending on servers with two or fewer CPUs. In total, servers with more than two CPUs should see spending increase 2.4%, while spending on lower configurations declines 2.9%.

Exhibit 125  
**Virtualization is driving an Increase in CPUs per Server**



Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

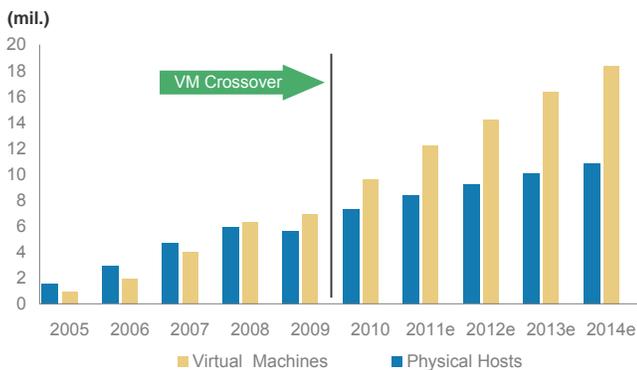
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**Virtualization moves into the mainstream**

We see virtualization moving more into the mainstream in 2011, which includes server virtualization moving more deeply into production workloads and tier 1 and tier 2 applications. Lower price points and more approachable technology is also opening the small- and medium-sized business space to virtualization. As more workloads move into virtual environments from physical, we should see vendors move more deeply into management, availability, security, and other adjacent markets. Additionally, we think 2011 will be a key year for the adoption of desktop virtualization (DV) — and server virtualization technology is needed to run the virtual desktops on the server. While 2010 saw the initial move of DV from pilot projects to production, we look for a more significant inflection towards mainstream adoption in 2011, and model market growth of over 60% in 2011.

As shown in the exhibit, substantially more VMs were deployed worldwide in 2010 than physical servers were shipped. Our sense is that more comfort with x86 virtualization technology over the first decade of availability could actually accelerate the next phase of penetration, while opening new markets in management and security.

Exhibit 126  
**Worldwide VM Deployments Exceeded Physical Server Shipments in 2009 for the First Time**



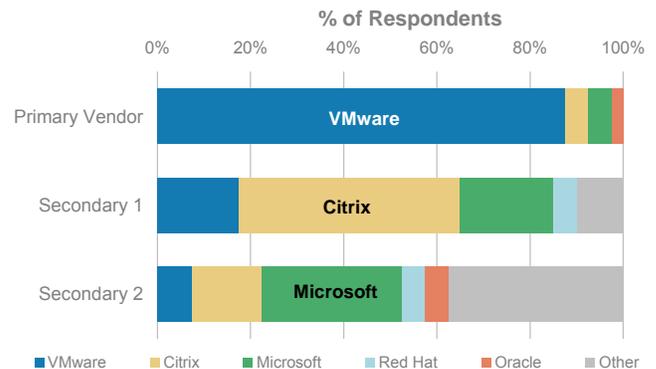
Source: Company data, IDC, Morgan Stanley Research

**VMW should maintain market leadership**

We recently surveyed 40 heavy server virtualization users, CIOs spending \$100,000 or more annually on virtualization. While our survey results may have some selection bias, 88% of respondents reported VMware as their primary server virtualization vendor, indicative of VMware’s continued dominance of the server virtualization market. That said, most

customers also consider other platforms to add a secondary vendor to their environments, with Citrix holding major share there (48% of respondents use it as a secondary platform), followed by Microsoft.

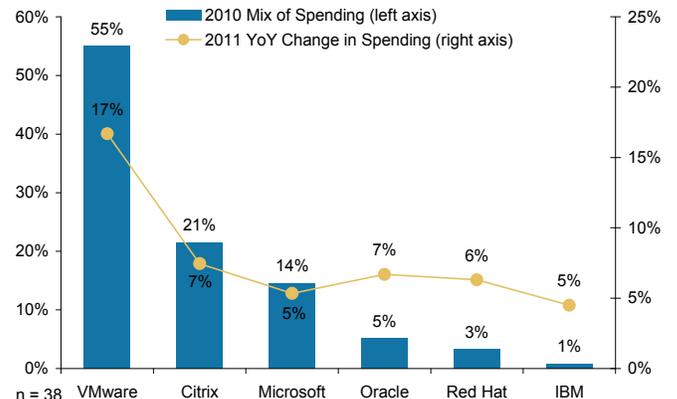
Exhibit 127  
**88% of Customers Use VMW as their Primary Vendor for Server Virtualization**



Source: Morgan Stanley, April 2011 CIO Survey

In a broader survey of 150 CIOs, 76% of all respondents reported having already deployed server virtualization, with VMware accounting for an average 55% of server virtualization spend, followed by Citrix (21%), and Microsoft (14%). Impressively, respondents expect to increase their spending with VMware by an average 17% in 2011, well above expected growth for other vendors, which range from 5–7%. The results provides further evidence that VMware should maintain its dominant position in the server virtualization market near term.

Exhibit 128  
**Customers Look to Grow Server Virtualization Spending 17% with VMW**



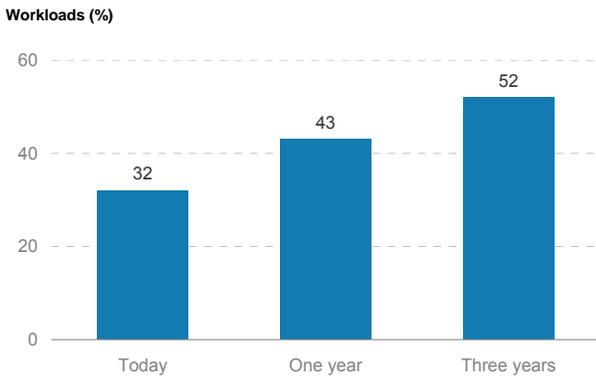
Source: Morgan Stanley, April 2011 CIO Survey

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**Server virtualization penetration set to increase materially**

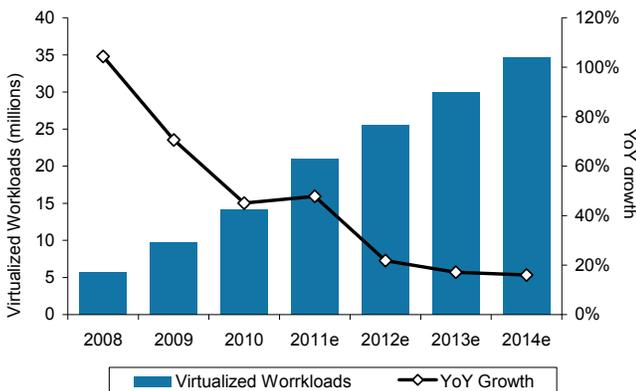
Our survey data suggests that penetration of server virtualization should increase substantially over the next three years. Current penetration of x86 workloads is reported to be 32%, moving to 43% in the next year and 52% in three years. However, as VM density (VMs per physical server) continues to increase, workload penetration and virtualized server growth does not have a one-to-one correlation. Our revised server model looks for a 28% three-year CAGR for virtualized workloads in on-premise environments. However, as average VM density increases from 6.2 to 7.0 over the next three years, the corresponding CAGR for virtualized servers is just 8%. We would note though, virtualized server growth is expected to be much more robust in managed hosting and public cloud environments — 23% and 61%, respectively — although off much smaller bases.

Exhibit 129  
**Material Increase in the Penetration of Virtualization into the X86 Base...**



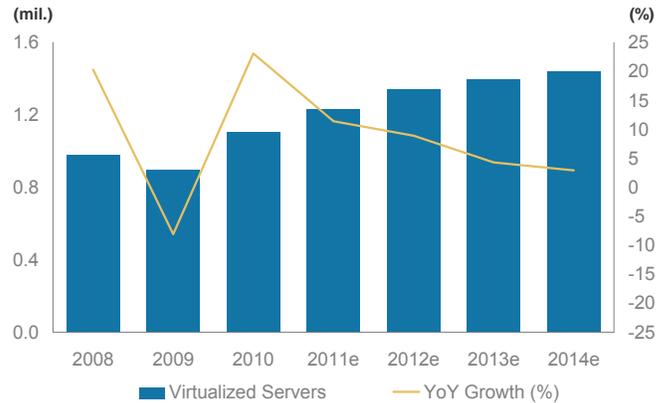
Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

Exhibit 130  
**...Drives Robust Growth in Virtualized Workloads...**



Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

Exhibit 131  
**...But Increased VM Density Results in Lower Virtualized Server Growth**



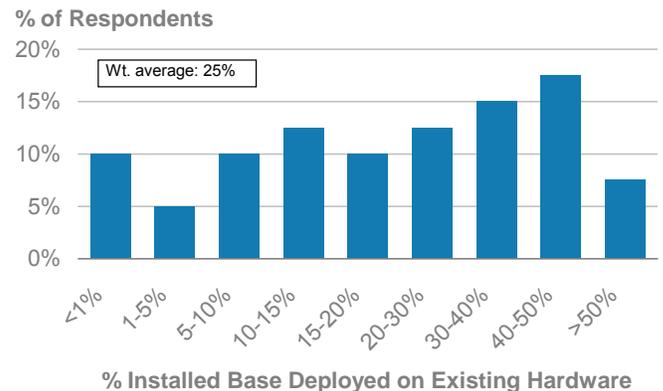
Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

**Installed base opportunity is material**

While x86 server shipments have been and will likely remain a key driver of growth for the server virtualization market, the back-to-base opportunity is accelerating. Our survey data suggests that about 25% of virtualized servers came from deploying virtualization on existing hardware versus new servers. This is in contrast to our checks, which until recently suggested a percentage closer to about 5%. We attribute the shift to greater comfort with production deployments and to the free and low-priced virtualization offerings from Citrix and Microsoft that are encouraging customers to deploy virtualization on existing servers. We think virtualization of existing servers will become more prevalent.

Exhibit 132  
**25% of Installed Base of Virtualized Servers is Deployed on Existing Server Hardware**

Within your virtualized server base, what % was deployed on existing servers vs. brand new servers?



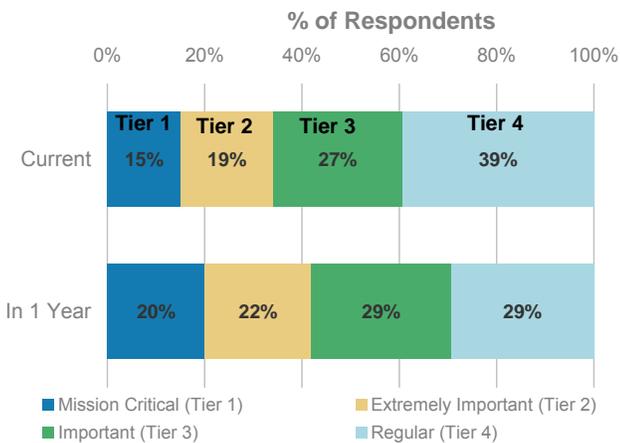
Source: Morgan Stanley, April 2011 CIO Survey

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**Virtualization on more tier-1 and tier-2 workloads**

We expect more tier-1 (mission-critical) and tier-2 (extremely important) workloads to be virtualized over the next year, enabling the next leg of penetration. Among customers that spend more than \$100,000 annually on server virtualization, our data indicates tier-1 and tier-2 make up 34% of virtual workloads, which respondents expect to increase to 42% in one year. Notably, tier-1 workloads are expected to see a sharp increase from 15% of workloads to 20% in one year. Cost savings, better management capabilities, and simplified storage and recovery are the most frequently cited benefits of virtualizing tier-1 and tier-2 workloads — with each cited by nearly two thirds of respondents in our survey.

Exhibit 133  
**Respondents Expect to Virtualize More tier-1 & 2 Workloads in the Next One Year**

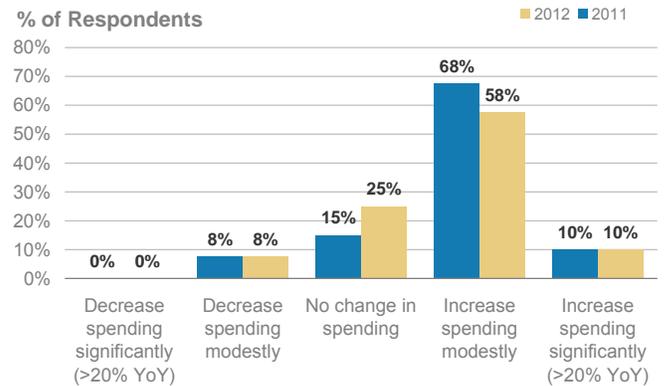


Source: Morgan Stanley, April 2011 CIO Survey

**Adoption of management capabilities is inflecting**

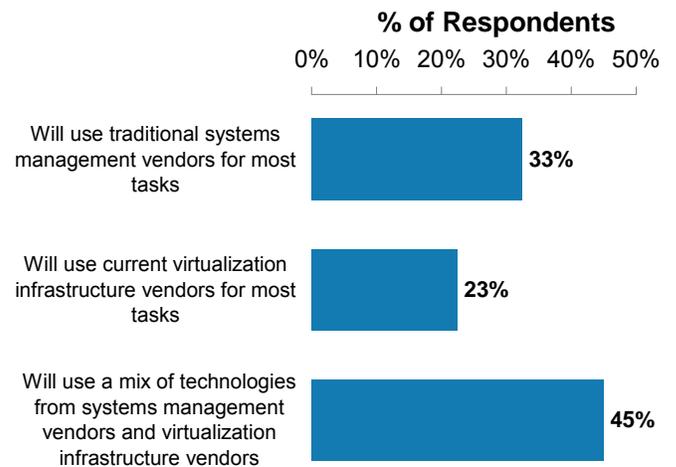
As penetration of virtualization in the data center has increased and the number of virtual machines has proliferated, customers are looking to increase their spending on management tools. We think that less than 10% of companies have adequate management tools for their virtual environments today. In the same survey, 78% of respondents expect to increase spending on management tools in 2011, suggesting an inflection this year. VMware launched several management modules in the last 12 months and should be able to increase substantially its management module attach rate from its current rate of 5-7%. We estimate that the addition of incremental management functionality to existing infrastructure deployments could add several hundred millions of dollars in license revenues for VMware in 2011.

Exhibit 134  
**Nearly 80% of Customers Expect to Increase Spending on Management Tools in 2011**



Source: Morgan Stanley, April 2011 CIO Survey

Exhibit 135  
**Virtualization Vendors Gain Traction with Customers for Systems Management Functionality**



Source: Morgan Stanley, April 2011 CIO Survey

## What cloud computing is not

The following business models do not come under the purview of cloud computing because they do not provide truly multi-tenant, on-demand computing service.

### Traditional managed hosting/colocation providers.

Traditionally, managed hosting/colocation providers like Terramark, Rackspace, and Savvis purchased and actively maintained customer hardware (servers, networking gear) and sometimes software (core applications, operating systems). However, now many of these traditional hosting/colocation providers are offering cloud infrastructure and platform services to complement their traditional hosting services.

**IT/business outsourcing.** Traditional IT outsourcing vendors like Accenture, EDS, and Infosys do not provide on-demand cloud services and hence do not come under the purview of cloud computing.

## Cloud Consolidation

We see three key drivers of consolidation in the cloud space: 1) the need for specific intellectual property, technological capability, or human capital; 2) the desire to build increased scale in an already established cloud based model; or (3) the need to diversify a business mix to support a weakening traditional revenue stream.

Rackspace's M&A history (Slicehost, Jungledisk, Cloudkick, and Anso Labs) provides examples of the first category, with each acquisition meant to augment the product set, add cloud management capabilities, or provide expertise in broadening adoption of open standards.

On the other hand, the telcos (i.e., Verizon and CenturyLink) have recently purchased data center businesses with cloud-based offerings to help improve the growth prospects for flat or declining legacy revenues. SoftLayer's recent merger with The Planet is an example of the second category, with two large managed hosting/cloud computing companies combining to benefit from enhanced scale and cross-selling.

Exhibit 136

## Robust M&A Environment for Cloud-Related Deals

Cloud M&A		
Date Announced	Acquirer	Target
5/10/2011	Microsoft	Skype
5/2/2011	Limelight Networks, Inc.	Clickability, Inc.
4/26/2011	SuccessFactors, Inc.	Plateau Systems Ltd.
3/30/2011	Radian6 Technologies, Inc.	Radian6 Technologies, Inc.
3/22/2011	Meltwater Group	JitterGram, Inc.
3/14/2011	SuccessFactors, Inc.	Jambok, Inc.
3/3/2011	Inmedius, Inc.	KnowledgeXTensions, Inc.
2/1/2011	Salesforce.com, Inc.	Manymoon
2/1/2011	Taleo Corp.	Cytiva Software, Inc.
1/19/2011	SolarWinds, Inc.	Hyper9, Inc.
1/18/2011	Adobe Systems, Inc.	Demdex, Inc.
1/18/2011	RightNow Technologies, Inc.	Q-go.com BV
1/16/2011	Salesforce.com, Inc.	Dimdim, Inc.
1/15/2011	Sourcefire, Inc.	Immunet Corp.
12/20/2010	Lawson Software, Inc.	Enwisen.com, Inc.
12/17/2010	Citrix Online LLC	Netviewer AG
12/17/2010	GCF International, Inc.	Division 5 Technology, Inc.
12/14/2010	Cloudbees, Inc.	Stax Networks, Inc.
12/8/2010	Salesforce.com, Inc.	Heroku, Inc.
11/30/2010	Red Hat, Inc.	Makara, Inc.
11/2/2010	Oracle Corp.	Art Technology Group, Inc.
10/19/2010	CollabNet, Inc.	Codesion, Inc.
10/18/2010	SuccessFactors, Inc.	Epista Software A/S
9/20/2010	SumTotal Systems, Inc.	Softscape, Inc.
9/1/2010	Kenexa Corp.	Salary.com, Inc.
9/1/2010	Taleo Corp.	Learn.com, Inc.
8/31/2011	VMware	TriCipher
8/30/2010	Citrix	VMLogix
8/26/2010	HP	Stratavia
8/19/2010	Hitachi Data Systems	ParaScale
8/12/2010	CA, Inc.	4Base Technology
8/12/2010	Voxeo	Teleku
7/29/2010	Quest Software	Surgient
7/1/2010	Dell	Scalent
5/6/2010	VMware/SpringSource	GemStone Systems
5/3/2010	IBM	Cast Iron Systems
4/13/2010	VMware/SpringSource	Rabbit Technologies
4/6/2010	iWave Software	Enigmatic
3/22/2010	TDS Telecommunications	VISI
3/10/2010	CA	Nimsoft
2/24/2010	CA	3Tera
2/5/2010	Bick	Blue Mountain Labs
1/27/2010	Good Technology	CloudSync
1/11/2010	CA	Oblicore
12/11/2009	Microsoft	Opalis Software
9/14/2009	CA	NetQoS
9/13/2009	Intuit	Mint.com
9/1/2009	Intalio	Webtide
8/31/2009	EMC	FastScale Technology
8/24/2009	TIBCO	DataSynapse
8/18/2009	Mirantis	Grid Dynamics
8/10/2009	VMware	SpringSource
7/21/2009	Host.net	Fairway Consulting Group
7/17/2009	HP	IBRIX
6/23/2009	iWeb Group	Netsimplify Solutions
6/15/2009	SpringSource	Cloud Foundry
6/2/2009	Intuit	PayCycle
6/2/2009	CA	Cassatt Corp.
5/7/2009	Socius	J.D. Cloud
5/4/2009	SpringSource	Hyperic

Source: The 451 Group, Tier-1 Research, Morgan Stanley Research

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Exhibit 137

## Recent Cloud/Data Center M&A Activity in the Telecom Space

Strategic				
Target	Acquirer	Date Announced	Price (EV)	LTM EV / EBITDA Pre-Synergies
SAVVIS	CenturyLink	Apr-11	\$3.2	10.9x
Terremark	Verizon	Jan-11	\$1.9	21.0x
Navisite	Time Warner Cable	Jan-11	\$0.3	11.4x
Team Technologies	TDS	Dec-10	\$0.05	NA
Hosted Solutions	Windstream	Nov-10	\$0.3	10.0x
Fusepoint	SAVVIS	Jun-10	\$0.1	10.4x
CyrusOne	Cincinnati Bell	May-10	\$0.5	12.5x
Switch and Data	Equinix	Oct-09	\$0.9	11.4x
IX Europe	Equinix	Jun-07	\$0.5	30.6x
Data Return	Terremark	May-07	\$0.1	19.3x

Private Equity				
Target	Acquirer	Date Announced	Price (EV)	LTM EV / EBITDA Pre-Synergies
Peak 10	Welsh, Carson, Anderson & Stowe	Sep-10	\$0.4	NA
Q9 Networks	ABRY Partners	Aug-08	CAD 0.3	18.8x
Hosted Solutions	ABRY Partners	Apr-08	\$0.1	NA

Source: Company data

### Emerging Cloud Projects

We continue to see further innovation in the cloud space on a near daily basis. Open standards for IaaS and PaaS, more seamless hardware integration in the data center, and greater architectural efficiencies around data center design are all key areas of focus. We detail a few examples below.

**VMware's Cloud Foundry.** A VMware-led project billed as the world's first open PaaS offering. Cloud Foundry provides a platform for building, deploying, and running cloud apps using Spring for Java developers, Rails and Sinatra for Ruby developers, Node.js and other Java Virtual Machine frameworks, including Grails. Essentially, VMware is opening its development environment to provide more ways to create and administer cloud-based applications, offering far more options for developers when it comes to variables like programming and storage:

- <http://cloudfoundry.com/>. A complete PaaS environment hosted by VMware for the development and deployment of new applications.
- <http://cloudfoundry.org/>. An open-source project where developers and community members can collaborate and contribute to the project. The open source cloud development environment can be used as a front end for multiple cloud infrastructure providers.

**Rackspace Open Stack Initiative.** In collaboration with NASA, Dell, Citrix, Equinix, and others, Rackspace launched an open-source cloud development platform in July of 2010.

Open Stack adoption serves to eliminate proprietary lock-in and create a commoditized cloud architecture with high scalability. All of the code for Open Stack is freely available for developers to access, build, run applications on—or to change. Lew Moorman, Rackspace's head of Cloud Operations, has said, "What Android is to smartphone operating systems, we want Open Stack to be for the cloud" (as told to Gigaom.com, July 2010).

**Cisco UCS/VMware vBlock.** Cisco UCS (unified computing system) is a single system that combines network connectivity with virtualized storage and compute capabilities for more efficient capacity utilization within the data center. vBlock allows cloud-service providers to enhance the scalability of their architecture through a standardized infrastructure including Cisco's UCS servers, Nexus 1000v and MDS switches, VMware's vSphere, and EMC storage products.

**Red Hat's Cloud Foundations.** In June 2010 Red Hat started its Cloud Foundations program (open PaaS architecture), allowing customers to build private cloud environments with a streamlined and straight-forward implementation process. In Edition One, Red Hat provided configuration specifications for creating cloud deployments, tools to help facilitate customer migration to the cloud, and a training program to foster rapid development of cloud expertise. In August, Red Hat announced that DreamWorks Animation would use the Cloud Foundations platform to derive scale benefits in the production setting. Cloud Foundations is also vendor agnostic, allowing customers to use existing infrastructure or another provider like Amazon EC2.

**Facebook's Open Cloud Project.** Facebook recently announced that it had been able to realize significant efficiency advantages over traditional data centers and servers. The company custom designed its compute architecture with "vanity free servers" that are 38% more efficient and 24% less expensive than other state-of-the-art data centers. Facebook said that its Oregon data center now ranks as one of the most efficient in the world with a PUE (power utilization efficiency) score of 1.07 (suggesting that 93% of the energy coming into the facility is absorbed by the server infrastructure). Additionally, Facebook released the hardware specifications for its custom designed servers, allowing anyone to contribute ideas or innovations.

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## Appendix I: Morgan Stanley Best Positioned for Cloud Migration Basket Constituents (Bloomberg ticker: <MSMSBPCM>)

Our *Morgan Stanley Best Positioned for Cloud Migration* basket contains 19 stocks covering five sectors. However, within the tradable basket, Quanta and Wistron have been removed because they trade in a different market and Taleo's weighting has been reduced because of liquidity constraints. The basket is denominated in US dollars.

Company	Ticker	Sector	Weight
Salesforce.com	CRM	Software	6.2%
VMware	VMW	Software	6.2%
SuccessFactors	SFSF	Software	6.2%
Citrix	CTXS	Software	6.2%
Taleo*	TLEO	Software	1.0%
EMC	EMC	Hardware	6.2%
Teradata	TDC	Hardware	6.2%
Quanta*	2382-TAI	Hardware	NA
Wistron*	3231-TAI	Hardware	NA
NetApp	NTAP	Hardware	6.2%
Rackspace Hosting	RAX	Telecom Services	6.2%
Juniper Networks	JNPR	Telecom Equipment	6.2%
F5 Networks	FFIV	Telecom Equipment	6.2%
Riverbed Technology	RVBD	Telecom Equipment	6.2%
Broadcom	BRCM	Semiconductors	6.2%
Cavium Networks	CAVM	Semiconductors	6.2%
SanDisk	SNDK	Semiconductors	6.2%
Accenture	ACN	IT Services	6.2%
Cognizant Technology	CTSH	IT Services	6.2%

\*Cited as Best Positioned for Cloud Migration by analyst, but removed from the tradable basket due to liquidity concerns or trade only on overseas market.

An investable basket: Morgan Stanley Research has created a basket of stocks that we believe are most positively geared to the themes outlined in this report. The basket can be viewed on Bloomberg under the symbol MSMSBPCM. Type MSES <Go> to access the Morgan Stanley Equity Baskets / Indices homepage and select Strategy / Research <MSMSBPCM>.

The information contained herein has been prepared solely for informational purposes and is not a solicitation of any offer to buy or sell any security or other financial instrument or to participate in any trading strategy. Products and trades of this type may not be appropriate for every investor. Please consult with your legal and tax advisors before making any investment decision.

Please contact your Morgan Stanley sales representative for more details.

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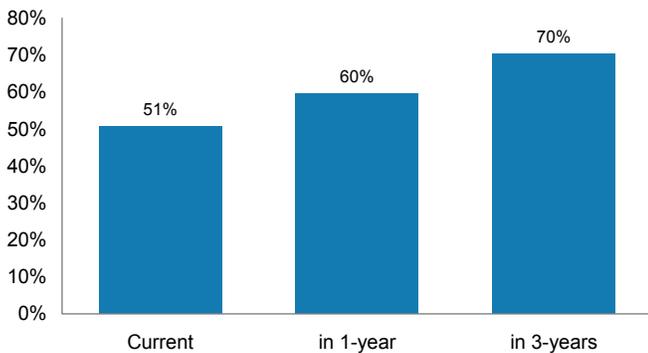
## Appendix II: Cloud Survey Results

Morgan Stanley AlphaWise conducted a global survey of IT managers in March-April 2011 as a part of this report. During the course of the survey, the AlphaWise team interviewed 304 companies, of which 103 were located in the US, 101 in Europe, and 100 in the Asia-Pacific region. Of the companies interviewed, 198 had more than 500 employees and the rest had fewer than 500. The key findings of the survey are discussed below.

### Half of Companies are Running Workloads in Public Cloud or Managed Hosting Environments

At a high level, roughly half of respondents cited using either a public cloud (SaaS/PaaS/IaaS) or a managed hosting model to run at least a portion of their workloads, with the expected percentage increasing to 70% over the next three years. While this in itself does not reflect the level of intensity to which companies are actively using cloud services, it does demonstrate a high and increasing level of willingness to explore the benefits of on-demand models.

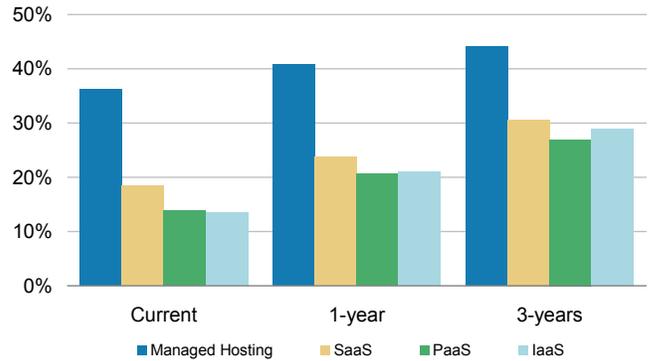
Exhibit 138  
**Half of Respondents Using Managed Hosting or Public Cloud Today, Growing to 70% in Three Years**



Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

As we think about which areas of cloud computing are currently of most interest to companies, we note that roughly twice as many companies utilize the managed hosting model, as opposed to the closest public cloud delivery mechanism, SaaS. Managed hosting has made sense for many companies historically because of the lower associated infrastructure cost compared with on-premise delivery, while still providing some flexibility around scalability. However, as companies have gained more comfort around potential barriers like security concerns and the lack of complete infrastructure/operational control and have gained clarity on the ROI, adoption of the public cloud has gained momentum.

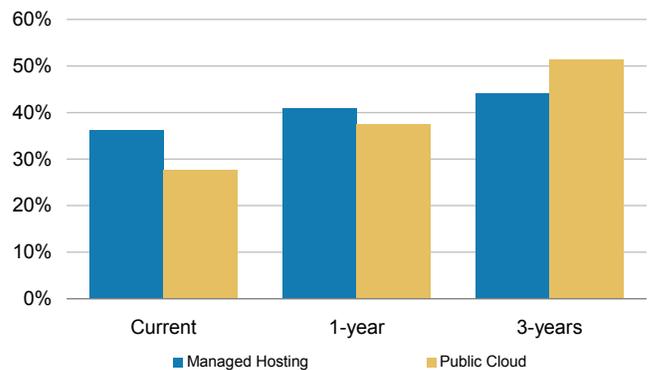
Exhibit 139  
**Managed Hosting is the Most Common Off-Premise Delivery Environment Today...**



Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

The gap between the percent of companies utilizing managed hosting and the most common public cloud delivery environment, SaaS, stands at about 18% today. However, respondents effectively project that gap to shrink to about 12% over the next three years. At that point, more companies will be using some variety of public cloud delivery (51%) than managed hosting (44%), with roughly equal usage of SaaS, PaaS, and IaaS.

Exhibit 140  
**... But Public Cloud Usage Will Likely Surpass in Next Three Years**



Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

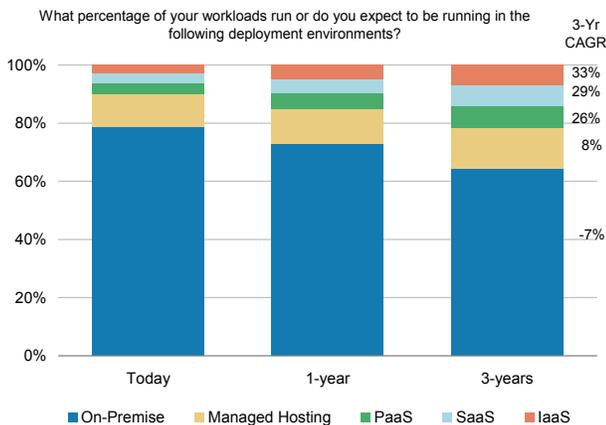
### Actual Workloads in the Public Cloud Expected to Increase at Nearly 30% CAGR

Our survey looked more closely at where actual workloads are run to get a better idea of where the greatest effect on server purchasing habits might be, as different workloads have different processing requirements. Even though 51% of companies currently use some form of on-demand delivery,

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only 21% of actual workloads are currently running in a cloud environment, implying that companies continue to rely heavily on on-premise hardware. However, the number of workloads run in the cloud is expected to grow to 36% over the next three years, with IaaS demonstrating the fastest growth in deployment environment from 3% to 7% of all workloads (33% CAGR). This is followed by SaaS with a 29% CAGR, PaaS at 26%, managed hosting at 8%, and last, on-premise with a 7% annual decline.

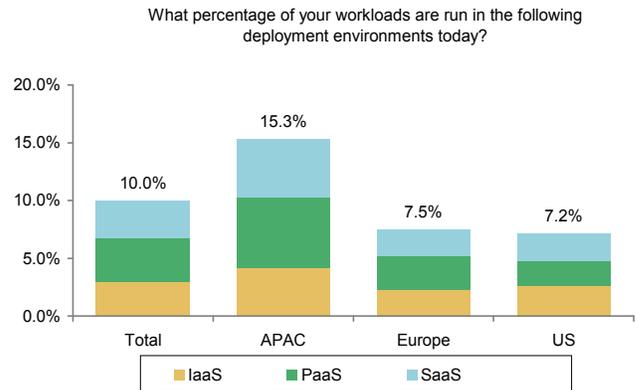
Exhibit 141  
**Workloads in IaaS Expected to Grow at Fastest Rate, Followed by SaaS and PaaS**



Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

An interesting data point in the survey data accompanies the distribution of public cloud workloads across various regions. Asia actually demonstrates the highest level of penetration today across respondents, at more than twice the level found in Europe or the US. In particular, companies in China and Japan are the heaviest users of the public cloud, with more than 73% and 65% of those in our survey from those countries, respectively, provisioning workloads in SaaS, PaaS, or IaaS environments, representing nearly 37% and 27% of workloads (compared with the 10% of workloads in public clouds across our entire survey). Of those, SaaS and PaaS represent the largest two areas of usage. The pervasiveness of the public cloud in Japan is not that surprising when one considers that Salesforce.com (the largest standalone SaaS vendor) actually established a joint venture in Japan more than 10 years ago with SunBridge Corp., a Japanese VAR of international enterprise software. It is somewhat surprising, though, that penetration in Asia is so much greater than in the US, the base and focus for most of the largest cloud vendors.

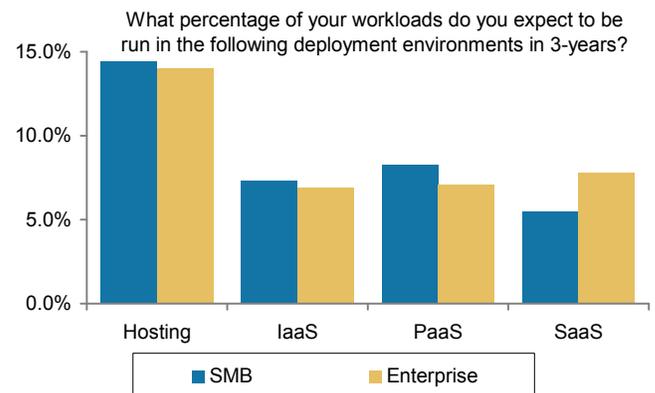
Exhibit 142  
**Asia-Pacific Companies Provision Twice as Many Workloads in Public Cloud vs. Europe and US**



Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

In addition to differences across geographies, our survey also picked up some interesting differences in expectations between small/medium-sized businesses and enterprises. While both believe they will be utilizing managed hosting and IaaS in similar quantities, we note differences in deploying PaaS and SaaS. Enterprise responses indicate that they expect nearly 42% greater penetration in deploying in SaaS environments than do small/medium-sized businesses, but enterprises expect roughly 14% less in PaaS.

Exhibit 143  
**Enterprise Expects Greater Usage of SaaS as Compared with SMBs, Opposite for PaaS**



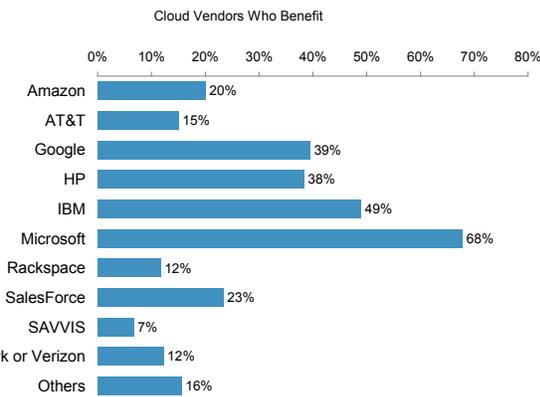
Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

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### Several Cloud-Based Vendors to Benefit

Several vendors with cloud offerings stand to benefit from this trend. Many of these vendors—Amazon, IBM, Microsoft—have established cloud products and have been active in this space for a number of years.

Exhibit 144  
**Cloud Vendors that Benefit**



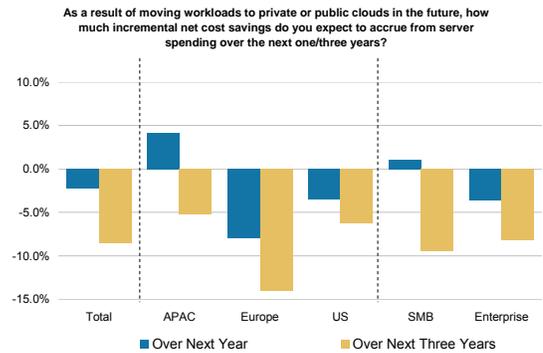
Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

**We note that although several vendors stand to benefit from this trend, Microsoft is likely to gain most from a broader adoption of the cloud.** Of all respondents, 68% of all respondents who expect to move workloads or provision new ones to the cloud environment mention Microsoft as their preferred vendor of choice—a surprisingly high number. This is consistent across regions and company size.

### Largest Reduction in Infrastructure Spending Expected to be on Servers

One of the more significant benefits of moving to the cloud is a reduction in spending on infrastructure that tends to be underutilized. A majority of our respondents believe that cloud migration will result in a decrease in server, storage, and networking spending over the next three years.

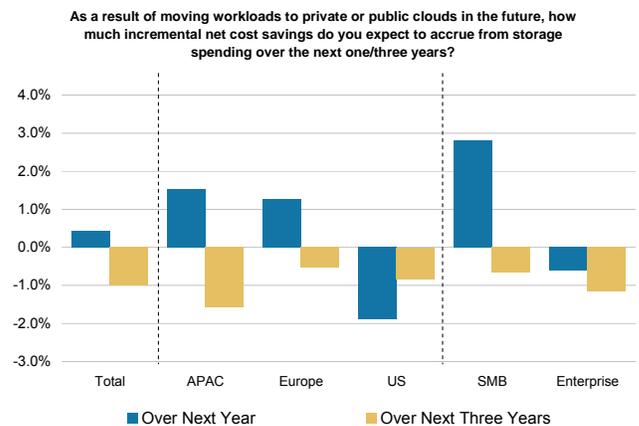
Exhibit 145  
**Server Spending Expected to See Declines across All Geographies and Company Sizes**



Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

Of those surveyed who do not expect to be 100% on-premise within the next three years, the largest area of spend reduction will be on servers. On average, respondents expect that related expenditures will decline 2.2% over the next year and 8.6% over the next three years, specifically because of the migration of workloads to cloud environments. This decline appears more pronounced in Europe, with a 14.1% decline in spending over the next three years and more modest cuts in Asia-Pacific (5.3%) and the US (6.3%).

Exhibit 146  
**Storage Spending Expected to Modestly Decline**



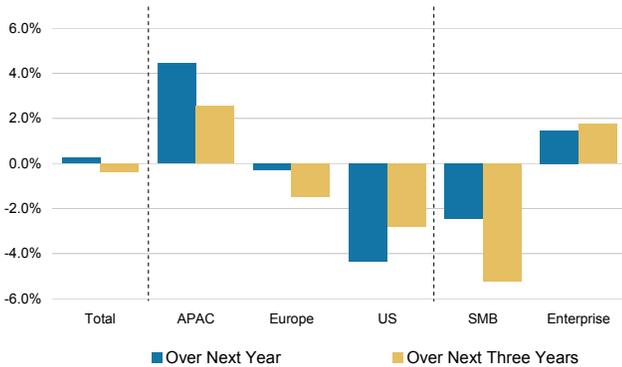
Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

Storage spending is actually expected to increase modestly over the next year across most segments (and overall), although it will likely see modest declines over the longer term but not nearly to the degree that we see within servers.

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Exhibit 147  
**Networking Spending Expected to be Unchanged Overall, but Strength/Weakness in Certain Areas**

As a result of moving workloads to private or public clouds in the future, how much incremental net cost savings do you expect to accrue from networking spending over the next one/three years?



Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

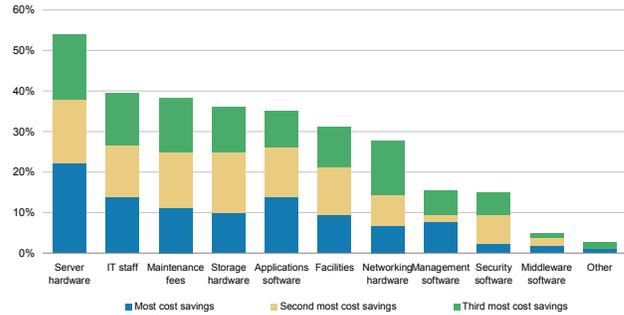
Network spending expectations are actually one of the more interesting areas within infrastructure spending changes, as overall there does not appear to be any significant change in behavior. However, when broken out by geography and company size, we see patches of both strength and weakness. Asia-Pacific respondents expect to increase spending by more than 4% over the next year and 2% over the next three years, while US companies expect to spend nearly 4% less in the next year, moderating to -3% over the next three years. Similarly, enterprises worldwide expect to spend more over both the one- and three-year periods, while small-/medium-sized businesses expect a 2.5% decline over the next year and a greater-than-5% decline in spending over the next three years.

**Cost Savings Expected across Wide Range of Areas, With Server Hardware the Most Significant**

As we look across the entire spectrum of areas where those responding expect the largest spending declines to be, server hardware was, not surprisingly, the area noted for the most cost savings (54% of respondents). While this holds true across all geographies and customer size segmentations, respondents noted some differences in the second- and third-greatest areas for cost savings. While IT staff costs and maintenances fees were the next two areas of largest savings overall (39% and 38%, respectively), application software savings are expected to provide the second greatest cost savings in Europe and small-/medium-sized businesses (41% and 40%), while storage hardware is the third-largest area for savings in Europe (41%).

Exhibit 148  
**Server Hardware Expected to Provide Biggest Area of Cost Savings**

If you do expect to provision new workloads or move existing workloads to private or public cloud environments in the future, what are the top three areas where you expect to see cost savings?



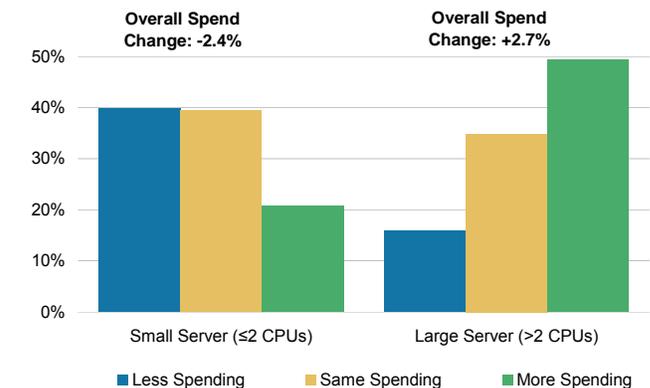
Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

**Larger Share of Spend Expected to Go Towards Larger Capacity Servers v. Smaller Over Next Three Years**

Taking into account companies that are planning to migrate some processes to the cloud, as well as those that expect to remain 100% on-premise, spending on small capacity servers (defined as having fewer than two CPUs) is expected to decline 2.4%, as only 20% of companies expect to spend more in this segment. This contrasts with expected spend on large-capacity servers, where spending is expected to increase by roughly 2.7% over the next year, as nearly 50% of companies expect to increase their spending on this type of server.

Exhibit 149  
**Virtualization Shifting Demand toward Larger Servers**

How do you expect your server buying patterns to change in regards to server size over the next year?

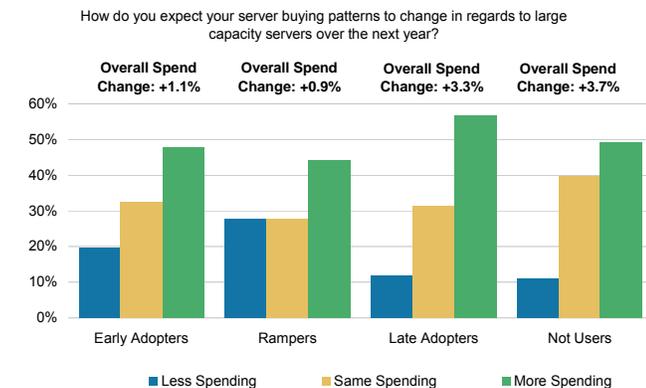


Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

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Because of the data we obtained regarding the percentage of respondent workloads currently in the cloud and those expected to be, we were able to divide some of the data based on the adoption status of companies. We use the descriptors “Early Adopters” (currently greater than 25% of workloads in the cloud), “Rampers” (greater than 25% of workloads expected to be in the cloud within three years), “Late Adopters (1-24% of workloads within three years) and “Not Users” (0% of workloads in three years). Cutting across the data this way, we note that companies that are not cloud users or do not expect significant penetration believe that large-capacity server spending will increase more than 3%, while cloud early adopters and rampers see a more mild 1% increase over the next year.

Exhibit 150  
**Public Cloud Users Expected to Increase Large Capacity Server Spending 1% vs. Non-Users 4%**

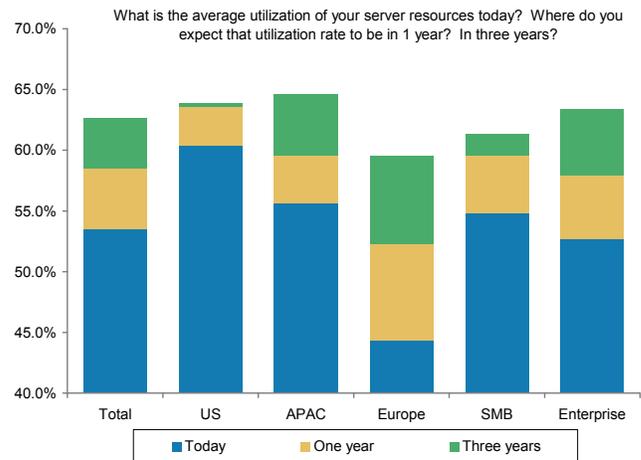


Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

**Utilization Rates Expected to Improve Significantly Over Next Three Years**

Across the board, companies expect meaningful improvements in their server utilization rates, although they do note a varying range of starting points and improvements. Overall, companies in our survey report having a 55% utilization rate today, which they expect to increase to 63% over the next three years. However, companies in Europe display the lowest current resource utilization at only 44.3%, though demonstrate the highest expected increase, to nearly 60% over the next three years, for a 15-point improvement. This strongly contrasts to US companies, which are already at 60% utilization and expect to see only another 4 points of improvement. Companies in Asia-Pacific are in between today, but actually expect to have the highest utilization rate three years from now, at nearly 65%.

Exhibit 151  
**Significant Differences in Current Utilization Rates, but Expected to Converge Over Next Three Years**



Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

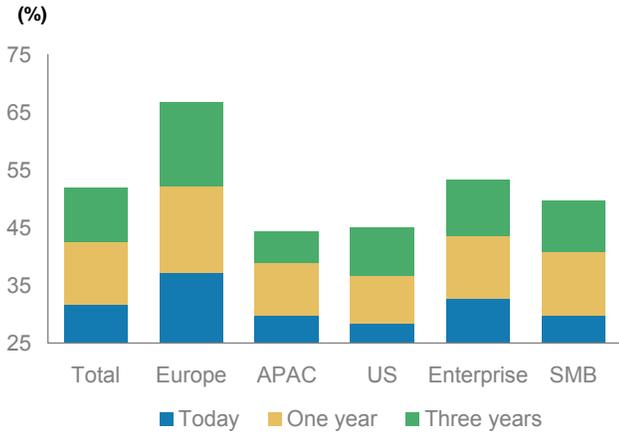
Additionally, the survey indicates that 32% of all on-premise or collocated workloads run in virtualized or private cloud environments today. Once again, our survey picked up some noticeable differences between regions, especially for Europe, where nearly 37% of workloads are in those environments today and roughly 67% project to be within three years, which is a significantly greater percentage than in any other geography or company size segment. This is somewhat surprising, considering that European companies also reported having the lowest server utilization rates and, typically, virtualization or private cloud usage would help improve those types of rates.

**Security and Uncertainty are the Two Greatest Barriers to Cloud Adoption**

Not surprisingly, data security was the most-cited reason companies gave for the decision not to move to a cloud environment, although less than half of respondents noted it as a top-three barrier. While we believe concerns about security in cloud environments have slowly dissipated over the last few years, it is still top of the mind, especially considering significant data breaches that have occurred recently. After security, the two largest barriers are the uncertain savings associated with moving to the cloud (38%) and the loss of control for the organization (33%) over factors like upgrades, backup timing, downtime, etc. Notably, companies did not cite concerns over data portability (19%) and performance (13%) very frequently as a top-three concerns for adoption.

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Exhibit 152  
**Workloads in Virtualized or Private Cloud Environments Expected to Nearly Double**



Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

Exhibit 153  
**Security Still the Largest Barrier to Cloud Adoption**



Source: AlphaWise<sup>SM</sup>, AlphaWise<sup>SM</sup>, Morgan Stanley Research

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## Appendix III: Quantifying the Cloud Impact on Server Growth

### Impact Expected to Reach 1.7 Million Total Servers by 2013

Combining our revised workload-driven server model with survey responses regarding the percentage of respondents' workloads in each type of public cloud environment, we were able to project how workloads would migrate from on-premise to on-demand environments. We then translated this forecasted workload migration to servers using other data from our survey and from companies we consulted about compression ratios. Ultimately, we were able to quantify the total impact on the server market from each of SaaS/PaaS/IaaS.

In our base case estimate, we calculate that migration towards public cloud environments resulted in a 13.6% drop in new server growth in 2010, affecting slightly more than 1 million actual server shipments. We forecast that this impact will become more pronounced in 2013, with a 19.3% drop in new server growth, affecting roughly 1.7 million servers. However, while the total server impact is highly relevant, it is important to recognize that what is just as significant, if not more so, is the degree to which the headwinds are growing or declining each year—or, the incremental impact. In our base case, we project that there was a 285,000 total incremental server impact in 2010 from public cloud migration. We forecast this number to decline to 190,000 in 2013, much lower than the total accumulated number of servers expected to be affected—1.7 million.

Exhibit 154

### Roughly 190,000-285,000 Annual Incremental Server Impact from Public Cloud

	2010	2011e	2012e	2013e
Total server migration	1,461,954	1,868,394	2,165,750	2,452,229
Public cloud vendor server purchasing				
Lower consolidation ratio	890,913	1,130,784	1,324,292	1,513,565
Base case	420,340	530,949	626,283	720,406
Higher consolidation ratio	242,157	304,792	361,425	417,693
<b>Net server loss at</b>				
<b>Lower consolidation ratio</b>	571,041	737,610	841,458	938,664
% of new servers	7.4	8.9	9.8	10.5
Incremental server impact	162,651	166,569	103,848	97,206
<b>Base case</b>	1,041,614	1,337,446	1,539,466	1,731,823
% of new servers	13.6	16.2	17.9	19.3
Incremental server impact	286,974	295,831	202,021	192,357
<b>Higher consolidation ratio</b>	1,219,797	1,563,603	1,804,325	2,034,536
% of new servers	15.9	19	21	22.7
Incremental server impact	332,871	343,806	240,722	230,212
Average	944,151	1,212,886	1,395,083	1,568,341
% of new servers	12.3	14.7	16.3	17.5
Incremental server impact	260,832	268,735	182,197	173,258

e=Morgan Stanley Research estimates.

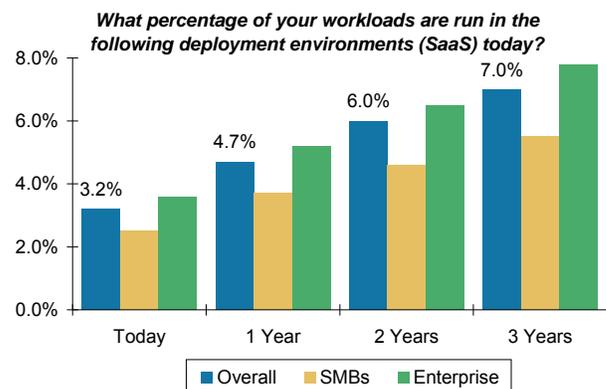
Source: Morgan Stanley Research

### Quantifying the Direct Impact of Workloads Moving to SaaS Environments

Using our total application workload forecast as our base, we can use workload migration expectations from our survey to estimate the effect on servers from migrations to SaaS environments. Our survey respondents noted an average of 3.2% of workloads running in SaaS environments today, which they expect will more than double to 7.0% over the next three years. Importantly, small-/medium-sized businesses noted a modestly lower level of migration, though they expect to see penetration rise from 2.5% to 5.5%. Enterprises also expect to more than double their SaaS workloads, from 3.6% today to 7.8% in three years.

Exhibit 155

### SaaS Workloads as Percentage of Total Workloads to More than Double Over the Next Three Years

Source: AlphaWise<sup>SM</sup>, Morgan Stanley Research

Combined with our model for the annual total installed base of workloads that could be migrated, we project 6.3 million workloads will run in a SaaS environment in 2013, as opposed to an estimated 1.8 million today. This leads to an estimated 1.3-1.7 million incremental workloads moving to or being created in SaaS environments annually for the next three years—a CAGR of 51%.

Exhibit 156

### About 1.3-1.7 Million Workloads Expected to Move to SaaS Environments Annually through 2013

	2010	2011e	2012e	2013e
Total workload base	56,850,696	65,946,807	76,630,190	89,412,106
% of workloads in SaaS	3.2	4.7	6	7
Workloads in SaaS environment	1,819,222	3,099,500	4,597,811	6,258,847
Incremental workloads moving to SaaS	836,790	1,280,278	1,498,311	1,661,036

e=Morgan Stanley Research estimates.

Source: Morgan Stanley Research

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However, as some of the workloads moving to SaaS may already be virtualized, the 1.3 million incremental workloads expected to move to SaaS in 2011 do not represent a like-to-like 1.3 million server headwind. According to IDC and others, virtualized workloads shipped are now outpacing physical workloads, compared with six years ago when physical workloads made up nearly 95% of total workloads shipped.

### Impact from SaaS on server shipments

To assess the impact from SaaS on server shipments, we quantify how many of these workloads are derived from virtualized environments as opposed to physical ones. As the virtual machine workload to server ratio is significantly higher than 1:1, these shifts represent smaller impacts on future server sales than those workloads currently on non-virtualized servers. We assume that the incremental workloads moving to SaaS have the same proportion of virtualized to non-virtualized as the underlying installed base composition (55% in 2010, increasing to 65% by 2013). Using these proportions, combined with virtual machine and non-virtual machine historical and projected compression factors, we estimate total gross server migration of roughly 690,000 to 730,000 per year due to incremental workloads running in SaaS environments.

Exhibit 157

### New Workloads in SaaS Leading to 10,000-190,000 Incremental Gross Server Migration...

	2010	2011e	2012e	2013e
Incremental workloads moving to SaaS	836,790	1,280,278	1,498,311	1,661,036
Virtualized workloads (% of Total)	49	55	61	65
Virtual workloads being migrated	408,087	704,153	913,970	1,079,673
Virtual machine compression factor	6	6	7	7
Virtual machine server impact	73,633	112,746	132,907	146,164
Non-virtualized workloads	51	45	39	35
Non-virtual workloads being migrated	428,704	576,125	584,341	581,363
Non-virtual machine compression factor	1	1	1	1
Non-virtual machine server impact	428,704	576,125	584,341	581,363
Total server migration	502,337	688,871	717,249	727,526
Incremental server impact	191,636	186,534	28,378	10,278

e=Morgan Stanley Research estimates.

Source: Morgan Stanley Research

However, this figure does not take into consideration the number of servers that the SaaS providers themselves will need to purchase to support the end-customer base. As stated earlier, part of the efficiency of public cloud providers is that the multi-tenant architecture (described in more detail earlier in our primer) allows vendors to consolidate numerous companies efficiently onto the same server—as many as 30:1 in the case of Salesforce, as discussed earlier.

At one extreme, if all SaaS companies have similar compression ratios, they would only have the need to purchase about 25,000 servers per year, thus only slightly mitigating the overall level of server migration. However, we believe that certain providers have unique characteristics in their models, which results in such a high ratio, including the size of its customer base, application type, and the company's own scale. Therefore, as we consider the buying patterns of SaaS vendors as a whole, we believe it is appropriate to take a more conservative approach, based on our discussions with companies and examining the impact in a bull/bear/base framework.

Our base case assumes a 5:1 compression ratio, our bull case a 10:1 ratio, and our bear case a 2:1 ratio. For clarity, our bull case implies that SaaS providers gain even greater efficiencies and higher consolidation ratios and therefore have to purchase fewer servers for themselves, thus dampening the overall effect on new server purchases.

### Result is About Half Million Servers Per Year

Our analysis shows a drop in total server shipments of 550,000-580,000 units per year for the next three years for our base case, whereas the average of our three cases is about 505,000-530,000 units per year, or 5-6% of expected new server sales. It is important to make the distinction though that this figure does not represent a new incremental effect on server shipments each year. For example, server manufacturers would likely have sold 368,000 more servers in 2010 if not for the incremental migration from companies to SaaS. Therefore, based on our assumptions about the percentage of workloads in SaaS environments back in 2009, we see that there was nearly a 5% headwind already embedded in last year's server shipments, which will likely peak in 2011 before easing. The reason for this decline is the greater representation of virtualized servers and workloads in the installed base. Going forward, more migration is likely to occur from already virtualized servers and therefore demonstrate a higher compression factor.

Looking at the incremental impact to server growth, in our base case there was an additional 150,000-server impact in 2010, and we expect another 150,000-server impact in 2011, before it eases to 22,000 in 2012 and 9,000 in 2013.

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Exhibit 158

### ... However, Impact is Partially Mitigated by SaaS Vendor Purchases

	2010	2011e	2012e	2013e
Total server migration	502,337	688,871	717,249	727,526
SaaS vendor server purchasing				
Lower consolidation ratio: 2-to-1	251,169	344,436	358,624	363,763
Base case: 5-to-1	100,467	137,774	143,450	145,505
Higher consolidation ratio: 10-to-1	50,234	68,887	71,725	72,753
<b>Net server loss at</b>				
Lower consolidation ratio: 2-to-1	251,169	344,436	358,624	363,763
% of new servers	3.3	4.2	4.2	4.1
Incremental server impact	95,818	93,267	14,189	5,139
Base case: 5-to-1	401,870	551,097	573,799	582,021
% of new servers	5.2	6.7	6.7	6.5
Incremental server impact	153,309	149,227	22,702	8,222
Higher consolidation ratio: 10-to-1	452,103	619,984	645,524	654,774
% of new servers	5.9	7.5	7.5	7.3
Incremental server impact	172,473	167,881	25,540	9,250

e=Morgan Stanley Research estimates.

Source: Company data, Morgan Stanley Research

### Impact of Higher/Lower Penetration and Consolidation Ratios

In the exhibit we assess the impact from changes to the percentage of workloads in SaaS environments with different adoption curves and server consolidation ratios. In our base case, we use our survey-generated SaaS penetration rates, which reach 7% in 2013 and a 5:1 SaaS server consolidation ratio. Our base case analysis suggests an incremental 150bps impact to new server growth this year, with the headwind moderating in the following two years. In our high penetration/high consolidation ratio case, SaaS gains faster acceptance, with 9% of workloads by 2013, while consolidation ratios reach 10:1. In this scenario, we see a drop of more than 360bps this year in the migration, declining 120bps further in 2012 and 30bps in 2013 (or nearly 1 million net servers). In our low penetration/low consolidation ratio case, we see slower increases in SaaS penetration, only reaching 5.5% in 2013, with SaaS providers achieving lower efficiencies, with a 2:1 consolidation ratio. In this case, we calculate the new server headwind growth to slightly moderate from 3.3% today to 2.7% over the next three years.

Exhibit 159

### Impact Ranges from 2.7%-11.0% of New Servers Depending on Penetration and Consolidation Rates

	Today	1 Year	2 Years	3 Years
Low Penetration / Consolidation Ratio	3.2	4.2	5	5.5
Net Server Loss	251,169	255,727	244,960	246,441
% of New Servers	3.3	3.1	2.9	2.7
	251,169	344,436	358,624	363,763
Base Case	3.2	4.7	6	7
Net Server Loss	401,870	551,097	573,799	582,397
% of New Servers	5.2	6.7	6.7	6.5
	401,870	551,097	573,799	582,021
High Penetration / Consolidation Ratio	3.2	5.2	7.3	9
Net Server Loss	452,103	779,660	916,149	982,644
% of New Servers	5.9	9.5	10.7	11

Source: Morgan Stanley Research

### Impact from Workloads Originating from Virtual or Physical Environments

In our base case, we assume that the workloads migrating to SaaS are proportional to the virtualized and non-virtualized workload portions in the overall installed base. This assumes that 49% of workloads were virtualized in 2010, rising to 65% in 2013. However, if the application workloads that moved to SaaS actually come from a greater percentage of physical environments, there would be a more significant impact to new server growth. Physical server workloads are migrated at a rate of 1:1 instead of the 5.5-7.4:1 compressed rate of virtualized workloads. Assuming 25% of workloads originate from virtualized environments, the headwind to 2010 server growth would have been 6.9%, as opposed to 5.2% in our base case, while the impact would become more pronounced over the next three years, at roughly 9.7%.

Exhibit 160

### More Workloads Migrating from Physical Servers Would Add 200-300bps Headwind

	Today	1 Year	2 Years	3 Years
% of Workloads Virtualized in Base	25	30	35	40
Net Server Loss	532,272	766,154	840,128	869,255
% of New Servers	6.9	9.3	9.8	9.7
	2,103,476	3,231,394	4,751,072	6,705,908
Base Case: % of Workloads Virtualized in Base	48.8	55	61	65
Net Server Loss	401,870	551,097	573,799	582,021
% of New Servers	5.2	6.7	6.7	6.5
% of Workloads Virtualized in Base	55	60	65	70
Net Server Loss	367,679	508,085	532,825	524,574
% of New Servers	4.8	6.2	6.2	5.9

Source: Morgan Stanley Research

### Impact on Servers from Migration towards PaaS and IaaS Environments

As in our SaaS impact analysis, we estimate the headwind to server growth from PaaS and IaaS. Using the data from our survey, we assume that the percentage of total workloads in PaaS increases from 3.7% today to 7.5% in three years, while IaaS workloads will increase from 3.0% of total workloads today to 7.0% of total workloads in 2013. The main difference between our PaaS/IaaS and SaaS analyses is that we have assumed a lower range of consolidation ratios. Assuming a 3:1 ratio in our base case, we believe that there was a 350,000 total headwind to new server shipments in 2010, which will increase to 570,000 by 2013, representing 6.4% of new server shipments, for a drop of 180bps, as compared with the 4.6% drop in 2010. The incremental impact is muted, at about 50,000-90,000 units per year.

Exhibit 161

**Impact of PaaS Expected to be More Muted, with only 50,000-90,000 Incremental Effect to Servers**

	2010	2011e	2012e	2013e
Total server migration	525,536	606,892	727,477	856,713
PaaS vendor server purchase				
Lower consolidation ratio: 3-to-2	350,358	404,594	484,985	571,142
Base case: 3-to-1	175,179	202,297	242,492	285,571
Higher consolidation ratio: 5-to-1	105,107	121,378	145,495	171,343
Net server loss at				
Lower consolidation ratio: 3-to-2	175,179	202,297	242,492	285,571
% of new servers	2.3	2.5	2.8	3.2
Incremental server impact	25,706	27,118	40,195	43,079
Base case: 3-to-1	350,358	404,594	484,985	571,142
% of new servers	4.6	4.9	5.7	6.4
Incremental server impact	51,412	54,237	80,390	86,157
Higher consolidation ratio: 5-to-1	420,429	485,513	581,982	685,370
% of new servers	5.5	5.9	6.8	7.6
Incremental server impact	61,695	65,084	96,468	103,389
Average	315,322	364,135	436,486	514,028
% of new servers	4.1	4.4	5.1	5.7
Incremental server impact	46,271	48,813	72,351	77,542

e=Morgan Stanley Research estimates.  
Source: Morgan Stanley Research

Looking at IaaS in a similar way, using our survey data, we estimate there was a total 290,000 server unit impact in 2010, or 3.8% of total server shipments. Based on respondents' expectations of workload migration, this should increase to a roughly 580,000 units in 2013, or 6.5% of server shipments, for an incremental impact of 270bps, or roughly 80,000-100,000 servers per year.

Exhibit 162

**IaaS Expected to Have 80,000-100,000 Incremental Effect to Servers**

	2010	2011e	2012e	2013e
Total server migration	434,080	572,632	721,024	868,494
IaaS vendor server purchasing				
Lower consolidation ratio: 3-to-2	289,387	381,754	480,683	578,996
Base case: 3-to-1	144,693	190,877	240,341	289,498
Higher consolidation ratio: 5-to-1	86,816	114,526	144,205	173,699
Net server loss at				
Lower consolidation ratio: 3-to-2	144,693	190,877	240,341	289,498
% of new servers	1.9	2.3	2.8	3.2
Incremental server impact	41,127	46,184	49,464	49,157
Base case: 3-to-1	289,387	381,754	480,683	578,996
% of new servers	3.8	4.6	5.6	6.5
Incremental server impact	82,253	92,367	98,928	98,313
Higher consolidation ratio: 5-to-1	347,264	458,105	576,819	694,795
% of new servers	0.0	0.1	0.1	0.1
Incremental server impact	98,704	110,841	118,714	117,976
Average	260,448	343,579	432,615	521,096
% of new servers	4.5	5.6	6.7	7.8
Incremental server impact	74,028	83,131	89,036	88,482

e=Morgan Stanley Research estimates.  
Source: Morgan Stanley Research

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(as of April 30, 2011)

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Stock Rating Category	Coverage Universe		Investment Banking Clients (IBC)		
	Count	% of Total	Count	% of Total IBC	% of Rating Category
<b>Overweight/Buy</b>	<b>1172</b>	<b>41%</b>	<b>470</b>	<b>48%</b>	<b>40%</b>
<b>Equal-weight/Hold</b>	<b>1158</b>	<b>41%</b>	<b>386</b>	<b>39%</b>	<b>33%</b>
<b>Not-Rated/Hold</b>	<b>114</b>	<b>4%</b>	<b>20</b>	<b>2%</b>	<b>18%</b>
<b>Underweight/Sell</b>	<b>384</b>	<b>14%</b>	<b>102</b>	<b>10%</b>	<b>27%</b>
<b>Total</b>	<b>2,828</b>		<b>978</b>		

Data include common stock and ADRs currently assigned ratings. An investor's decision to buy or sell a stock should depend on individual circumstances (such as the investor's existing holdings) and other considerations. Investment Banking Clients are companies from whom Morgan Stanley received investment banking compensation in the last 12 months.

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Overweight (O). The stock's total return is expected to exceed the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

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Unless otherwise specified, the time frame for price targets included in Morgan Stanley Research is 12 to 18 months.

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Attractive (A): The analyst expects the performance of his or her industry coverage universe over the next 12-18 months to be attractive vs. the relevant broad market benchmark, as indicated below.

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Ticker	Company Name	Close Price (as of 05/20/2011)	Ticker	Company Name	Close Price (as of 05/20/2011)
ABVT.N	AboveNet Inc	USD 64.28	LSI.N	LSI Corporation	USD 7.51
ACN.N	Accenture Plc	USD 57.42	MRVL.O	Marvell Technology Group Ltd	USD 14.34
ADBE.O	Adobe Systems	USD 35.31	MU.O	Micron Technology Inc.	USD 10.00
AMD.N	Advanced Micro Devices	USD 8.64	MSFT.O	Microsoft	USD 24.49
ALUA.PA	Alcatel-Lucent	EUR 4.079	NTAP.O	NetApp Inc	USD 53.70
AMZN.O	Amazon.com	USD 198.65	N.N	NetSuite	USD 36.39
ATOS.PA	Atos Origin	EUR 41.085	4307.T	Nomura Research Institute	JPY 1607
AUTN.L	Autonomy	GBp 1813	2327.T	NS Solutions	JPY 1485
BRCM.O	Broadcom Corporation	USD 33.51	9613.T	NTT Data	JPY 253800
BRCD.O	Brocade Communications Systems	USD 6.67	ORCL.O	Oracle Corporation	USD 34.27
CAPP.PA	Capgemini	EUR 40.10	4716.T	Oracle Japan	JPY 3565
CAVM.O	Cavium Networks Inc.	USD 45.77	4768.T	Otsuka Corporation	JPY 4885
CSCO.O	Cisco Systems, Inc.	USD 16.53	PMCS.O	PMC - Sierra Inc.	USD 7.88
CTSH.O	Cognizant Technology Solutions Corp	USD 74.05	QLGC.O	QLogic Corporation	USD 16.83
CSC.N	Computer Sciences Corporation	USD 44.58	2382.TW	Quanta Computer Inc.	TWD 60.20
DAST.PA	Dassault Systemes SA	EUR 58.06	RAX.N	Rackspace Hosting, Inc.	USD 43.08
DELL.O	DELL	USD 16.01	RHT.N	Red Hat, Inc.	USD 45.74
DMAN.O	DemandTec	USD 10.02	RNOW.O	RightNow Technologies, Inc.	USD 32.91
EMC.N	EMC Corp.	USD 28.06	RVBD.O	Riverbed Technology, Inc.	USD 37.11
EQIX.O	Equinix Inc.	USD 100.76	SGE.L	Sage	GBp 288.5
FFIV.O	F5 Networks Inc	USD 105.71	CRM.N	Salesforce.com	USD 146.61
6702.T	Fujitsu	JPY 407.00	SNDK.O	SanDisk	USD 46.46
GOOG.O	Google	USD 524.03	SAPG.DE	SAP AG	EUR 43.6
HPQ.N	Hewlett-Packard	USD 35.98	SFSF.O	SuccessFactors	USD 34.34
IBM.N	IBM	USD 170.16	SYMC.O	Symantec	USD 19.43
INFY.BO	Infosys Technologies	INR 2835.7	TLEO.O	Taleo Corporation	USD 37.10
IPHI.N	Inphi Corporation	USD 20.13	TCS.BO	Tata Consultancy Services	INR 1164.1
INTC.O	Intel Corporation	USD 22.90	TDC.N	Teradata	USD 55.68
IL.N	IntraLinks Holdings, Inc.	USD 20.42	VMW.N	VMware Inc	USD 95.57
4739.T	ITOCHU Techno-Solutions	JPY 2672	WIPR.BO	Wipro Ltd.	INR 440.15
JNPR.N	Juniper Networks, Inc.	USD 38.86	3231.TW	Wistron Corporation	TWD 49.00