

IT trends

Cost reduction through virtualization
and cloud computing



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Foreword

Cost reduction is a “top-of-mind” issue for most business executives in today’s turbulent environment. Many organizations are looking to drive costs out of the IT function, and still others are looking for ways where technology can help rationalize costs across the enterprise.

This issue covers two important IT trends which have garnered significant attention recently, namely virtualization and cloud computing. Many business and IT leaders are looking to virtualization – or the more efficient pooling of IT resources, including networks, servers and storage – as a way to drive enhanced efficiency and cost savings. Increasing IT infrastructure costs and demands are forcing IT functions to examine the distribution of computing resources, especially where servers may be operating well below capacity.

If virtualization is one side of a coin, then cloud computing is the other. Cloud computing essentially involves the outsourcing of computing capacity to third party services over the internet – as a way to reduce power, storage, hardware, personnel and other related costs. In addition, outsourcing computing capacity can also promote greater flexibility and free-up valuable IT resources for more strategic projects.

Considering and implementing virtualization and/or cloud computing, however, are not without challenges and risks. Both of these can be disruptive initiatives, requiring cultural and logistical changes. And both involve potentially significant risks in areas such as information security, privacy, application controls, and enterprise architecture, among others. The overriding point in this issue is simple – virtualization and cloud computing are business topics with IT implications and not simply IT tasks to be completed.

Regards,

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Virtualization

Making computing resources virtual and savings real

Synopsis

- ▶ Virtualization is the pooling and sharing of physical IT resources (e.g., networks, servers, storage)
- ▶ Virtualization can cut your energy, hardware and software infrastructure and real estate-related costs
- ▶ Implementing virtualization, however, is not without challenges and risks, most notably around controls and security

Overview

Given the current economic turmoil, virtualization offers some attractive options for business leaders looking to cut costs, increase manageability and improve overall IT efficiency.

The potential cost savings from virtualization – essentially, a more efficient pooling of IT resources, including networks, servers and storage – can be significant. Advancements in technology now allow companies to improve the efficiency of their current systems, reduce their total cost of ownership of IT assets and improve business continuity and overall speed-to-market.

Rising costs and infrastructure needs are forcing IT departments around the globe to examine the distribution of computing resources. In particular, business and IT leaders are investigating whether they would benefit from reallocating computer processes to machines that might otherwise be sitting idle or operating well below capacity. By migrating IT applications to a virtual infrastructure – virtual servers, virtual network devices (e.g., routers, switches, firewalls), and virtual storage – companies can reduce their operating expenses significantly, especially those related to real estate, data center power, cooling and hardware.

Virtualization can also significantly improve load-balancing, application provisioning, disaster recovery and systems management. As a result, virtualization was ranked as the top strategic technology for 2009 by Gartner Group (see Figure 1).

Figure 1

Top 10 strategic technologies for 2009

1. **Virtualization**
2. **Cloud computing**
3. **Computing fabrics**
4. **Web-oriented architecture**
5. **Enterprise mash-ups**
6. **Specialized systems**
7. **Social networking**
8. **Unified communications**
9. **Business intelligence**
10. **Green IT**

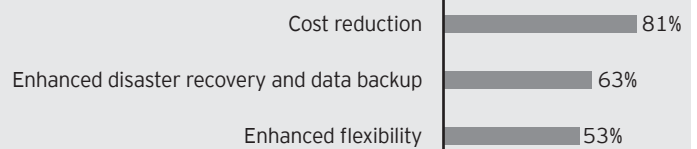
Source: *Gartner Group*, survey of IT leaders at Gartner Inc.'s Symposium ITxpo in October 2008

Laying the groundwork

While virtualization offers many potential benefits, and is most often associated with cost savings, it must be considered in the context of corporate goals and objectives (see Figure 2). Since virtualization is a major change effort and can affect the very heart of your company's approach to enterprise architecture, it should be part of a broader IT strategy. Some of the areas of IT strategy that are potentially impacted by virtualization include: enterprise architecture; identity and access management; application controls and security; and hardware maintenance and data storage.

Figure 2

Primary reasons for pursuing virtualization



Source: *CIO.com*, January 2008 study of 300 CIOs.

Implications

IT departments around the globe are being asked to do more with their current resources or with reduced resources. The failure to capitalize on some of the potential benefits of virtualization could impact IT's ability to create value and rationalize costs across the enterprise. Other potential implications of virtualization include:

- ▶ Reduce future hardware expenses and increase system capacity by reallocating computing capacity to machines that are underused.
- ▶ Contribute to overall objectives relating to environmentally-friendly – or “green” – projects since virtualization helps make the IT systems that support the business more energy efficient.

Potential benefits

The potential benefits of a well-devised and well-executed virtualization strategy can be significant and include:

- ▶ Reduced costs related to virtualized computing resources (see Figure 3 on page 5). This happens in two ways: 1) the reallocation of unused resources results in an increase in the collective capacity of the current hardware environment; 2) thereby reducing the need for future hardware purchases. A single full time equivalent (FTE) can often support three to five times more infrastructure components with virtualization than without.
- ▶ Less floor space, cooling and power resources required. Virtualization can result in significant server and storage consolidation, thus making data center consolidation initiatives much more cost effective, maximizing floor space and other peripheral resource utilization (e.g., network ports, network switch and cabling etc.) Achieving an 8:1 to 20:1 ratio of virtual machines per physical server is common, thus helping to significantly reduce real estate, power and cooling related costs.
- ▶ Reductions in the cost of storage through more efficient use of underused capacity.
- ▶ Effective and potentially more dynamic load balancing and optimized server utilization. The hypervisor is able to reallocate computing power to those virtual machines on the network that have more capacity. This helps handle massive computer traffic spikes quickly and efficiently. Similarly, a hypervisor can optimize server utilization, helping companies increase the ROI on their infrastructure capital investments.
- ▶ Enhanced scalability for sporadic application usages and related data surges.
- ▶ Hardware infrastructure flexibility and related cost savings. Because virtualization leverages underused machines, more applications suddenly gain access to new switches without having the need to purchase new “boxes.”
- ▶ Quicker and more cost-effective disaster recovery and damage mitigation. Virtualization may supplant the need for physical servers because of the ability to provision onto virtual resources. Virtual machines can be easily moved to alternate hardware environments in case of disaster, and this event-based migration can be highly automated to make it quick and efficient.
- ▶ Virtualization supporting business growth and innovation can provide a much needed agility to react quickly to sudden business changes, freeing up more resources to be invested in innovation-related projects.
- ▶ Effective implementation of virtualization will help enable an enterprise-wide architecture roadmap to facilitate “cloud computing,” which is a cost-saving method of accessing IT-related capabilities “as a service,” over the Internet (“in the cloud”).

If you are considering virtualization

Companies considering virtualization should assess the broad range of business factors and impacts that could result from this initiative. Among the virtualization-related areas to consider are:

- ▶ Enterprise architecture
- ▶ Information security
- ▶ Application controls and security
- ▶ IT effectiveness/transformation
- ▶ Data warehousing

Questions to ask

The following questions are critical for business leaders to consider before implementing virtualization:

- ▶ Do we have the right personnel to prepare for and manage virtualization?
- ▶ How do we plan to fully leverage all of the potential benefits of virtualization?
- ▶ Are our security tools and processes robust and updated to accommodate such a disruptive technology?
- ▶ Are we fully aware of all the security issues around virtualization?
- ▶ What costs can we expect to be associated with virtualization?
- ▶ What ROI do we expect?
- ▶ What other technology needs will be required as a result of virtualization?
- ▶ How can virtualization support “cloud computing”?
- ▶ How might virtualization impact our ERP applications, data storage systems and networks?



Potential challenges

Virtualization involves major IT cultural and logistical changes. For this reason, and others, companies need to carefully consider the potential challenges that lie ahead, including:

- ▶ The systemic nature of virtualization as a major disruptor, changing the way IT thinks about architectures, processes, and business in general. Similarly, there is uncertainty about applications supported by virtualization. As a result, there will be a learning curve, both within IT and from others, about virtualization and the challenges that come with it. This cultural and intellectual change can consume time and resources.
- ▶ The need for significant network bandwidth within the “inner circle” core of main servers. Unlike a more traditional system, a virtualized system relies on a series of servers, or virtual machines, at the core. Because these machines serve as the core team, and work so closely together in managing the system, they need to have sufficient bandwidth to support fast response times. This need could require network infrastructure upgrades.
- ▶ The disruptive nature of virtualizing servers and network devices can have a significant impact on the overall IT architecture, an important component of which is data storage. A virtualization strategy that does not take storage components into consideration is likely to reduce the efficiency and increase cost of storage.
- ▶ Because of the relatively complicated nature of relying on a virtual system, the ability to operate, maintain and remediate issues relating to the system can often fall to a small group of people. In addition, role-based authorization is difficult to provision using the management software currently available. As a result, knowledge of the system and how it operates can generate a “keys to the kingdom” issue, presenting security and operating concerns.

Next steps

Companies interested in exploring virtualization need to understand and build a strong business case. They must recognize the challenges inherent in such a disruptive and architectural change to your IT infrastructure. A strong consensus must be secured with all potentially impacted stakeholders, including those responsible for security, servers, network management and data storage.

Business and IT leaders should consider revisiting their portfolio of infrastructure services and products to support the business and assess how virtualization can help rebalance the portfolio to better meet the enterprise IT agenda.

Key security considerations for virtualization

One of the major concerns in implementing virtualization is information security. Listed below are some specific security risks and considerations:

- ▶ **Spread the risk** – Companies should spread out the critical application instances across physical machines as much as possible. This can be done by combining them with different types of applications, while maintaining an appropriate ratio between physical and virtual machines. This helps achieve higher application availability and reduce security risks.
- ▶ **Limit access** – Inappropriate access to server administrative interfaces can expose numerous production applications at once in virtualized environments. Develop a checklist in accordance with leading practices for securing administrative interfaces, including strict password policies and file permissions.
- ▶ **Use secure networks** – Secure networks should be utilized for data migrations involving virtualization software, since data is not typically encrypted in these migrations.
- ▶ **Monitor threats** – Properly functioning applications on virtual machines can hide latent security vulnerabilities at the hypervisor level. Thus, it is critical to continuously monitor both the virtual machines as well as the underlying hypervisor for potential threats.



Figure 3

Virtualization total cost of ownership (TCO) analysis - example

TCO Comparisons	Without virtualization	With virtualization
Hardware and software costs		
Number of physical servers required	92	8
Total hardware costs	US\$690,000	US\$201,999
Hardware maintenance	N/A	N/A
VMware software	\$0	\$40,000
VMware software support	\$0	\$13,006
VMware training and service	\$0	\$3,000
Total hardware and software costs	US\$690,000	US\$258,005
Hardware and software TCO reduction		63%
IT operations		
Affected datacenter costs: (network and other data center costs)	US\$169,533	US\$14,721
Total server deployment costs	US\$41,400	US\$27,600
Server development time (hrs)	552	368
Average hourly labor cost	75	75
Server support	US\$221,697	US\$87,650
Total affected IT operations costs	US\$432,630	US\$125,971
IT operations TCO reduction		70%
Total affected costs	US\$1,122,630	US\$387,976
Total TCO reduction		65%
Six month ROI		189%
Other benefits		
Recovery time (hrs)	N/A	N/A
Server consolidation ratio	12	1
Average CPU utilization	<10%	60-70%

Source: VMware

Cloud computing

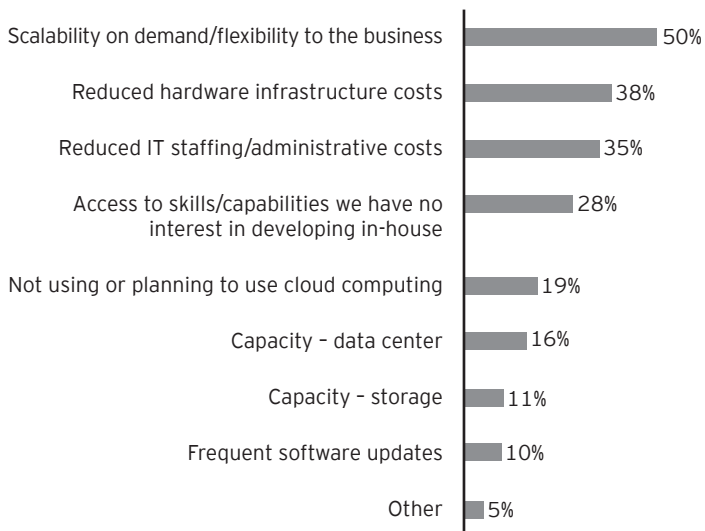
Potential savings from thin air

Synopsis

- ▶ Cloud computing essentially involves the outsourcing of computing capacity through third-party services over the internet
- ▶ Cloud computing can help cut your power, storage, hardware, personnel and real estate-related costs
- ▶ There are a number of challenges to business and IT leaders in making the move to cloud computing, principally around increased privacy and security risks

Figure 4

Primary reasons to use cloud computing



Respondents selected up to three criteria

Source: *CIO magazine* survey involving 173 IT and business leaders, October 2008

Overview

There is a new "twist" to outsourcing or shared services from an IT perspective. Business and IT leaders are increasingly turning to third-party services for increased computing capacity. In addition, many turn to third parties for access to software applications supporting business functions such as human resources, data storage, marketing, sales and knowledge management, learning systems, payroll and email systems.

This outsourcing of computing capacity – commonly referred to as "cloud computing" – has been enabled by recent technological advances, and is being driven in part by pressures to reduce enterprise costs.

The fact that so many companies are considering implementing some version of cloud computing is not surprising (see Figure 4). An estimated 80 percent of all business processes are powered by or integrated with IT.

With cloud computing, the required computing capacity for some ancillary functions becomes the responsibility of a third-party company whose excess computing capacity can be provided on an as-needed, "pay-as-you-go" basis. In addition, some companies are also employing a version of cloud computing – known as "software-as-a-service" (SaaS) – to help reduce daily technical operations and support business and consumer software.

The effective use of cloud computing can help reduce costs, promote flexibility, free-up valuable resources for strategic reallocation, reduce overall expenses, and assign specific responsibilities to outside service providers potentially more capable than existing in-house functions.

Spending on IT cloud services will reach US\$42 billion by 2012, driven in part by the economic crisis and companies looking to reap the expected benefits of cloud computing. (Source: IDC, survey of 244 IT leaders released October 2008)

Laying the groundwork

There is a strong potential that any cloud computing effort will generate savings and allow the company to better focus on its core business. For companies considering cloud computing, however, it is important to thoroughly examine how this approach fits into the company's overall IT and business strategies. Because the use of cloud computing can be a major change in the way IT thinks and operates, it is important for all impacted stakeholders to examine the key areas potentially impacted by cloud computing, including: privacy (e.g., customers, employees, etc.); information security; data storage; identity and access management; and enterprise architecture.

The explosion of data and information has generated a corresponding rise in the costs related to the purchase and maintenance of servers and storage capacity. Most companies have finite hardware, storage and budgets. Buying new servers that may remain below capacity levels for some time is difficult to justify.

Many large organizations such have developed massive computing capacities and specialized IT staffs around the globe. As a result, their economies of scale present opportunities for companies looking to outsource their computing needs (see Figure 5, page 9). In some cases, having another company handle your computing requirements can help business and IT leaders improve their return on in-house IT investments.

Implications

In challenging economic times, companies are looking for ways to operate more efficiently and reduce costs. Cloud computing can have several major impacts on the enterprise, including:

- ▶ Reallocating and refocusing in-house IT staffs away from day-to-day maintenance of servers and toward activities that add directly to the bottom line; this can help reposition IT functions more as revenue contributors than cost centers.
- ▶ By leading the way in efforts to reduce overhead costs through computing outsourcing, IT functions help to set an internal tone in support of the company's overall strategic goals and initiatives.
- ▶ Virtualization - the more efficient pooling of IT resources such as networks, servers and storage - is facilitated by cloud computing.
- ▶ Potential reductions in IT staff, budgets and resources - either short term or permanent.

Potential benefits

The potential benefits of a well-devised and well-executed cloud computing strategy can be significant and include:

- ▶ Potential reductions in personnel, software, hardware, real estate, cooling, power, licenses and maintenance costs. Companies may no longer need to maintain large, specialized IT staff and resources responsible for the maintenance and upkeep of expensive computing and storage infrastructure. The potential for reduced hardware and software costs means that capital can be freed up for use elsewhere towards strategic corporate goals. In addition, most patches, fixes, browser application updates and other expensive and time-consuming trouble-shooting would be done by the computing hosts rather than in-house personnel.
- ▶ Minimal start-up costs. Much of the computing capacity available through these third-party providers is available with little more than a flip of a switch. Often, businesses need specific

servers to be specifically configured in an application or for only a small amount of time - requiring time and money. A large-capacity third party provider would likely have immediately available what is needed.

- ▶ Better realignment of IT support services and resources. By directing more specialized IT resources away from the relatively commoditized duties of computing and storage maintenance, and toward initiatives that add directly to the bottom line, companies can better see the potential benefits of IT professionals.
- ▶ More efficient IT services focused on infrastructure and non-application services. For many companies, the IT function is a cost-intensive support function. At larger computing outsourcing companies, however, IT is in itself a revenue generator and a core competency. As a result, the IT infrastructure receives the attention necessary to provide faster bandwidth, more capacity and reduced downtime.
- ▶ Flexible infrastructure and capacity. Cloud computing allows companies that need massive amounts of computing capability for only short periods of time quick and easy access without long-term amortization costs.
- ▶ Improved disaster recovery/damage mitigation. Companies that have on-site or nearby data centers are at risk of data loss and downtime caused by catastrophic occurrences such as hurricanes, earthquakes, fire, or terrorist activities. However, with cloud computing, because the data exists "in the cloud" and usually offsite, the potential that one specific event to cause major problems is significantly reduced.

Cloud computing glossary

Software-as-a-service - The ongoing support of applications whose core value to the customer is the alleviation of the ongoing maintenance, daily technical operation and support of business and consumer software.

Platform-as-a-service - This is an outgrowth of the software-as-a-service application delivery model. This model makes all of the facilities and services required to support the complete life cycle of building and delivering web applications (e.g., application design, development, testing, deployment, hosting, and application services such as security, scalability and versioning) entirely available as an integrated suite from the internet – with no software downloads or installation required for developers, IT managers or end-users. Since everything is delivered through the internet, it is sometimes referred to as “cloudware.”

Infrastructure-as-a-service - An IT infrastructure delivery platform used to deliver software application environments; customers no longer purchase servers, software, data center space or network equipment, but instead buy those resources as a fully outsourced service.

Potential challenges

In today's turbulent economic times, companies are looking for IT to operate more efficiently and to help drive costs out of the business. Implementing cloud computing, however, is not without its challenges. Some of the key challenges include:

- ▶ Potential data privacy and security issues. A recent CIO.com survey indicated that 45% of respondents cited security as the major concern facing cloud computing. The companies that provide

cloud computing services may provide those services in different data systems in various data centers in cities around the world. Unlike a more traditional IT outsourcing arrangement, cloud computing clients do not have dedicated servers or dedicated lines. This raises issues about exactly where clients' data exists, and under whose jurisdiction it resides at any one given point. In addition, the possible need to recode data may increase the exposure to errors and security risks.

- ▶ Control and responsiveness. With in-house IT functions, with employees reporting directly to in-house executives, there is little question about who should be doing what and when. However, when the employees and the servers are far away, there is a risk that the provider's and executive's priorities may not be in alignment.
- ▶ Uncertainty over where the legal line exists concerning data privacy. There is some data that cannot – or at least should not – be co-mingled, such as private health and financial information. Which entity bears ultimate responsibility for maintaining data privacy? What kind of public, legal or consumer backlash might occur because of a failure to maintain privacy? Data privacy can be a cross-border issue. For example, the European Union restricts not only the sharing of data but also where the data can be held. These issues need to be considered early in the process.
- ▶ Lack of benchmarking or leading practice experience. Because the use of off-site computing capability is relatively new, there is insufficient experience from which to draw guidance for companies looking to build an effective cloud computing strategy. For example, there is some uncertainty on how to incorporate current applications and

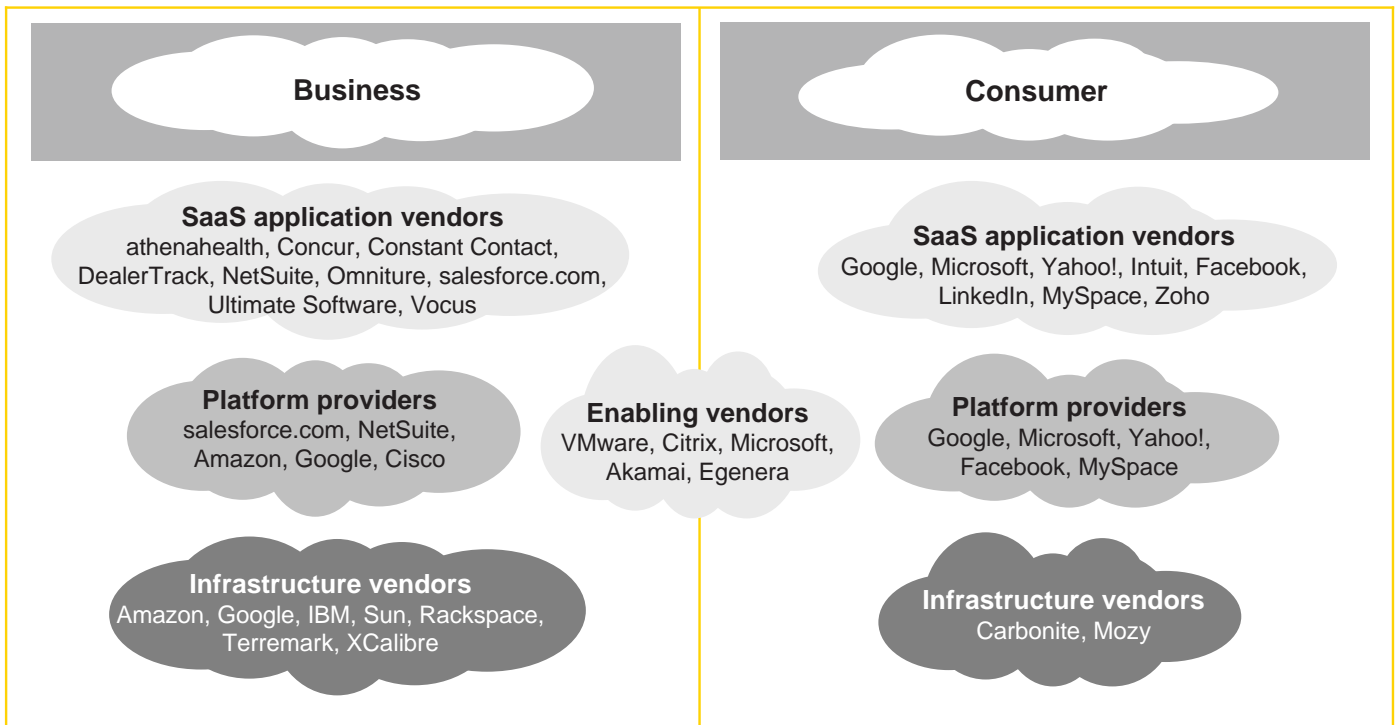
technology into the cloud platform. Can internal proprietary business applications easily run on outside using servers not configured for this specific purpose? For example, software-as-a-service applications are maturing, but the platform-as-a-service and infrastructure-as-a-service applications are developing more slowly.

- ▶ Ambiguity over how best to quantify, track and communicate the benefits of cloud computing. Because costs are shifted to a third-party provider, benefits tend to be measured more with intuitive and anecdotal feedback than with quantifiable information. This can complicate attempts to accurately measure the return on investment.
- ▶ Potential for a public relations nightmare. Not being able to state the exact location where their computing services are performed, or where data is housed, may leave a cloud computing client open to concerns that its internal controls are insufficient to reassure stakeholders. This issue could arise through consumer product recalls, and workplace or product liability litigation.
- ▶ Threat of potential overreliance on a single-source IT provider. The relatively easy turnkey nature of cloud computing and the subsequent attraction of cost reduction through its use may promote a company's gradual overreliance on a particular third-party service provider. And this could cause problems at some point in the relationship.



Figure 5

Cloud computing market players



Source: William Blair & Company, LLC, July 2008.

If you are considering cloud computing

Companies considering cloud computing should consider the broad range of business factors and impacts that could come with such an initiative. Among the cloud computing-related areas companies should consider are:

- ▶ Privacy
- ▶ Enterprise architecture
- ▶ Information security
- ▶ Application controls and security
- ▶ IT effectiveness/transformation

Questions to ask

The following questions are critical for business leaders to consider before implementing cloud computing:

- ▶ What are the implications for our virtualization strategy?
- ▶ What specific areas are most appropriate for cloud computing?
- ▶ What existing relationships do we have with potential third-party vendors?
- ▶ What are the most significant data privacy and security issues that we will likely face?
- ▶ What are we trying to achieve through cloud computing? What ROI do we expect?
- ▶ What technology needs will be required with cloud computing?
- ▶ How would existing resources – both machines and people – be reallocated for maximum impact?
- ▶ What are the broader cultural and operational implications of this approach?

Next steps

Cloud computing may not be the most attractive option for companies with large and diverse IT resources and specialized personnel. For many other companies, however, the economies of scale provided by third-party organizations and the benefits of cloud computing might be a solid option for reducing costs, and better aligning limited IT resources with key business goals and initiatives.

A gradual, or phased, approach to cloud computing may make the most sense. Companies could start by selecting a non-critical business function or application as a pilot example.

Finally, companies considering cloud computing should assess potential impacts on the organization's culture, finances, processes, need for control and tolerance for risk. Most of all, companies should have a plan that takes into consideration the potential benefits - and challenges - associated with cloud computing.

Key privacy considerations for cloud computing

Cloud computing can dramatically increase risks to customer data privacy. Key risks and considerations include:

- ▶ **Ensure outside organizations comply with your security standards** – Your applications may co-reside with applications from other organizations on same physical servers and/or operating system. A security compromise on other applications could potentially expose your own organization's critical data.
- ▶ **Understand privacy laws** – The privacy laws applicable where your application is hosted in the vendor's facilities may not meet the requirements of your local or national regulatory agencies. You must verify the applicable privacy laws and how data privacy disputes will be resolved in case of an unfavorable incident.
- ▶ **Encrypt your data** – Since data from your applications travels over the internet to the end-users, there is a higher possibility of data privacy being compromised. Adequate security measures, such as encryption, should be implemented to help minimize this risk.

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