



# CLOUD COMPUTING

Guidance on choosing the right cloud environment and determining how to yield the most benefit from it

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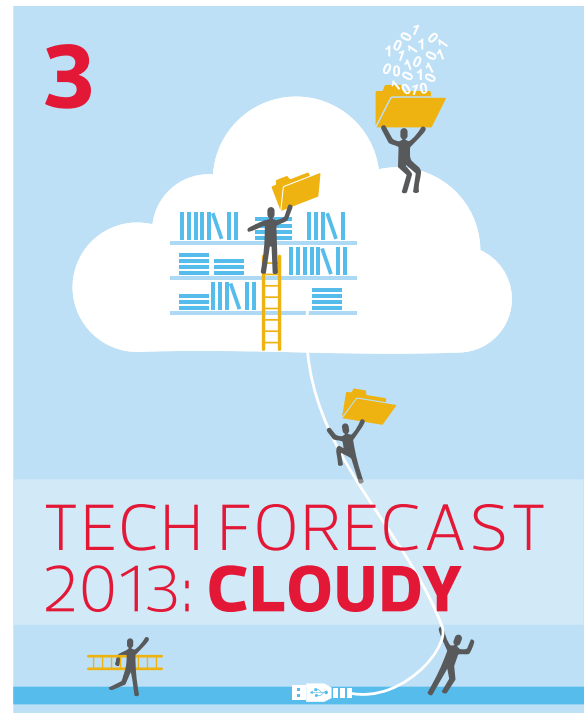
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What Cloud Is (and Is Not)
Cloud in Focus
How Cloud Helps
Where Virtualization Fits In
Interacting with Other IT Trends

# TECH FORECAST 2013: CLOUDY

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Understanding this evolving resource today and where it's headed tomorrow

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**Just when we've all gotten used to the term, *cloud computing* may not be known by this moniker much longer.**

Already, it's more accurate to talk about cloud computing in terms of the IT resources and processes it allows organizations to access and deploy quickly, easily and cost-effectively – applications, development platforms and hardware – than it is to discuss where those IT resources reside. After all, organizations have utilized these IT resources for decades, but now they acquire them in a different, better way.

## **What Cloud Is (and Is Not)**

Cloud computing, as most enterprises understand it, is a service, not a product; it's a capability, not a solution, and it encompasses the disciplined process of managing IT resources. It is important to understand this distinction when, for example, an organization implements a strategy for hosting its own cloud on a managed service provider's infrastructure

(known as a cloud in a cloud).

Cloud computing is an operating expense, not a capital expense. When enterprises pay for this service on an ongoing basis, it's delivered over a network in one of several flavors:

- **Software as a service (SaaS)** | leasing applications that exist on someone's servers (an organization's own or those of a third party)
- **Platform as a service (PaaS)** | leasing the software development environment (but not the applications)
- **Infrastructure as a service (IaaS)** | leasing hardware capabilities, such as storage, processing or virtual servers

Enterprises often opt for SaaS, developers favor PaaS and small organizations or startups turn to IaaS. But increasingly, IT departments of all stripes are identifying a distinctive mix of cloud services to meet their specific computing, business and operational needs. How sophisticated

the cloud mix is depends largely on where the IT department is in the process of modernizing its data center.

A cloud can be public, whereby many different organizations share computing resources. A cloud can also be private, in which cloud resources are dedicated to a single organization and run either in its data center or that of a service provider. A final option is a hybrid cloud, which is a combination of shared and dedicated cloud resources. Increasingly, organizations are exploring hybrid cloud options to enjoy the best of both worlds.

### Cloud in Focus

Cloud computing may mean different things to different people, but a true cloud infrastructure has four key characteristics:

1. Cloud services are available on demand, through self-service by users themselves if required.
2. Cloud services are "burstable," meaning if the organization needs more resources than it is already using, it can get them with minimal difficulty and pay for the extra service later.
3. Cloud services are elastic, so they can shrink as well as expand to fit the enterprise's needs.
4. Cloud services are managed, metered and controlled by mature IT processes (such as those outlined in the IT Infrastructure Library or ITIL); the organization pays only for what it uses.

Cloud computing is also characterized by other important attributes. It is available anywhere a user finds an Internet connection. It is based on virtualized IT resources. Organizations subscribe to cloud services. But if a service doesn't have the four key characteristics, it's something less than a cloud, and the enterprise isn't enjoying



the full benefits of cloud computing.

An organization that can scale processing and storage but needs intervention from the IT team to do so isn't enjoying true cloud computing. And an enterprise with a virtualized data center and a portal for requesting resources isn't exploiting cloud computing if it isn't tracking usage and charging departments for what they use. The "service" aspect of cloud computing cannot be emphasized enough. The IT team supplies, manages, controls, monitors and charges by service. This service can run anywhere.

### How Cloud Helps

In an ideal deployment, cloud services are transparent to end users. Workers don't necessarily realize that the productivity applications, storage systems or computing resources they're using run in a data center and not on their desktops — and they don't need to know.

IT departments, however, understand the impact of cloud services. Why are they attracted to cloud computing? There are several reasons.

**It allows for quick action.** Because cloud-based services run on centralized

servers (either in the organization's or the cloud vendor's data center), IT departments don't have to install software locally. If the organization needs a new computing capability, the IT team can procure it from the cloud and have it operational within days, hours or minutes, rather than weeks or months.

**Management overhead is reduced.**

If the IT group rents its cloud capability from a third-party vendor, that vendor handles software upgrades, servers and storage, and more. If the enterprise builds its own cloud, services originate from that central location, meaning the IT department can fix problems with applications or other services from the data center, not by visiting every office and cubicle in the organization.

These gains require a great deal of discipline on the part of the IT department. Typically, such gains only come to IT shops that evolve to become service-centric and utilize established frameworks to manage these services wherever they run. ITIL or IT Services Management (ITSM) processes are the foundation for all cloud computing.

**Users can serve themselves.** In some cases, a self-service model can be implemented for cloud services, similar to the way workers have become used to downloading and installing apps on their mobile devices. In this case, users don't need to initiate a help desk ticket to install a productivity or enterprise application. They point their browsers to an IT-maintained services portal and shop for the approved software they are seeking.

**Computing capabilities can be ramped up (and down) as needed.** In a true cloud, service capacity can be added or subtracted from a central console. If an organization requires more computing capacity to handle periods of greater demand, the IT team can dial up that extra service for as long as it's needed, then dial it

## WHEN TO JUMP INTO THE CLOUD? TODAY

**An organization that hasn't begun to consider cloud computing is at a competitive disadvantage — and it's in the minority. According to a recent study performed by the market research firm IDC, nearly two-thirds of enterprises surveyed worldwide are already planning, implementing or using cloud computing.**

Markets change quickly, spawning new technology solutions almost overnight. The difference between an organization on the cutting edge and one that's behind the curve can be measured in months, not years. So all organizations must be able to adapt quickly. The cloud helps them do it.

Most IT departments don't have time for methodical technology rollouts. They must approach IT as a strategic resource and deliver value to the enterprise quickly or risk obsolescence. The cloud helps to accomplish this in two ways.

First, it presents a low-cost, self-service option for commodity solutions, such as email, storage and productivity apps. Offloading the operation of such everyday applications allows

the IT team to focus on solutions that deliver greater value.

Second, when IT staff does identify new services for rapid deployment, the ready availability of cloud resources, from infrastructure to development platforms, allows it to get those services into the hands of users faster than traditional computing models.

Organizations don't have to start big in cloud computing to realize its benefits, but they should get started. A solid strategy for implementation is to identify the easy, quick successes, such as cloud-based email or office productivity suites, then build up cloud expertise and perform the analysis necessary to determine which applications are bound for the cloud.

back down. If an enterprise goes on a hiring spree, it can "turn on" extra email inboxes, productivity applications, data storage and more for new workers.

**IT costs can be better managed.**

Cloud computing can be less expensive than traditional computing, particularly when the enterprise leases its resources from a shared pool, either in a public or community cloud. Moreover, cloud services are recurring, predictable operating expenses and don't require large upfront capital investments that must be amortized over time. Plus, IT departments pay as they go, meaning they don't have to go through extensive capacity planning and

deal with the problem of buying too much or too little infrastructure.

**The IT group can say "yes" more easily to enterprise requests.**

For example:

• **QUESTION:** "Can we enable mobility throughout our company?"

**ANSWER:** "Yes, we'll deploy cloud services so people can securely access resources anywhere."

• **QUESTION:** "Can we cost-effectively collect and analyze Big Data?"

**ANSWER:** "Yes, we'll rent storage, processing and analytics capabilities in the cloud."

• **QUESTION:** "Can we be sure that if there's a natural disaster our IT operations will run without interruption?"

**ANSWER:** "Yes, we will use cloud services to implement full redundancy and disaster recovery."

### Where Virtualization Fits In

It is difficult for organizations to realize all the benefits of cloud computing if they haven't completed the long journey of enabling their IT infrastructures. True cloud computing is the last step in a process that starts with consolidating resources and includes virtualizing systems. Before an organization can completely migrate to a cloud infrastructure, it should look at its current systems and identify which are redundant, such as multiple email systems, storage arrays or enterprise software platforms.

Consolidating IT systems can remove unnecessary complexity, waste and cost from an enterprise infrastructure. When an organization is able to boil down its messaging systems, for example, to a single platform running on a single server (or a single server farm, depending on the size of the deployment), it can more easily decouple that software platform from the underlying hardware and virtualize it.

Virtualization is not required to take advantage of cloud computing, particularly public cloud computing. However, in situations where organizations want to build their own private clouds, or want to create hybrids that blend both private and public cloud resources, virtualization is an important step. A virtualized infrastructure is not necessarily a cloud infrastructure, but an enterprise intent on building its own cloud resources needs to virtualize relevant parts of its IT infrastructure.

Virtualization enables many of the

same IT dynamics that characterize cloud computing, including elastic pools of resources and centralized, on-demand provisioning. It does this by decoupling software from hardware. A server is no longer defined by the operating system and enterprise software it runs. It is a virtual machine that IT managers can move from hardware resource to hardware resource, depending on when it's needed.

In practice, the IT group can eliminate extraneous physical servers by virtualizing their software stacks and storing them together on just one server. And because they're not tied to any physical server, virtual machines can be moved onto a shared computing infrastructure in the cloud as needed; for example, to render a complex 3D animation or to analyze a large data set.

These days, IT departments can virtualize more and more of their infrastructure, including servers, storage, networks and desktop computers. In general, the more virtualized an infrastructure, the better the utilization and the easier for an organization to move to a cloud computing model.

The next steps on the journey toward cloud computing (after consolidation and virtualization) are automation and orchestration. Taken together, these are the technology enablers that allow users to request cloud resources on their own. The cloud then automatically pulls together the necessary virtualized resources (applications, middleware, processing and storage) so users can accomplish their tasks. And when properly implemented, automation and orchestration allow this provisioning to happen without intervention from the IT department.

### Interacting with Other IT Trends

With a properly enabled cloud infrastructure, organizations are positioned to reap more benefits through IT initiatives that the cloud helps support. In many ways, cloud computing enables a variety of important technologies, including disaster recovery, mobility and Big Data.

It can be easier to maintain continuity of operations when virtualized systems are located in a cloud. In the event of a system failure, virtual machines can be moved to available systems and kept running. What's more, when organizations move other critical IT functions, such as enterprise storage, to a cloud, they are still able to access those resources should disaster strike their offices.

The arrival of smartphones and tablets to the IT landscape has increased the importance of mobile computing, allowing workers to bring along IT resources to just about any place they go. By centralizing applications, infrastructure and other IT components, a cloud allows workers to access necessary resources from anywhere they can get a network connection.

Organizations don't have to be big to take advantage of Big Data, which is essentially an IT initiative to make sense of all the information that organizations collect. Some collect far more data than others – from transactional databases, IP-based sensors, social media, video and other sources.

Still, storing all the data and eventually processing it to identify trends, patterns or other business intelligence may require more IT resources than an enterprise has. Cloud computing offers a means of engaging in Big Data without making infrastructure investments. ■

# THERE'S SOMETHING ABOUT SaaS

Delivering applications directly to users



## Software as a service is arguably where cloud computing started.

Services such as Google's Gmail, Hotmail and Yahoo Mail revolutionized the paradigm in which all email clients ran on personal computers. These days, more and more computer users obtain software services from the cloud – whether they know it or not. And this is giving IT departments the confidence to transfer more business functions to the cloud.

### SaaS Explained

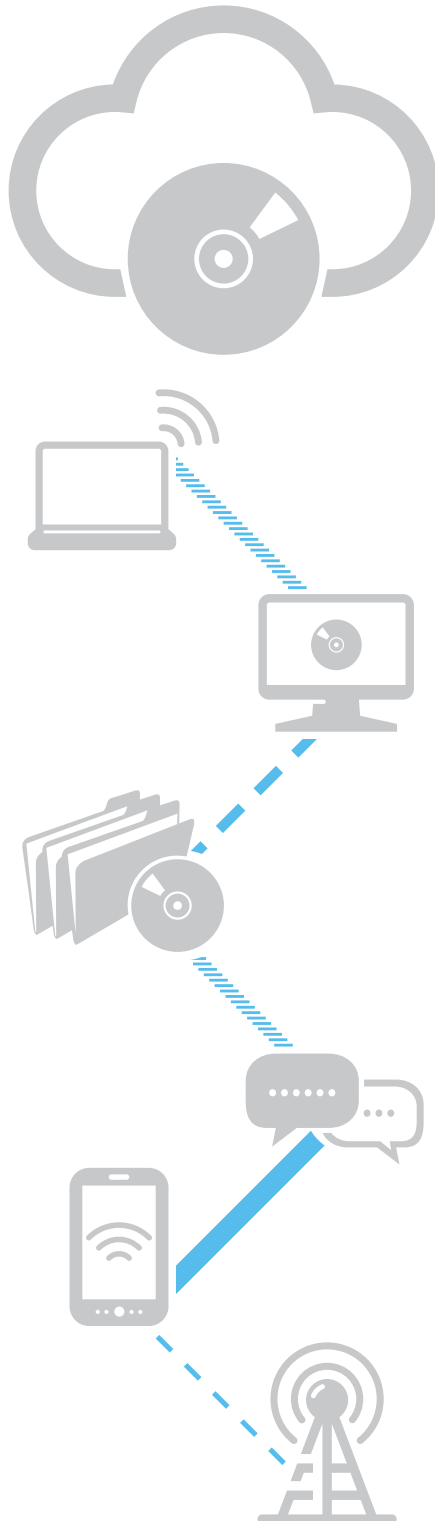
SaaS describes applications that are delivered on demand over a network, including over the Internet. These can include email services, office productivity programs, enterprise applications (enterprise resource planning, customer resource management and human resources) and security services. They are not loaded onto a PC's local hard drive or an enterprise server, but rather run in a web browser.

The IT department doesn't buy

copies of SaaS. SaaS is rented from a third-party provider, or from a centralized services catalog (if the organization offers its own SaaS to internal business units). In doing so, the IT department frees itself from many of the management tasks that come with deploying enterprise software.

In a traditional SaaS model, a third-party provider supplies the hardware to run the software. But an enterprise can offer its own SaaS to workers using its own systems.

At the heart of what makes SaaS compelling for organizations is multitenancy, which allows many groups, whether within one enterprise or across many organizations, to access the same software services from the same shared computing infrastructure. Multitenancy drives down costs for all organizations that rent SaaS applications, as the provider does not require the same amount of hardware resources to host the software as the organizations would require collectively.



What's more, because the hosting infrastructure is centralized, the provider can focus its efforts on maintaining the software platform itself, thereby responding quickly to issues as they arise. This extends to IT security, which is easier to ensure in a contained environment. And because SaaS is a specialty, SaaS customers can expect a higher level of performance, reliability and features than if they tried to host similar applications themselves.

### How SaaS Benefits

The benefits that customers of SaaS solutions can expect include the following:

**Low costs** | For starters, renting software applications in the cloud means an organization doesn't have to purchase, operate and maintain the application in-house. It doesn't have to buy a license for each PC that runs the software, nor a server infrastructure for running enterprise software. A third-party provider, in particular, operates on economies of scale. Ultimately, the total cost of "owning" a cloud-based SaaS solution is usually less than the total cost of ownership (TCO) of an in-house platform.

**Predictable costs** | When launching SaaS, a software solution goes from being a capital investment to a recurring, pay-as-you-go operating expense. Enterprises enjoy much more visibility into the ongoing costs of that software. They don't need to budget for added capacity or application support, nor do they need to plan for unforeseen maintenance and software upgrades. Everything is handled by the SaaS provider and reflected in recurring fees.

**IT efficiency** | With applications hosted in the cloud, IT personnel are free to pursue initiatives that

better serve the enterprise's core business functions. SaaS means the IT group doesn't have to develop application test beds in-house (though testing SaaS offerings through routine trial periods is recommended), apply patches and upgrades or troubleshoot software installations. The organization receives the most secure, up-to-date, bug-free software without IT intervention.

**Redundancy without being redundant** | When an enterprise runs critical applications in-house, it may need to build out redundant systems to ensure that the applications remain available. A SaaS provider is responsible for keeping the system operational to a level negotiated in a service-level agreement (SLA). The SaaS provider can move the organization's application resources to different parts of its infrastructure to maintain uptime.

**Enterprise agility** | An organization can make a SaaS offering available to users through a browser in a fraction of the time it would take to license and install software, buy and set up servers, and test and roll out the program. And when the software is updated with new features, workers can use them immediately. Moreover, because SaaS applications can access a large resource pool, an enterprise can easily keep up with usage demands.

**Increased mobility** | Because SaaS solutions, by their nature, are detached from computing devices and accessible over a network, workers can use them from wherever they are, provided they have a good network connection. Depending on the richness and complexity of the SaaS application, this means even smartphone and tablet users may be able to access the same enterprise programs that office-based desktop workers use.

Using a third-party SaaS provider



comes with its own benefits as well. For one thing, a cloud provider can focus all its best resources and smartest people on providing quality services to customers. As a result, SaaS solutions are generally of high quality and very reliable.

In addition, cloud providers stake their business livelihood on security. While organizations obviously should investigate the measures a provider takes to protect its infrastructure and data, cloud providers are often better at protecting their applications and customers' data than customers themselves could ever be.

And if an enterprise realizes that its service provider isn't working out, or that migrating a certain system to the cloud was a mistake, it can usually discontinue the service with few, if any, ramifications. The same can't be said for building an in-house infrastructure to support an enterprise application.

### Best Apps for SaaS

Customer relationship management (CRM) applications are among the most popular SaaS offerings, but other application types are growing faster in the cloud, including office suites and digital content creation programs. Enterprises that are exploring SaaS as a first step in cloud computing can find several types of applications that offer significant benefits over traditional IT solutions.

**Email** | Even large government agencies, for which information security is paramount, have begun migrating to email SaaS, often through Google or Microsoft cloud services. Email is one of the most commoditized applications, which means an organization can usually lease the number of accounts it needs for just a few dollars a month, per user account.

**Productivity** | Increasingly, organizations are foregoing the

sometimes-cumbersome upgrade path of modern productivity suites in favor of SaaS versions. Google Apps comes in flavors for business, education, government and nonprofits. And similar to SaaS-based email, Google Apps can be had for as little as \$5 per month per user.

Enterprises can also opt for Microsoft Office 365, the SaaS equivalent of the ubiquitous office suite. In either case, users get access to word processing, spreadsheet, presentation, email and other core programs. Tiered plans are available for organizations with additional requirements or many employees.

**Unified communications/conferencing** | Organizations may already be familiar with collaboration platforms such as Citrix GoToMeeting, Microsoft Skype, Cisco Systems WebEx or even Google Hangouts. Each fits an enterprise SaaS portfolio for allowing online conferencing. Increasingly, higher-end SaaS conferencing offerings, such as Blue Jeans Network, Cisco Jabber, Microsoft Lync Online and Polycom RealPresence Cloud are enabling the type of video conferencing once associated with room-to-room systems.

**Security** | Many enterprises already know the benefit of SaaS-based security solutions, such as online services that keep spam and viruses out of their email inboxes. Gradually, vendors have rolled out more sophisticated SaaS security offerings, such as endpoint security, encryption, web traffic protection and vulnerability management.

Other popular SaaS applications include enterprise apps such as payroll and finance, human resources and business analytics. Moreover, IT departments have begun to make good use of SaaS for trouble ticketing and other IT service management functions.

## WHEN NOT TO USE SaaS

Despite the benefits of leasing software applications from the cloud, in the following situations, organizations may be better off delivering software solutions the old-fashioned way:

- The software solution already meets the enterprise requirements for security, mobility and continuity of operations.
- The software in question requires very high performance or handles real-time data.
- Laws or other regulations don't allow the data that the software uses to be housed or otherwise travel beyond an organization's IT infrastructure.

As other IT initiatives progress, expect to see a rise in SaaS solutions, such as consolidated access control for ensuring security of mobile programs or cloud-based analytics and reporting for handling Big Data.

### Adoption Considerations

SaaS may seem like a no-brainer, but is it? Not exactly. Although the benefits of SaaS can seem so great that an enterprise may want to rush to adopt it, several factors must go into a decision to employ SaaS.

#### On-premises or with a vendor

Although SaaS is most closely associated with service providers, organizations can virtualize and offer SaaS solutions from their own cloud infrastructure. This might be necessary for proprietary applications, or off-the-shelf programs that have



been carefully customized over time.

What's more, many enterprises decide that, for security purposes, they would rather not utilize SaaS solutions from a third-party provider. These organizations may be interested in building their own private cloud from which to offer SaaS solutions to their workers.

Using a vendor and maintaining a private cloud need not be mutually exclusive, however. Enterprises can negotiate with service providers to host their applications on a private cloud infrastructure that is not shared with other tenants.

### **Security and compliance |**

Obviously, when considering hosting an application in a cloud, particularly a service provider's cloud, the organization must understand how security is handled. How does the SaaS application authenticate users? How does the provider protect data on its servers? How does it encrypt data over a network? Can the provider's site be audited?

Answering these and other questions is especially important for organizations that must comply with

laws or regulatory requirements. Government agencies, healthcare companies and financial services firms, for example, should not move to a SaaS model without understanding how the service complies with regulations.

**Cost |** The notion of predictable monthly fees for SaaS solutions may be attractive, but it can be hard to compare apples to apples. Enterprises should understand everything that goes into a SaaS contract.

Does the fee quoted include all the SaaS capabilities the organization requires? If the SaaS solution is transactional, is there an additional charge if transactions exceed a certain amount? How much storage is included in the monthly fee?

Depending on the application and an organization's usage model, a SaaS solution could actually cost more than a traditional enterprise application. It's important to analyze usage and perform a complete cost-benefit analysis before adopting a SaaS solution.

### **Infrastructure preparation |**

An organization will need to meet

network bandwidth requirements to run a SaaS solution that will be accessed by workers online. It also must support the encryption of data that may traverse the Internet. SaaS solutions eliminate the need for some on-premises equipment, but they also require other infrastructure planning.

**Service performance |** Any enterprise planning a move to cloud services must negotiate an SLA that spells out things such as expected application uptime, frequency of updates, liability and security measures. The organization must understand how the SLA applies to the application in question.

Not every program requires 99.999 percent availability, but some may require the ability to rapidly move data to a new platform if necessary. Organizations must analyze their application needs when negotiating SaaS SLAs. It is also important to ensure that there are penalties for failure to meet availability requirements, as well as an upfront termination agreement. ■

# PaaS PROVIDES THE TOOLS FOR SUCCESS

Creating applications in-house yields numerous benefits.



**I**n a platform as a service model, a cloud provider supplies a computing platform that includes networks, servers, storage and other services, while the consumer develops software using tools and libraries from the provider. Such an environment can help an organization develop applications while avoiding the cost and complexity of buying and managing the development platform.

PaaS is becoming particularly popular with software developers. As a wider market of users has accepted SaaS, enterprises have sought greater customization and integration among their cloud-based and in-house applications.

To many, it makes sense to enable that customization and integration with cloud tools. Microsoft's recent, aggressive move into PaaS is notable because so many developers already use Microsoft tools for creating applications that run on or utilize the provider's enterprise software.

With PaaS, developers access an

entire development platform over the network. To date, the biggest adopters of PaaS have been nimble startups and small software developers that want to rapidly develop, test and deploy innovative mobile and web programs. And they're using PaaS in a variety of ways, not just for coding. PaaS is available for application lifecycle management, business process management, database services and more.

Gradually, PaaS is making greater inroads into enterprise IT, as organizations realize how quickly they can get new applications into the hands of users if they rent the necessary development platform in the cloud. That being said, larger enterprises are also wary of PaaS, especially as it exists in public clouds, because they are cautious about placing what amounts to intellectual property on a service provider's infrastructure.

Research firm IDC sees a coming wave of industry-specific PaaS offerings. After all, financial industry

applications are different from healthcare applications, which differ from municipal government programs. Cloud-based development platforms that are tailored to vertical markets hold the promise of generating better industry-specific software that can be deployed more quickly.

For example, the New York Stock Exchange runs an industry-specific PaaS for financial services firms. Analysts expect that as more enterprises embrace industry PaaS, more will adopt cloud services in general.

But IT departments must get a handle on PaaS. Like other cloud services, PaaS can be acquired via self-service, which in the short term could present a challenge to IT departments.

### Why PaaS Is Popular

Organizations can use PaaS to develop applications, web pages or entire websites. And in most cases, they can access all the programming technologies they'd normally access in-house: Java, Perl, PHP, Python, Ruby, and Microsoft ASP and .NET.

Here are some of the broader benefits of PaaS:

**Increased agility** | In many industries, organizations gain their edge by rolling out new products or IT capabilities more quickly than competitors. This is why many tech companies have pioneered the use of PaaS for developing new applications. Accessing a development platform on demand in a cloud shortens the time from concept to application delivery.

**Decreased costs** | PaaS can potentially help organizations reduce costs. Obviously, the multitenancy model of cloud computing allows multiple entities to share the same IT resources, which reduces the costs the provider's customers each pay.

In many cases, this represents a money-saving alternative to

traditional technology investments requiring an organization to bear the full cost for all its IT services. The costs are predictable, even with the ups and downs of demand cycles, because the fees are prenegotiated monthly expenses.

Further savings can come from lower costs for the fuel to power and cool the equipment in the development environment, as well as from fewer high-priced specialists needed to keep everything running at optimum levels.

Automated backups, improved business continuity and disaster recovery are other advantages. Rather than investing in dedicated equipment that mirrors the production environment for backups, organizations can contract with PaaS providers to handle backups automatically. Cloud-based systems, such as PaaS, also offer the advantage of sending critical data to a distant location that likely won't be threatened if a local or regional disaster hits on-premises environments.

**Better collaboration** | With development platforms hosted in the cloud, an organization can bring together its best developers (as well as third-party developers, as necessary) to collaborate on applications, regardless of their physical location. Developers can securely share code online and work asynchronously.

Developers in one corner of the world can work on a program, then hand it off to developers across the globe, effectively enabling a 24-hour development cycle. Many PaaS frameworks also incorporate collaboration tools similar to social media for brainstorming and discussing technical solutions online.

**Targeted app development** | Because PaaS allows organizations to deploy development platforms on demand, they can become granular in their application development. If the IT

department identifies a specialized need or receives a specific user request, it has more latitude to entertain the request because it knows it can lease just the programming tools it needs, for only as long as programmers need them.

#### **The latest programming tools** |

Because PaaS is maintained in the cloud, developers can be sure that they have the latest tools at their disposal. It's the provider's job to maintain its PaaS offerings with the latest versions and capabilities. And developers don't have to worry that they're missing key languages and frameworks by working in the cloud.

**A complete toolset** | PaaS solutions are more than just development platforms. After all, few applications these days are stand-alone programs. They interface with databases, enterprise systems and other applications.

Many PaaS offerings include standard and proprietary application programming interfaces (APIs) for integrating new applications with existing systems, including those that also run in clouds. In fact, existing in the cloud as PaaS tools do, they will be important to what many consider the next great frontier in cloud computing: stitching together disparate clouds and cloud resources to form even more powerful cloud platforms.

#### **Faster quality assurance and shorter time to deployment** |

PaaS also allows the IT team to stand up and tear down application test beds quickly and easily. The team doesn't need to build in-house test beds and then manage those resources among internal stakeholders, each of which often believes its application rollout to be a higher priority. Many PaaS solutions also support small, secure development areas online where programmers can test and collaborate on pieces of code before integrating them with the larger application.

### PaaS in a Public Cloud?

Currently, nimble enterprises are making quick and efficient use of publicly available PaaS tools. But is there a downside to developing an organization's application code in a public cloud?

Like other information stored in the cloud – email messages, databases, customer data and more – the application code developed in a PaaS environment must be protected to the level that the organization demands. Enterprises must analyze PaaS providers' controls for protecting customers' application data.

Organizations trusting their development platforms to PaaS providers also need to worry about vendor lock-in. For many, application code is valuable intellectual property that must not only be secure in the cloud, but also accessible at any time and in a standard format should the organization move to another provider's infrastructure or take its development efforts back in-house.

Here are some key questions to ask when exploring options for acquiring PaaS from a public cloud:

- Who maintains the PaaS infrastructure, the PaaS provider or another cloud services provider?
- How does the PaaS provider secure data in transit and at rest?
- How does the provider control access to its PaaS cloud?
- What level of availability can the organization expect? How does the PaaS provider achieve it?
- What is the total cost for using the PaaS solution, factoring in all of the enterprise's development needs?
- What programming languages, interfaces, tools and database support are available? How do those offerings match up with the organization's developer needs?
- Will this provider still be in business

next year when the enterprise needs to roll out additional new applications?

- Is there a trial period during which the developer can evaluate the PaaS solution for functionality, reliability and ease of use?

PaaS solutions are still a nascent area of cloud computing, so organizations should explore many issues to ensure that they don't wind up at a dead end. For example, based on the tools and infrastructure of a particular PaaS provider, how will the applications developed in its cloud integrate with existing enterprise applications or applications obtained through SaaS providers? No organization wants to rush into PaaS and end up with incompatible, siloed applications.

### Who Fits the PaaS Profile?

Depending on the maturity and efficiency of the enterprise's existing development platform, it may not save any money by moving to a PaaS solution – and that's not necessarily a bad thing.

Developers know and love the tools they use to create applications. Driving them to a new platform may actually boost costs in the short term. That being said, developers also like to use the latest and greatest tools, which could lead to a rash of oversubscribing to PaaS services. Organizations need to craft and clearly communicate the policy toward employing PaaS solutions to ensure they don't overspend on disparate tools.

Clearly, small businesses, startups and others that have not previously developed their own applications (because they didn't want to invest in them) may be drawn to the no-overhead model of developing software in the cloud. For them, a PaaS solution represents an incremental cost.

But such enterprises have already determined what others should keep in

## WHEN NOT TO USE PaaS

Analysts contend that there is little that developers can't accomplish via the cloud. But organizations might want to think twice about PaaS solutions under the following circumstances:

- There's a plan to introduce proprietary programming languages, which could actually hinder a process that PaaS was designed to streamline.
- Something about the way they develop applications makes them wary of PaaS vendor lock-in.
- There's a plan to port application code among many different platforms.
- Access to certain hardware or software functions of the underlying infrastructure is required in order to optimize applications.

mind when evaluating PaaS: The ability to quickly deploy new applications that make the organization more efficient, competitive or innovative is what makes PaaS worthwhile.

Based on careful analysis of their existing and projected platforms, some may determine that they can save money by moving to a PaaS solution. Maybe they realize monetary benefits through higher productivity or better IT staff utilization. But if potential PaaS adopters determine that getting software tools into the hands of users quickly and easily is the best result that they can achieve with PaaS, then that may be enough to establish its worth. ■

**WE GET**

**CLOUD PRODUCTIVITY**



**BY 2014,  
62% OF  
WORKLOADS  
WILL BE  
CLOUD BASED.**

Source: IBM

## **ON-PREMISES SOFTWARE COULD BE WEIGHING YOU DOWN.**

SaaS solutions have created quite the buzz in recent years among IT decision-makers. And it's no wonder. The concept is a compelling one: organizations subscribe to software that is maintained and delivered by an external host, benefiting from a standard rate of cost that can scale up and down according to use. In contrast to on-premises software, which is loaded onto individual computers or client devices, SaaS software is offloaded to the data center of a third-party service provider; and instead of accessing applications from the data center, users simply access them via the Internet. The result is fast deployment, high scalability, and on-demand accessibility.

**When it comes to the benefits of this cloud-based model, the sky's the limit:**

### **REDUCED IT COSTS**

Because SaaS applications are delivered and maintained by an external provider, they eliminate many hardware, software and maintenance expenses associated with traditional software.

### **PAY-AS-YOU-GO STRUCTURE**

Flexible SaaS subscription terms and fees make it simple and easy to add new users to your system as your organization's needs grow. (And you won't need to worry about adding hardware, software or bandwidth when they do.)

### **RAPID DEPLOYMENT**

SaaS can be deployed in a fraction of the time it takes for on-prem software. Simply load your data

into the software running on the vendor's site, and you're good to go.

### **SIMPLIFIED UPGRADES**

Your SaaS provider handles all updates, upgrades and backup tasks for you. There's no wait time for updates or patches either; your software is upgraded instantly without any demand on your resources.

### **EASY INTEGRATION**

Unlike most organizations, SaaS providers can scale indefinitely to answer demand. Many even provide customization to better meet specific needs, including integration with your existing internal applications.



**Microsoft Office 365 for large and small organizations is a subscription service that combines the familiar Microsoft Office Apps** with a set of web-enabled tools that are easy to learn and use, that work with your existing hardware, and that come backed by the robust security, reliability and control you need to run your organization.



CDW.com/ibm

**Focus on your organization** – not IT deployment – IBM SmartCloud Solutions are SaaS applications and business process-as-a-service (BPaaS) capabilities that help you accelerate innovation and focus on business goals rather than IT deployment.



CDW.com/adobe

**Equip your team with the entire collection of Adobe creative tools, along with new apps and services for building websites and publishing mobile apps.** With 100GB of cloud storage per user, it's easy to access your work anywhere. After your team is ready to show off their work, Adobe Connect for Web Meeting allows them to go beyond screen sharing, enabling far more effective collaboration and communication with colleagues, partners and customers – anytime, anywhere, on virtually any device.



**With Box, say goodbye to the frustrations of sharing documents through email and FTP and hello to simple, fast, cloud-based collaboration and content sharing.** Maintenance, shared logins, downtime and bandwidth limitations become a thing of the past – simply get your work done anywhere, on any device.



**40% OF RESPONDENTS ARE SOMEWHAT OR VERY SATISFIED WITH THE RELIABILITY OF THEIR ON-PREMISES APPLICATIONS, COMPARED WITH 55% SATISFACTION WITH SERVICE RELIABILITY AMONG SaaS USERS.**

Source: InformationWeek 2012 Enterprise Applications Survey, August 2012

## PARTNER WITH THE PROS

When organizations implement advanced technology solutions, they want to rely on a partner that delivers comprehensive product knowledge, proven technical expertise and total service capabilities. That's why organizations of all sizes rely on CDW. Through assessment and design to deployment and ongoing support, we'll review your needs and infrastructure to determine the best software approach for your organization, be it SaaS, traditional software or a combination of both.



**Get started at CDW.com/SaaS**

**WE GET**

**CLOUD SECURITY**



**43% OF I.T. DECISION-MAKERS ARE AWARE OF PEOPLE IN THEIR ORGANIZATIONS WHO HAVE USED CLOUD SERVICES INDEPENDENTLY OF THEIR I.T. DEPARTMENT.**

Source: McLaughlin & Associates, 2012  
Cloud Computing Adoption Survey

## **CLOUD SECURITY CONCERNS**

With its promises to increase organizational agility, scalability and responsiveness, cloud computing is transforming the way organizations provide and consume IT services. But for all the benefits cloud computing delivers, there are real considerations that must be made regarding security, reliability and accessibility. With the continued growth of mobility and the Bring Your Own Device (BYOD) movement, mobile security ranks at the top of the priority list for many IT professionals.

Mobile device management (MDM) software helps solve these issues by allowing IT administrators to gain cross-platform control of Apple iOS-, Android- and Windows-based devices. The strategy is to optimize the functionality and security of a mobile communication network while minimizing cost and downtime.

MDM solutions offer the ability to write security policies that are both platform- and device-agnostic, leaving the details of implementation to the MDM system itself. Other benefits include reduced support costs and business risks by controlling and protecting the data and configuration settings with advanced capabilities.

Moreover, MDM products offer insight into the ways devices are used in organizations. Administrators can monitor and control the applications installed on devices, monitor the use and transfer of information between mobile devices and enforce encryption policies for sensitive information.

### **CONTROLLING CLOUD SERVICES**

The consumerization of technology is not limited to the mobile-computing devices in end users' hands. It has also driven users to adopt cloud-based information services that give them ubiquitous access to information, collaboration capabilities and social media. Security becomes an issue when users access such services via mobile devices, especially when the services employ unknown or unacceptable terms and conditions and the users are accessing enterprise data.

MDM platforms provide a number of ways for administrators to restrict the use of unauthorized cloud services. CDW's dedicated cloud solution architects will guide you through the entire evaluation and implementation process to determine the optimal deployment options, including on-premises, cloud-based, or some combination of both.





CDW.com/symantec

Even as individuals and organizations realize the potential agility and cost savings benefits of cloud computing, concerns about security and availability of clouds persist. Gain confidence in your cloud with protection from Symantec. Whether you want to consume services directly, build your own cloud for internal operations or external reach, or extend into third-party clouds safely and efficiently, Symantec delivers the path to a protected cloud.



CDW.com/websense

WebSense Cloud Web Security provides threat protection, simplified management and reporting, web controls and more – all in a deployment requiring no hardware or software to buy and install, and no maintenance to perform.



CDW.com/trendmicro

Trend Micro Deep Security provides a comprehensive server security platform designed to simplify security operations while accelerating the ROI of virtualization and cloud projects. Tightly integrated modules easily expand the platform to ensure server, application and data security across physical, virtual and cloud servers, as well as virtual desktops.



An Intel Company

CDW.com/mcafee

McAfee SaaS Endpoint Protection provides the essential protection to keep small businesses safe from viruses, spyware, web threats and hacker attacks. SaaS Endpoint Protection makes it easy to deploy and manage security at your company by automating security updates, upgrades and management – all through the online McAfee SecurityCenter.



## 22% OF I.T. MANAGERS ARE AFRAID THEY WILL LOSE CONTROL OF THE DATA STORED IN THE CLOUD.

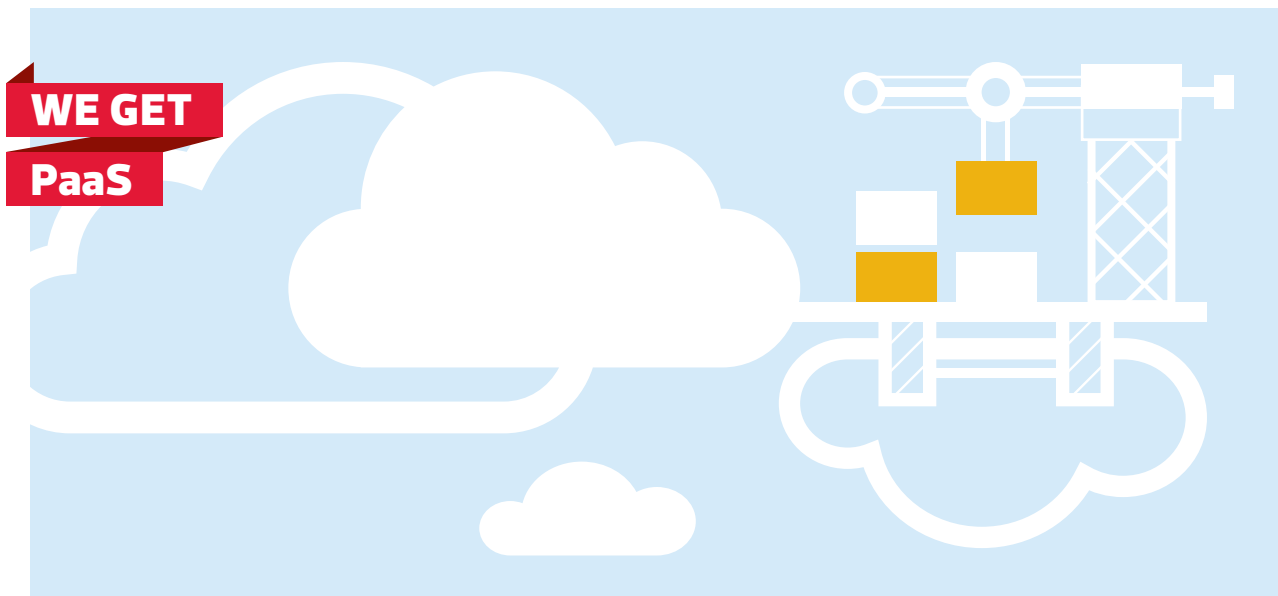
Source: GreenSQL, October 2012 Database Security Survey

## CLOUD SECURITY: HELP IS ON THE WAY

Security is one of the biggest reasons many organizations hold back from moving to public-cloud services. In response, several of the most prominent security manufacturers have released products to ease these concerns. One category is cloud-based email security. Products such as Symantec cloud and Panda Cloud Email Protection offer virus and spam protection, along with content and image control. Symantec also offers a product that delivers instant messaging protection in the cloud.



**Learn more about cloud security at [CDW.com/cloud](http://CDW.com/cloud)**



**\$1.8 BILLION**  
**PROJECTED SIZE  
OF THE GLOBAL  
PaaS MARKET  
BY 2015.**

Source: The Technology Café,  
"Forget SaaS: Platform as a Service  
(PaaS) is Here Infographic.

## THE POWER OF PaaS

**Platform as a Service tools provide a path toward agility while reducing costs.**

When it comes to being able to develop an advantage over competition or quickly provide the enhanced services that workers and customers demand today, the IT department stands out among other business units. But creating new applications or making key additions to existing programs to meet these needs requires modern and agile development platforms.

Many organizations may not have the budget to invest in the latest programming tools – not to mention comprehensive testing platforms that can validate new code before it is introduced into production environments.

This is where the value of PaaS becomes clear. Platform as a Service is one of the cornerstones of cloud computing, embodying the core characteristic of delivering computing resources as needed. Other essential elements include resource pooling and rapid elasticity, in addition to expansion of development capabilities.

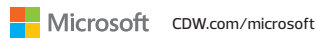
Along with being free from upfront infrastructure costs, PaaS can offer increased accessibility to the latest tools for making developers more productive. This in turn can shorten the time it takes to give business users or customers enhanced services.

What capabilities come with a typical PaaS offering? Most significant, PaaS delivers all of the essential building blocks necessary for the IT staff to create and run its own custom software. This includes the development environment and programming library for creating custom applications, as well as the entire computing stack to test and run the proprietary programs.

The benefits of PaaS go beyond just relieving the burdens of managing servers, operating systems, development frameworks and related technologies. PaaS resources can be deployed or expanded quickly – within days or minutes in some cases – because the IT department doesn't have to install a host of on-premises software and hardware for programming operations.



**Salesforce Chatter is the engine of the social enterprise, helping companies get more done through instant collaboration via enterprise social networking.** One single, secure environment connects you to everything you need for your social enterprise, and eliminates islands of collaboration by enabling employees to work together on sales deals, service cases, marketing campaigns, files, dashboards – any business process – on one, trusted platform.



**Lync Online connects people everywhere, on devices running Windows 8 and other operating systems, as part of their everyday productivity experience.** Lync provides a consistent, single client experience for presence, instant messaging, voice, video and a great meeting experience. Lync enables instant messaging (IM) and voice calling with the hundreds of millions of people around the world who use Skype.

## WHITE PAPER

### THE POWER OF PaaS

Platform as a Service is one of the cornerstones of cloud computing, embodying the core characteristic of delivering computing resources as needed. Find out how to make it work for your organization in this informative white paper from CDW.

**[CDW.com/platasaserv](http://CDW.com/platasaserv)**



# \$1.2 BILLION



**UPWARD TREND**  
WORLDWIDE REVENUES FOR PaaS SOLUTIONS COULD TOP **\$1.2 BILLION** WHEN THE FINAL RESULTS ARE TALLIED FOR 2012, WHICH REPRESENTS A SIZABLE BOOST OF \$300 MILLION OVER 2011. FORECASTS SUGGEST STEADY GROWTH FOR THE PaaS MARKET, TOTALING **\$2.9 BILLION BY 2016.**

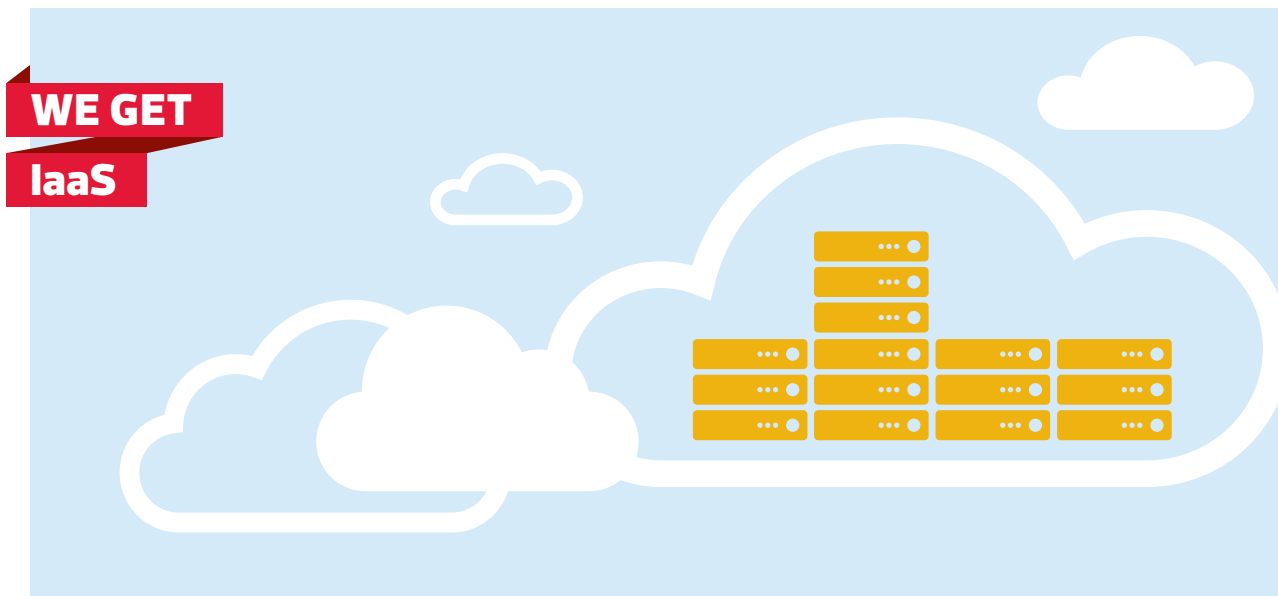
SOURCE: Gartner

## WHAT CDW OFFERS FOR PaaS

As the Platform as a Service market continues to mature, CDW has established itself as a leading source for these solutions. We have partnered with the largest, most reliable PaaS providers in the industry and have a team of dedicated cloud specialists available to help organizations decide what best fits their needs, whether it's a PaaS or an on-premises application development solution.



**To learn more about the power of PaaS visit [CDW.com/PaaS](http://CDW.com/PaaS)**



# #1

## IaaS IS THE FASTEST GROWING AREA OF CLOUD COMPUTING.

Source: Gartner

## IaaS: PREPARING FOR MIGRATION

Moving an entire infrastructure (or even a portion of it) to the cloud can yield significant benefits. Not only can organizations get the computing power, storage or other services they need when, where and how they need them, but they pay only for the capacity used. What's more, they get it in a secure, monitored, metered environment that promises nearly 100 percent uptime.

Making the leap from a physical infrastructure to an IaaS environment may seem overwhelming, but there is a logical way to structure the move. The first step is to virtualize the current environment. Virtualization gives IT managers and executives a clearer understanding of which applications and data are most important, along with the interdependencies among them. Through this process, it becomes clear which applications make sense to port to the IaaS environment.

The next step is to discover which applications and software versions are in use throughout the environment, which users have permission to use them and the interdependencies among those applications.

IT shops will also need network and storage metrics, specifically as they describe throughput and latency. This data is crucial to determining how the applications will work in the new IaaS environment.

Application dependency mapping is next. This involves identifying dependencies between applications, as well as between applications and the data infrastructure. The idea is to find out how to architect the migration plan so that those dependencies aren't disrupted. It's a painstaking process, one that an outside consultant or a special-purpose mapping tool can help with.

It's also important to ensure that the cloud-based infrastructure is compatible with the organization's existing server hardware and operating systems. If the hardware isn't compatible, applications may have to be deployed or recompiled for the new platform.

Finally, it's important to prepare the IT staff for its changing role. With an IaaS model in place, the IT role shifts from one of a hands-on, troubleshooting, in-the-weeds role to one that is more managerial. The IT manager now becomes a liaison to the IaaS provider, monitoring its work and making sure the organization gets the best value.



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



#### Box Enterprise Unlimited

**A secure collaboration and content-sharing platform.** With Box, say goodbye to the frustrations of sharing documents through email and FTP and hello to simple, fast, cloud-based collaboration and content sharing. Maintenance, shared logins, downtime and bandwidth limitations become a thing of the past – simply get your work done anywhere, on any device.

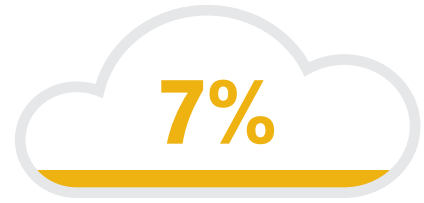


CDW.com/hp

**HP Cloud Collaboration as a Service enables organizations to manage data and enable file/information sharing with extremely low latency.** With its economics and agility, HP Cloud Object Storage enables flexible and cost-effective capacity, tight security and control, and anywhere, any-device collaboration at enterprise scale.



**VMware vCloud Hybrid Service is a secure, dedicated hybrid cloud service operated by VMware, built on the trusted foundation of VMware vSphere.** The service supports existing workloads and third-party applications as well as new application development, giving IT a common platform for seamlessly extending its data center to the cloud. vCloud Hybrid Service is available in two service types – Dedicated Cloud and Virtual Private Cloud.



**7% OF DATA IS CURRENTLY STORED IN THE CLOUD. BY 2016, IT IS ESTIMATED THIS WILL RISE TO 36%.**

Source: IDC Predictions 2012:  
Competing for 2020

## MAKING THE JOURNEY

As with any transformational change to the way organizations work and work together, the journey to the cloud can be overwhelming. To fully realize the compelling benefits of cloud computing, your business needs a good roadmap – and that's where CDW can help. We can show you how to divide, prioritize and connect your efforts – and how to maximize the benefits every step of the way.



**CDW can help you get started. Visit [CDW.com/laaS](http://CDW.com/laaS) to learn more.**

Why IaaS Is Attractive

Varieties of Infrastructure Services

Apps that Thrive in IaaS

# INTELLIGENT RESOURCE ACQUISITION VIA IaaS

Improving the bottom line by removing large IT capital expenses



**D**ifferent organizations may benefit from infrastructure as a service in different ways. Many, such as startups, small businesses, nonprofits, etc., typically don't have the time or resources to build their own infrastructure of servers, desktop PCs, storage arrays, network switches and routers. These enterprises are perfect candidates for IaaS.

Prospective IaaS adopters may also be resource-rich organizations. They're successful and well established, but need more computing infrastructure than they can add at any one time. These organizations may be researchers mapping the human genome, federal agencies mining geospatial data or Silicon Valley startups analyzing terabytes of information to create new web services and applications.

It doesn't make practical sense, for instance, to build and own a high-performance computing cluster if it remains idle more than it's used. By exploiting IaaS, organizations can rent the high-performance

computing power they need and throttle it back when they're finished.

## Why IaaS Is Attractive

IaaS comprises computing, storage, desktop and networking resources delivered on demand. Of the types of services that enterprises can procure from the cloud, IaaS has the potential to have the biggest measurable impact because it can take large IT system purchases out of the budget. Don't buy servers; lease server capability. Don't deploy new storage systems; rent storage space in the cloud. Forget standing up multiple networks; provision them with a service provider.

Moreover, IaaS can help realize goals that IT departments have had for years but have been unable to attain because of their traditional infrastructure models. For example, true disaster recovery has remained elusive for many because it was largely an exercise in redundancy — redundant servers, storage arrays and communications links. Today, maintaining those



resources in the cloud and implementing tools that can quickly and automatically move computing jobs among them as needed ensures that the enterprise's infrastructure is always available.

In general, organizations embrace IaaS for one or more of the following reasons:

**Capital cost avoidance** | Nowhere is cloud computing's cost equation more stark than when it comes to infrastructure. The difference between the capital cost of purchasing servers that an organization must write down over a period of years and the operational cost of renting the same server capabilities from a cloud provider is a core argument for IaaS. But every organization's needs are different, and IaaS doesn't always make better financial sense over in-house infrastructure solutions.

**Fresh technology** | With more enterprises holding on longer to their PCs, servers, storage and networking gear, the prospect of renting infrastructure in the cloud can be a welcome idea. IaaS providers

are more likely to employ the latest technology to attract customers. They can afford to do so because they lease IaaS resources to many different organizations at the same time.

**Resources on demand** | In a traditional infrastructure model, if the IT team needs, for example, more storage to support a new initiative, it must procure the storage system, have it delivered, set it up, configure and test it, and then make it operational. In the cloud, such IaaS is provisioned online and available in a fraction of the time.

**Rapid response** | On-demand IaaS resources also make it possible for IT teams to pull together entire computing platforms rapidly. For example, if an organization must add hundreds of employees to meet a specific seasonal demand, the IT department can procure desktop resources, storage and the server environments and networking to support them from a centralized console.

**Low maintenance** | Best of all, with IaaS, IT staff don't have to put their hands on as many systems in order

to troubleshoot and maintain them all. Significant system upgrades can be time- and resource-consuming for the IT group. But in the cloud, an IaaS provider handles upgrades, support and maintenance.

The best time to derive maximum benefits from IaaS is when an organization has an immediate need. If its servers, desktops or storage systems are due for an upgrade, an organization can explore avoiding hardware upgrades by moving infrastructure capacity to the cloud. For many small businesses, nonprofits and other groups, IT is not a core competency. IaaS may be a natural solution to their IT needs.

### Varieties of Infrastructure Services

The IaaS market has attracted a lot of development in recent years, as it has become apparent that more enterprises are ready to shift core computing workloads to the cloud. Before, cloud efforts may have comprised an application here and a test







bed there. But as organizations have grown comfortable with clouds, several businesses have rushed to provide IaaS.

Amazon Web Services (AWS) was the original and is still the largest IaaS option. But now Rackspace, Google Compute Engine, HP Cloud Services, Microsoft Windows Azure and many others are available to help organizations run systems in the cloud.

In general, IaaS offerings fall into a few main categories that are offered by providers:

**Computing as a service** | The most popular form of IaaS, in part because it draws from various other IaaS offerings, is computing as a service. If an enterprise has a large-scale computing task it needs done and doesn't want to buy, integrate and maintain the required infrastructure, it can rent it, from servers to storage. One increasingly high-profile computing service is Hadoop, a high-performance, distributed processing framework for handling Big Data, especially unstructured Big Data.

Related to computing as a service is *servers as a service*. When an organization needs added capacity to process workloads, handle overtaxed enterprise applications or make server-based software accessible to distributed workers, it can virtualize those machines and upload them to cloud-based server resources.

In general, under traditional IT models, enterprises dedicate servers to single applications and, as a result, end up with more server capacity than they need. In the cloud, they provision only the server capacity they need and for only the length of time they need it.

**Storage as a service** | What started as a quintessential consumer cloud service — online storage for photos, videos, music and other files — has become a core IaaS offering for enterprises. Offline, on-premises storage capacity may be inexpensive, but scaling it up to handle

rapid data growth takes planning, capital investment and IT staff.

Even then, planning for storage can be an inexact science. Organizations often end up with too little or too much capacity for their needs. Cloud storage is elastic, so it grows and shrinks to match an enterprise's actual needs. Plus, it is secure, encrypted and highly available.

Related to storage as a service is *backup as a service*. The cloud is an ideal place to back up enterprise data so that it is accessible anywhere, whether to support mobility or disaster recovery. Cloud-based backup services offer many of the same features as traditional backup solutions: automatic failover, multiple restore points and encryption, among others.

These services can also play an important role in a tiered data lifecycle management program, wherein critical data remains close to users (on hard drives and in data centers) while older data migrates to the cloud for long-term storage. Even in the cloud, IaaS providers offer tiered storage solutions to match an organization's need for speedy input/output or bulk data warehousing.

**Desktop as a service** | Enterprises have begun a trend toward virtualizing desktop computer environments — operating systems, applications, storage and processing — and delivering them over the network. This type of virtual desktop infrastructure (VDI) relieves IT departments of the burden of visiting employees' workstations for troubleshooting, patch management and other maintenance chores.

The virtual desktops are stored centrally, on servers, where they can be upgraded and supported by fewer people before sending them out to users' PCs, thin clients, notebooks and even tablets and smartphones. Workers can't necessarily customize them with their favorite wallpaper, but that is also part of the allure.

Standardized desktop environments



are more secure and tightly controlled. Moreover, they allow workers to access the same resources through the same interface, whether they're on the road or in the office.

Throw cloud into the mix and you have IaaS providers that can deliver virtualized desktop environments to users anywhere they are required on a pay-as-you-go basis. But it's important to keep in mind that moving desktops from the location where the servers are housed will add latency to the end-user experience. This must be planned carefully. Ideally, servers, storage and desktop would all be moved at the same time.

#### Networking as a service |

Researchers believe software-defined networking will become an important enabler of next-generation cloud computing deployment. When an organization deploys networking as a service, it is accessing an abstraction layer of traditional network devices. As organizations integrate cloud services into their infrastructures, they will need to manage the network connections for those services.

Rather than buying and configuring gateways, routers and firewalls, they can access their functionality as a service and manage settings via a software console. When an enterprise needs more bandwidth or enhanced quality of service to support a critical, performance-sensitive cloud application or service, it can provision it in the cloud and pay only for what it uses.

#### Apps that Thrive in IaaS

What applications does IaaS ideally support? In general, good candidates are those that require an unpredictable, temporary or vast amount of infrastructure resources. Some examples include:

#### High-performance computing (HPC) |

Researchers today make frequent use of IaaS to process large data

sets across clusters of cloud-based systems. They load virtual machines onto IaaS resources and then receive the results at their workstations.

**Business intelligence, analytics and Big Data |** Related to HPC, many companies, universities, government agencies and others use IaaS to look for patterns, connect data points or otherwise analyze vast stores of data to create actionable intelligence. Big Data derives from transactions, digital media, traffic patterns, sensor feedback or other sources of information. IaaS offers the flexibility to temporarily hold Big Data for analysis or to store it long-term.

#### Test and development |

IaaS is ideal for temporary needs, such as IT testing and development, whether for applications, websites or advanced integration projects.

**Web applications |** In addition to everyday applications, organizations should consider IaaS for one-off applications, such as seasonal online retail sites, promotional applications or government awareness campaigns.

**SaaS and PaaS solutions |** Clearly, enterprises considering SaaS and PaaS implementations might also consider combining them with IaaS. Although many SaaS and PaaS vendors offer basic infrastructure resources (for example, storage, processing and security), certain deployments may require more robust IaaS. ■

## WHEN NOT TO USE IaaS

IaaS provides the plumbing that organizations need to run their IT operations. As long as the plumbing works, it's hard to argue with getting it quickly and cheaply. But sometimes, IaaS may not be the right fit, such as when:

- Current laws and regulations govern where and how data may be stored and/or processed.
- The performance requirements demand dedicated, in-house systems.
- A commodity infrastructure just won't do. (Part of the lure of IaaS is the economics of running services on commodity systems. But sometimes, organizations prefer high-end, brand-name components. Fortunately, analysts expect cloud service providers to begin differentiating themselves by the hardware and software they run their services on.)

## WHITE PAPER INFRASTRUCTURE as a SERVICE

Learn more about the benefits of not having to buy, manage or maintain IT equipment thanks to IaaS migration: [CDW.com/infraasaserv](http://CDW.com/infraasaserv)



Private Vs. Public Clouds

Why Consider a Private Cloud?

Build or Buy?

Private Cloud's Prerequisites

# SINGULAR FOCUS: THE PRIVATE CLOUD

.....

Harnessing this  
resource for  
increased control  
and data security

.....



**W**hen most people think of cloud computing, they think in terms of a public cloud – an infrastructure or service somewhere out on the network that's shared among other unknown organizations. From those public clouds, an organization can access software, platform and infrastructure as a service.

Unfortunately, many enterprises are uncomfortable with the idea of sharing IT resources. Much of the concern seems to gravitate around whose data is in close proximity to theirs. It could belong to competitors, hackers, criminals or other nation states. Aside from this general aversion to sharing resources or leaving any part of their IT operations to third-party cloud providers, many organizations are restricted by laws or regulations from moving information to a public cloud.

This is where private clouds come into play.

## **Private Vs. Public Clouds**

For years, enterprise data centers

have been evolving. IT departments have begun embracing the idea of shared services or a service-oriented architecture to more efficiently deliver computing capabilities to users. Coupled with a need to streamline data centers, the services approach has driven interest in virtualization. Organizations that have moved far along on their journey to a virtualized infrastructure are well positioned to build their own private cloud.

It's important to remember that a cloud isn't a thing; it's a set of capabilities and structured IT processes. Imagine an organization's data center – consolidated and virtualized – offering services on demand, elastic computing capacity and metered, pay-as-you-go usage. That describes a private cloud. In a nutshell, a private cloud is a virtualized data center with a new management layer.

The difference between public and private clouds is less about where the cloud resides and more about whose information it hosts. A public cloud



represents a shared infrastructure with many tenants. A private cloud is devoted to a single enterprise or group.

A private cloud can be built in an organization's own data center, or it can exist on third-party infrastructure devoted to the customer. Some public-cloud providers will cordon off servers and storage (logically and physically) into a private cloud to meet the security and privacy needs of certain clients.

Many organizations, when they first adopt the cloud computing model, opt for the private cloud. Some start by obtaining services through what are known as *community clouds*. These are private clouds built for groups that share similar resource, regulatory and security requirements.

Many experts believe that industry-specific community clouds, purpose-built for vertical markets such as healthcare, finance, government or retail, are the next big thing. For example, a healthcare community cloud could be designed to comply with the Health Insurance Portability

and Accountability Act (HIPAA).

These community clouds resemble public clouds in that they host services for several organizations. But they are private in that not just anyone can use them, and the tenants that do are normally aware of the other enterprises operating in the cloud.

Another popular type of private cloud is the *hybrid cloud*. As its name implies, a hybrid cloud blends the best security and control aspects of a private cloud with the massive scale of a public cloud. In other words, enterprises move select computing workloads to a public-cloud service while keeping others in-house.

### Why Consider a Private Cloud?

The reasons for considering cloud computing and the reasons for considering private-cloud computing can be very different. Most organizations first consider a private cloud because they are unwilling to trust their data and applications to a third party.

They may also need to meet specific

security requirements, particularly with regard to data privacy, that can't be met in a public-cloud model. Or they want to maintain control of their IT infrastructure, in part to ensure a certain level of availability.

Enterprises that are attracted to the potential cost savings and economies of scale afforded by the public cloud may be disappointed if they assume they can enjoy those same benefits in a private cloud. An organization that creates a private cloud in its own data center still must operate its own hardware and software infrastructure, plus the ingredients that make a cloud a cloud: automation and orchestration, self-service portal, metering and chargeback. And if the organization aims to license a private cloud in a public-cloud infrastructure, it's unlikely to enjoy the same cost benefits from a provider that must dedicate resources to the private cloud.

For private-cloud adopters, cost reduction comes from the consolidation and virtualization that the enterprise

>

must undergo. Analysts have found that when private clouds are adopted, the biggest benefit is agility — how quickly the organization can set up systems, launch new applications and provision IT resources.

That's not to say that cutting IT costs isn't a possible benefit of using a private-cloud solution. It's just that cost reductions may not come from reducing hardware or software needs. But IT maintenance eats up the lion's share of IT budgets, and by some estimates, moving to a private cloud can reduce maintenance costs by half.

**Among other benefits, private clouds also offer the following:**

- Greater IT efficiency and reduced time for provisioning and decommissioning
- The ability to launch new business capabilities quickly
- Protection against unauthorized use of public-cloud services
- Metering and chargeback to encourage responsible use of IT resources
- Better support of internal developers through on-demand resources
- The chance to demonstrate the value of cloud computing to skeptical stakeholders

Private clouds also provide for better alignment between IT and business functions. In recent years, IT departments have tried to reposition themselves as service providers supporting key business operations — not just technology operations that buy, install and maintain computing systems. In a private-cloud model, IT departments engage more with business units to understand their needs and rapidly develop cloud services that support them.

### Build or Buy?

As if the decision of whether to adopt a public or private cloud weren't enough, organizations that opt for the control and security benefits of a private cloud must determine how to deploy one. They can build it themselves in their own data center, or they can host it offsite on a managed service provider's infrastructure.

When an enterprise chooses to host a private cloud with a third party, the service provider operates the cloud on its infrastructure (including all cloud-based SaaS, PaaS and IaaS products the enterprise makes available to its users), but uses dedicated (private) hardware resources. The hosted private cloud offers the benefits of cloud computing, including self-provisioning, elasticity and metered usage, but without multitenancy.

For certain critical applications, only a nonshared, private cloud will meet an organization's security and regulatory requirements. Building that private cloud at the organization's facility is a data center–development project, requiring servers, storage, network bandwidth, security and the expertise to enable all of it for self-provisioning, rapid scalability, metering and chargeback (billing business units for what they use). If it is not handled correctly, building a private cloud can result in cost and schedule overruns.

Analysts such as research firm IDC expect enterprises to continue to be attracted to private clouds. However, more of them likely will choose hosted private clouds — virtual private clouds — that are managed by a third-party specialist. Doing so doesn't allow an organization to skip important steps in cloud migration, namely consolidation, virtualization, automation and orchestration, but it relieves them of having to build their own cloud.

Enterprises that want to build private clouds in their own data centers can use one of a growing number of prepackaged solutions. These “cloud in a box” offerings include the necessary hardware and software for getting a private cloud up and running.

Popular solutions include Vblock, from the Virtual Computing Environment (or VCE, a joint venture of VMware,



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Cisco Systems and EMC); FlexPod, from Cisco Systems and NetApp; IBM CloudBurst; and HP CloudSystem. These preintegrated hardware/software solutions have been tested in advance for interoperability, saving IT departments time and effort in getting systems up and running.

They are ideal if an organization is starting its private cloud from scratch, because they include servers, storage, networking hardware and all necessary cloud software. Forrester Research found that organizations that used preintegrated solutions to build their private clouds were most successful in creating a true cloud environment.

For enterprises that are already running a highly consolidated, virtualized data center on existing IT infrastructure, some software solutions can run on top of their installed resources to cloud-enable them. Typically, they can run on any infrastructure, but they may require a certain level of integration work to make the private cloud function properly.

### Private Cloud's Prerequisites

Unless an organization is starting with a clean slate and can build a private cloud using one of many preintegrated, cloud-in-a-box solutions, it must prepare its data center to enable private-cloud services. At the same time, it needs to understand and plan to introduce several new technologies that will turn its virtualized data center into a true private cloud, offering all the capabilities of cloud computing. Some of the key steps along the way include the following:

**Consolidate** | Most data centers have more systems than they need to support their users. It is always a good idea (and mandatory for a successful migration to a private cloud) to consolidate systems. Look for redundant applications, underutilized

servers and spare storage systems. Consider physical consolidation into blade servers and other technologies that can harness data center sprawl.

**Standardize** | Adopt a standard of "one" — one SAN vendor, one server vendor, one hypervisor vendor, etc. This step, along with the others, will leave the organization well-positioned for high orchestration and automation.

**Service** | Implement a services approach. Everything that the IT department does should be approached as a service: availability as a service, cost as a service, capacity as a service, security as a service, incident management as a service, change management as a service, etc. A services approach is critical to successful private, hybrid and public clouds.

**Virtualize** | With systems consolidated, look to virtualize anything that makes sense to IT operations. This could lead to further consolidation, as virtual machines need considerably less hardware to run on.

**Pump up the network** | In a private cloud, the IT department will serve resources over the network, which will require ample bandwidth to ensure a high level of performance. Think in terms of 10-Gigabit Ethernet LAN connections and examine the organization's WAN connections for similar performance.

**Decide what moves to the cloud** | Not every IT function should move to the cloud. IT staff should start thinking about which cloud services make sense and which don't, depending on the organization's infrastructure and business operations.

**Decide what moves to the private cloud** | Similarly, not every IT function should move to the private cloud. Despite some initial reluctance, the IT team may decide that certain systems, such as email,

## WHY I.T. MANAGERS LOVE HYBRID CLOUDS

In May 2013, Microsoft commissioned a study by 451 Research, which, among other things, led the company to call the coming years the "era of hybrid cloud." *The New Era of Hosted Services*, which polled 1,500 IT professionals, found that 68 percent were planning to adopt a hybrid cloud model over the next two years, up from 49 percent today.

Not only does a hybrid cloud offer enterprises the best of both worlds — security in the private cloud and economies of scale in the public — it also greatly enhances their ability to tackle large or unpredictable computing loads. One characteristic of a true hybrid cloud is that it is "burstable." This means that when the private cloud needs extra resources, such as storage or computing power, it can burst into the public cloud to acquire those resources.

can exist securely in a public cloud.

The hybrid-cloud model that this entails can be built in stages, but IT management should think long-term to minimize the migration process. If there's a good chance a system may eventually move to a public cloud, it may not make sense to move it to a private cloud first.

Building a private cloud can be a gradual process. One luxury of adopting cloud computing in-house is that enterprises can start small, build up their cloud

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expertise and then add capabilities when they're ready. However, to eventually arrive at a fully functional private-cloud infrastructure, organizations need to introduce several cloud-specific features, including the following:

**Automation and orchestration platform** | A key characteristic of cloud computing is that it is automated. Resources are provisioned automatically and expand or contract as needed without IT staff intervention.

Cloud automation comprises various scripts that handle tasks such as provisioning virtual machines, allocating storage and more. The orchestration platform assembles the scripts into a workflow and coordinates the configuration, management, service level and security of cloud resources into a single service for the user. Most cloud computing platforms that an organization might deploy in its data center include an orchestration component.

**A self-service portal** | One of the great benefits of a private cloud is when the IT group receives a request for resources and can answer, "Let's go ahead and do it." The self-service portal, which can be built after the automation and orchestration platform is in place, requires carefully considered policy. Standard choices for end users may be limited at first, but over time, as more resources are provisioned automatically through the portal and users grow comfortable using it, the savings to an organization can be massive.

**Metering and chargeback system** | Once the cloud service has been delivered to the user, the enterprise must track its usage and, if desired, charge business units for that usage. Metering shows users, or appropriate department heads, their cloud service usage and associated costs.

Should the organization determine that business units must pay for their IT services, the chargeback system

facilitates transactions and can integrate with existing IT financial management systems. Metering and chargeback are important for achieving the cloud benefits of improving utilization and cost management.

**Management and monitoring tools** | These tools allow assessment of how well a private cloud is running. Not only are the tools important for gauging performance against SLAs, but they also play a role in triggering the automation and orchestration system to add cloud resources (computing power or storage, for example) when services require them. ■

# SETTING BOUNDARIES: SECURING THE CLOUD

## Rethinking security with cloud in mind



**C**oncern about information security remains a top obstacle to realizing the benefits of cloud computing. The idea of handing over information systems to an outside provider spooks many IT departments. Questions about security in the cloud are a principal reason why, when organizations do opt for a cloud deployment, many of them look first to establish private clouds. But even in a private cloud, unique security situations demand the IT department's attention.

### How Cloud Influences Security Thinking

When it comes to fending off cyberattacks, cloud solutions are really no different than traditional networks. Both are susceptible to the same assaults. Moreover, in the public cloud, safety measures such as application authentication, disaster recovery and fault tolerance are managed by someone outside the enterprise. And in most cases, the organization's data sits on an infrastructure that it shares with others – potentially including competitors.

Private clouds can help ease some of those fears. A cloud that an organization owns and operates in-house is easier to secure and keep separate from the Internet. Plus, a private cloud can better help organizations comply with regulations such as the Payment Card Industry Data Security Standard (PCI DSS) or HIPAA.

Whether a cloud is public, private or hybrid, some of its specialized characteristics introduce unique security considerations. For example, multitenancy can exist in any cloud. In a public cloud, an enterprise may not know with whom it shares infrastructure. In a private or community cloud, the organization may know who it's sharing with, but may need assurances that another business unit, for example, can't access its information.

In a multitenant environment, it is reasonable to expect user groups to ask how the provider (public or private) keeps their data separate from other groups. For that matter, it is reasonable to investigate where the physical assets

are located and what type they are. In situations where the organization is procuring network services in the cloud, it should ask how these virtual networks are kept separate and secure.

In a cloud computing model, the traditional notions of internal, external and DMZ environments are muddled. One way to keep things separate in a cloud is to employ *domain isolation*. This helps to ensure that only authorized users and machines connect with an enterprise's resources.

An organization can employ a variety of techniques to enforce isolation, and in a private cloud, these are easier to manage. When dealing with a public-cloud provider, the organization must understand how the provider implements isolation.

In addition, the external links established between online resources create a unique security concern in cloud computing. These links don't exist in traditional software models, for example. Direct links between cloud resources meet a certain level of trust. When a third (or fourth, or fifth) resource establishes a link, that trust may be transmitted throughout the chain, when in fact, resources at the edge of the chain may be vulnerable to hackers.

Issues of *transitive trust*, as the concept is known, are relatively new to cloud computing. But as clouds grow more intricate and interconnected, these issues become more important. As users add external links to their cloud services – for pulling in other services, authentication solutions, external data and more – IT and security professionals will need to assess each external link for transitive trust issues and plan for possible breakdowns.

### Cloud Security Best Practices

In any cloud model, a few best practices can go a long way toward maximizing information security.

**Do your homework.** In a public cloud, an IT department must adequately question potential service providers about their security measures. What types of encryption methods do they use? What types of authentication? A service provider may actually get its authentication services from another vendor. Who is it and what assurances can the IT team extract from the authentication vendor that cloud platforms will be secure?

**Keep sensitive data internal.** Not everything should move to the cloud, especially data. In general, it may be best to keep confidential data on internal infrastructure (forming a hybrid cloud). Organizations should perform a risk analysis before migrating any data to the cloud.

**Encrypt all cloud traffic.** Chances are good that the enterprise already encrypts business data as it leaves and returns to the internal network, either via a virtual private network, Secure Sockets Layer encryption or some other method. Once data is in the cloud, it should be encrypted at rest. The service provider should use industry-accepted algorithms and encryption keys.

**Stay on top of updates to data security.** Cloud security needs to be an ongoing process. When dealing with cloud providers, an organization should make sure its SLA provides for regular reporting of possible security vulnerabilities and how the provider keeps the infrastructure secure.

**Employ web content filters.** When a web browser is the primary interface for accessing cloud services, it must be locked down tight. Web content filters watch what is coming and going through an Internet connection to identify viruses, spyware and other malware that could compromise a connection and allow hackers access to cloud resources.

## TRENDS IN CLOUD AUTHENTICATION

**Bring your own device** has become a common term, but many experts see a future for “bring your own identity” environments. Analysts expect BYOID to make it easier for users of enterprise cloud services to log in using Facebook, Google and other consumer online identification services. This might fit well in cloud initiatives that exploit cloud services for nonsensitive applications, but organizations need to look long and hard at BYOID for critical cloud services.

### Embrace security information and event management (SIEM).

In a public cloud, providers should be operating intrusion detection systems and other network security solutions to sense efforts by hackers to compromise systems. Organizations should also use such security devices to protect private clouds. A SIEM system takes information from disparate network security solutions and performs real-time analysis to further identify risks and issue alerts. It can also log security information to help generate useful reports.

### Don't forget physical security.

When part or all of an organization's IT infrastructure is hosted offsite, it's important to understand how the service provider controls physical access to its data center. Who has access to what, and how do they identify themselves? Enterprises should understand how the vendor gets assurances from employees that they will protect their customers' information. ■



# CLOUD GOVERNANCE AND MANAGEMENT

## Setting a framework for cloud operations



**C**loud computing requires different processes, ways of thinking and skill sets than other IT operations. Having studied the benefits, deployment models and security implications of a cloud infrastructure, organizations must make sure they can manage the cloud's unique details.

### ITSM and ITIL

Cloud computing requires IT to evolve into a services department – a major shift for any enterprise. IT service management (ITSM) is an umbrella term for a modern form of IT governance that changes the IT group from an isolated department focused on technology to an integrated part of the business focused on processes. ITSM is a natural fit with cloud computing because an IT department that implements the cloud is devoted to effectively delivering services to support the enterprise.

The IT Infrastructure Library is a framework for supporting ITSM. ITIL forms the foundation for ISO/IEC, an international standard for IT

service management that consists of five core components: service strategy, design, transition, operations and continual improvement.

Adopting ITIL prior to cloud migration will help an IT department navigate the necessary steps for successful implementation and support. These steps include creating a services catalog that can align the cloud offering with business process, and developing a change management database for tracking the deployment and decommissioning of cloud services, applications and virtual resources.

### Service-level Agreements

Related to ITSM and ITIL is the establishment of SLAs. Not only must an enterprise negotiate acceptable SLAs with its cloud providers, but if the IT department will be delivering services to business units, it should establish SLAs with users. This is how organizations measure services against expectations.

If the enterprise is a cloud customer, SLAs should address

important criteria such as:

- Costs above and beyond standard capacity, performance, users and so on (to be spelled out in the SLA if the standard contract doesn't cover them)
- Expected system availability or uptime
- Accountability for downtime and agreed-upon remedies (including financial compensation)
- Provisions for adding or subtracting resources to match demand, including how quickly it must be done
- Reports the organization can expect to receive to demonstrate performance against SLA metrics
- An exit clause that details how the enterprise can leave the cloud service – both for cause (poor service) and by the organization's choice – and how the data will be handled
- Security concerns, from how the cloud provider protects its infrastructure to how it separates tenants' data on its systems (if applicable)

For private cloud deployments, where the IT department is the cloud provider, consider SLAs for business units, as they are the cloud "customers." Such internal SLAs may be comparable to vendors' agreements, but may also include sections on metering and chargeback so internal customers know how much service they can expect, whether they will be charged for using it and how much it will cost based on users, resources, performance levels, etc.

### Software Licensing in the Cloud

One thing that cloud computing may actually make more difficult is software licensing. SaaS licensing is less likely to cause problems because the software is the basis of the vendor's service.

But with IaaS and PaaS cloud models, as well as private clouds, organizations may deploy their own virtualized applications in the cloud. That's where things can become confusing.

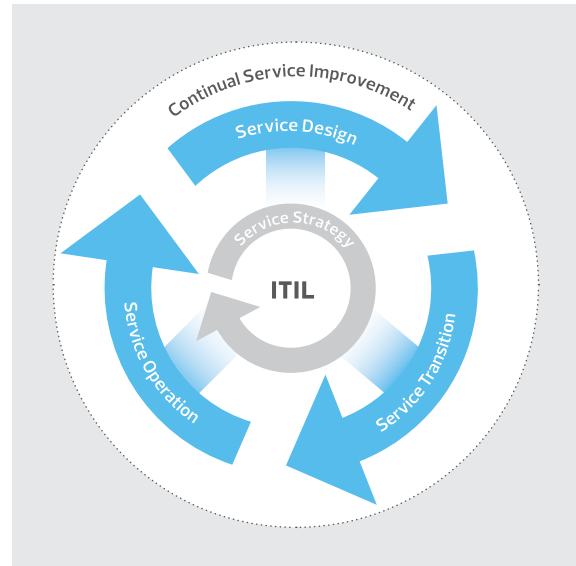
In the future, software licensing in the cloud may become clearer, but for now, software companies don't have a uniform way to address how customers can use their applications in a cloud situation.

Most agree that the cloud is an extension of traditional licensing, for which they can charge more, be it by user, by processor (particularly in private-cloud deployments) or by some other criteria.

Some enterprises may think that their traditional licensing agreements extend to the cloud, but that could prove to be an inaccurate assumption. In general, if a right isn't explicitly stated in a licensing agreement, it is usually retained by the software maker.

IT departments must think through all possible licensing stipulations when moving to a cloud. For example, if the organization plans to host an application on an IaaS or some other third-party platform, that third party may also require licensing-related clauses in its contract with the organization, including rights to access the software to ensure redundancy and assurances that the software is licensed to run in a cloud.

Many vendors today have software licensing experts on staff. Before deploying a cloud solution, IT departments should avail themselves of such experts and make sure they understand all the implications of



licensing in the cloud, which will reflect the enterprise's unique deployment model and usage needs.

### IT Workforce Development

Workforce development may be the biggest managerial issue IT departments face in their migration to the cloud. Many organizations say the shortage of IT workers skilled in cloud concepts and technologies is the top challenge they face in bolstering their cloud capabilities, according to IDC research.

Developing IT workers who are skilled in cloud computing is especially important for enterprises considering a private- or hybrid-cloud approach. Among needed expertise, IT staff must understand virtualization, cloud technologies, cloud security, multitiered and service-oriented architectures. Organizations should look for workers who have been involved in virtualizing data center resources, as they are most likely to know the basic tenets of consolidation, virtualization and (depending on prior experience) automation and orchestration. ■

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# ABOUT THE CONTRIBUTORS



**AARON ANDA** is a Cloud Solution Architect for CDW. He has worked in application development, spending most of that time as a business analyst and project manager for CDW's websites, mobile and internal applications. In early 2012, Aaron transitioned to his Cloud Solution Architect role, offering his IT knowledge to CDW sales teams, and their clients, through the alignment and integration of SaaS, IaaS and PaaS cloud services. Aaron graduated from the University of Iowa with a B.A. in Management Information Systems and Marketing.



**JASON HART** is a Cloud Client Executive for CDW with over 12 years of IT sales experience across various market segments. Using a consultative approach, he serves as a resource for CDW and clients, providing definitional, categorical and strategic expertise around CDW's cloud portfolio. He also serves as a "face-in-the-cloud" resource in the market, educating CDW sellers on various emerging market trends and cloud adoption use cases, speaking at various in-market events, and helping clients find the best-fit cloud solution for their business needs. Jason is a graduate of Purdue University and obtained his M.B.A. from Lake Forest Graduate School of Management.



**PAUL SCHAAPMAN** is a Data Center Solution Architect for CDW. With more than three decades of experience in IT infrastructure, he has a strong background in virtualization (server and client), server and storage engineering, IT architecture and IT consulting. Paul was awarded VMware's Virtual Vanguard Award in 2007 for his work on a large virtual infrastructure for the Virginia Farm Bureau.

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