

INFRASTRUCTURE AS A SERVICE

Utilizing this cloud resource allows small businesses to focus on their core business – rather than IT concerns

Executive Summary

Moving an enterprise's 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 they use. What's more, they get it in a secure, monitored, metered environment that promises nearly 100 percent uptime.

For small businesses without the financial or technical means to do it all themselves, moving some infrastructure to the cloud offers even more benefits than it does for larger organizations. Because the cloud operates as a utility, cash flow becomes easier to manage. In addition, because small businesses don't need IT staff on hand to support cloud-based hardware and the accompanying infrastructure, companies can focus on doing what they do best – managing the core business.

Table of Contents

- [2 IaaS Overview](#)
- [4 Benefits for Small Business](#)
- [4 Top Solutions](#)
- [6 When IaaS Makes Sense](#)
- [7 Preparing for Migration](#)

More small businesses are choosing some form of infrastructure as a service (IaaS) for help in managing their data center computing resources. In a 2011 study, the research and analysis firm SMB Group said that, of small businesses surveyed, 22 percent have purchased infrastructure management solutions in the past 24 months, and an additional 16 percent plan to do so within the next 12 months.

A recent study by research firm In-Stat found that IaaS spending by businesses with fewer than 500 employees is expected to grow to \$3.6 billion in 2015, up from \$1.4 billion in 2011.

IaaS Overview

At its core, infrastructure as a service is a way for organizations to get the hardware, storage, networking and other services they need to run their operations without worrying about buying, managing or maintaining the equipment. With this model, enterprises "rent" the equipment, paying only for the capacity and space they use.

An offsite service provider owns, manages and maintains the equipment, providing enough capacity to scale up or down to meet the needs of its customer organizations. And the organizations access the resources (virtual machines that run their applications) via a web browser.

There are many setups available for IaaS, from full-blown compute as a service to partial infrastructure as a service, such as storage, servers, web hosting and disaster recovery. The amount of infrastructure an organization chooses to move to the cloud depends on many factors, including their line of business, amount of available IT staff and IT expertise, and cash flow constraints.

There are also different ways of implementing IaaS: in a private cloud, public cloud or hybrid private/public cloud. Again, the path an enterprise chooses depends on several factors and usually comes down to balancing cost with security needs.

Lowering costs is a major driver for adopting the IaaS model. Buying an equivalent amount of computing power (not to mention the expertise to manage those resources and guarantee uptime) would be prohibitively expensive for most small and even many medium-size businesses. Other benefits include flexibility, scalability, greater security, almost 100 percent uptime, and the ability for enterprises to shift focus to their core business instead of focusing their resources on IT infrastructure.

Many IaaS Options

CDW offers many pathways for organizations to pursue an infrastructure as a service (IaaS) solution.

IaaS Solutions Available from CDW

vCloud Express: This IaaS solution (from Terremark, a Verizon company, and virtualized by VMware) is specifically for small businesses. vCloud supports a web-based console, standards-based architecture and multiple operating systems. Terremark's other IT infrastructure services include online backup and sharing, collocation, content acceleration, computing as a service and managed hosting.

VCE Vblock: The Vblock infrastructure platform is pre-engineered, pretested and preconfigured with compute, network, storage, management and virtualization, enabling rapid deployment.

FlexPod: Jointly designed by NetApp, Cisco and VMware, the FlexPod data center solution is an integrated infrastructure stack for all virtualization solutions. It includes storage, networking and server technologies, as well as a secure multitenant architecture.

HP CloudSystem Matrix: This IaaS solution for private- and hybrid-cloud deployments is an integrated hardware, software and services solution that includes everything necessary for a self-service infrastructure portal. It has auto-provisioning capabilities, tools to manage and optimize resource pools, multitenancy and a recovery management solution.

CDW Managed Infrastructure as a Service

CDW's IaaS offerings include:

- Dedicated Windows and Linux server instances, providing users with highly customized virtual machines
- Pay-as-you-go data storage and backup
- Secure networking, including enterprise-class firewalls and load-balancing services
- Managed infrastructure services for hosted servers and dedicated network and server hardware

The service can be hosted by CDW or Terremark.

Build-your-own Cloud Solutions

When an enterprise wants specific functionality in a private cloud, it can build its own, using leading platforms such as VMware's vSphere or vCloud Director, or Microsoft's Hyper-V and System Center technologies.

Although the features of different IaaS offerings and vendors vary, there are several that are fairly standard, including the following.

Dynamic infrastructure scaling: The service provider is responsible for ensuring that the organization's infrastructure needs will always be met, even if they include peaks and valleys. With this infrastructure model, organizations can always be assured that they will have the IT resources they need.

Guaranteed uptime: IaaS providers guarantee 99.95 percent or greater availability with 100 percent uptime. This is spelled out in the service-level agreement (SLA).

Automation of administrative tasks: These tasks include deploying and managing virtual desktops and servers for both employees and guests, managing virtual server pools, and monitoring ongoing activity such as disk utilization, network activity, active jobs, and member and guest activity.

Policy-based services: This feature imposes enterprise-defined policies on the infrastructure services that specific users or user groups can access. Based on these policies, provisioning and decommissioning resources becomes an automated process.

Elastic load balancing: Based on requirements at any given time, resources are balanced and distributed automatically, appropriately and efficiently across multiple virtual computers.

Customized machine images: With the IaaS model, building and deploying machine images on which applications can run is fast, automated and customized to specific needs. IaaS providers offer a host of virtual machine images to their customers, but organizations themselves can also develop their own or import images from the existing operational environment.

That way, they know the images will meet their configuration, security and compliance standards. It also vastly increases the speed at which new instances or the image can be deployed.

Preconfigured templates: Qualified users can create predefined templates for various types of virtual machines. This allows other users to choose from a preapproved list of templates, standardizing and removing risk from the process of quickly spinning up virtual machines.

Access to the newest technology: Because organizations don't own the equipment, they aren't stuck with technology that will eventually become outdated and need an upgrade. Instead, they always have access to the latest

equipment, with the most up-to-date features and highest levels of efficiency.

Stringent security controls: Depending on the solution and the vendor, an IaaS offering will be compliant with Secure Sockets Layer (SSL) or Advanced Encryption Standard (AES) encryption, employ a virtual private network (VPN) and provide role-based access control.

Taken together or in bunches, IaaS features provide the ability to scale up and down quickly and pay only for the capacity actually used, which is important in today's fast-paced, competitive environment.

For example, to stay on top of the competition, an enterprise may want to create batch processes that run nightly to better understand its sales data, but it may need ad hoc computing resources to do so. An IaaS infrastructure would give the organization the capacity it needs for nightly intelligence gathering without breaking the bank.

Another example of IaaS in action is website hosting. Instead of running the website from on-premise hardware, an organization can use IaaS to run its site and take advantage of the speed, uptime and resources that allow it to deliver marketing campaigns more quickly, handle spikes in web traffic and respond quickly to trends.

Public, Private or Hybrid?

Whether an organization chooses to move its infrastructure to a private or public cloud depends on many variables, namely cost, security and compliance requirements. If all things were equal, most organizations would probably opt for a private cloud – the most secure of the bunch. However, it can also be the most costly.

With a private cloud, organizations pay for a computing infrastructure dedicated to their business alone. Private clouds can be hosted on the organization's premise or by an IaaS provider. But in either case, they don't share resources with other tenants.

On the other end of the spectrum is the public cloud, where infrastructure is hosted in the IaaS provider's data center and often shared with other customers. For cost reasons alone, many small businesses prefer a public cloud. But there are caveats: If the organization's business deals in sensitive information, such as healthcare data or sensitive personal or financial data, a public cloud may not be the right avenue.

For these organizations, a hybrid-cloud model often makes sense. With this model, sensitive functions are hosted in a private cloud, while day-to-day functions are hosted in a shared, public environment. Under this strategy, small businesses can get the best of both worlds, without overpaying for private infrastructure when it's not needed.

Another way to use IaaS to remain competitive is through development and testing. When working on new products, marketing campaigns and other competitive resources, it's often necessary to quickly increase IT infrastructure for running specific workloads and then throttle it back when the work is finished. The IaaS model provides the scalability and load balancing required to perform complex development and testing, and then reduce capacity once testing and development have been completed.

Benefits for Small Business

With IaaS, small businesses don't have to buy, maintain or upgrade software, hardware or operating systems, and they don't have to worry about network configurations. That's a big cost savings, both up front and over time.

IaaS, like all cloud offerings, is a pay-as-you-go model, so enterprises don't have to manage large cash outlays. Instead, they pay for only the resources they use, saving money over the traditional method of paying set fees for services and equipment, even when they aren't being used. What's more, there are usually no service contracts to deal with.

Without the burden of supporting hardware and associated infrastructure in house, small businesses are free to focus on their business instead of worrying about IT infrastructure support. They have the quality and scalability of resources they need to take advantage of market opportunities that previously may have been out of reach. These lower barriers to entry can enable the type of rapid innovation that will allow smaller organizations to more effectively compete with their larger counterparts, helping to level the playing field.

For example, a small home security manufacturer may have an idea for a new programmable unit that is sure to gain traction in the market. With static infrastructure, the product development team may not have the resources to develop and test the solution quickly, and the marketing team may lack the resources to create compelling materials in a timely manner. However, with a scalable, on-demand infrastructure, the manufacturer can rapidly move the product from idea to production to market, without breaking the bank.

Moving some or all infrastructure to the cloud also ensures that small enterprises – many without dedicated IT staff – always get the help they need, quickly and professionally. With an on-premise infrastructure, small businesses may employ one or two IT professionals to manage everything,

But as the infrastructure becomes more complicated, either from organizational growth or new technology, it may become more than a small IT staff can handle. Hiring an outside IT contractor is always an option, but that can get expensive, and the quality of contractors changes over time. With the IaaS model, issues (if they occur) are handled professionally and away from the core business.

IaaS also moves even the smallest companies into today's anywhere, anytime work model. Because everything in the IaaS model is web-based, administrators can manage the systems from anywhere, whether they're adding capacity, removing users or accessing reports. And users can get the computing resources they need from wherever they happen to be, significantly improving the agility of the organization as a whole.

Finally, IaaS can solve the issue of inevitable system upgrades. Technology changes rapidly, and those changes usually bring higher capacities, greater reliability and useful new features. However, upgrades aren't inexpensive.

Organizations that rely on an internal IT infrastructure must eventually upgrade their equipment, whether to increase capacity or features, or because a system has failed or is no longer supported by a vendor. With IaaS, that never happens, because the equipment isn't the organization's problem – it's the IaaS provider's concern.

Top Solutions

The term *infrastructure* is broad in meaning, so it's not surprising that subcategories of cloud-based services fall into the IaaS bucket. Some of the most popular IaaS solutions include the following.

Compute as a service: One of the most ubiquitous IaaS offerings today, compute as a service provides compute capacity that includes servers, operating system access, firewalls, routers and load balancing on demand. These systems have management interfaces, and their capacity can be either shared or private.

Depending on the provider and the options an enterprise chooses, compute as a service also can include automated patch management, management of infrastructure software, storage management, security management, dedicated customer support and customized SLAs.

Web hosting: Even the smallest organizations rely on their websites for marketing and revenue. Any glitch in operations can mean a loss of business. Moving a website to an IaaS-based model ensures that the website won't get bogged down during peak traffic times – and that

organizations won't have to overpay for capacity to manage those traffic spikes. What's more, loads will always be balanced, and uptime is guaranteed, thanks to SLAs.

Other perks include offsite backup and fast connections for eliminating slow page and content downloads, no matter how much rich media a site includes.

Storage as a service: Storage is one of those necessary evils that only grows over time. It can be a constant struggle to maintain enough storage capacity and manage it effectively. Storage as a service goes a long way toward easing the burden.

These solutions have interactive self-service portals that allow administrators to provision storage, transfer data to different tiers of storage, dispatch specific data sets to different media (such as disk or tape), and add or remove storage as needed. Storage as a service providers also have the latest storage technologies and virtually limitless capacity.

Tiers generally include fast storage for high I/O applications, standard storage for system disk and bulk storage for file serving. And as with other types of IaaS, enterprises pay only for what they use.

One of the concerns that organizations have about moving storage to the cloud is security. After all, storage systems contain sensitive information about the business and its customers. Cloud-based storage has the security controls to ensure that all data is stored in secure data center facilities, with extremely high availability.

Disaster recovery and backup as a service: The idea behind moving disaster recovery to the cloud is to ensure that organizations have uninterrupted access to data and applications, regardless of emergencies, such as power outages, natural disasters or system failures. These solutions always include redundancy and automatic failover to ensure ongoing access, reducing downtime to nearly zero.

Many solutions also employ continuous data protection (CDP), which allows for multiple versions of all data sets to be recovered. This gives users the ability to restore data to any point in time. Data and applications are stored in secure offsite facilities.

There are two basic options when it comes to disaster recovery as a service: backup and restore *from* the cloud and backup and restore *to* the cloud. With the first option, organizations retain applications and data on their own premise, but back up data to the cloud and restore it to hardware on their own premise when a disaster occurs.

Good Security Means Working Together

The security concerns organizations have about relegating part of their infrastructure to the cloud are much the same as concerns they have (or should have) about managing virtualized machines. By far, the biggest worry is unauthorized use.

Good security depends on the quality of the IaaS service provider, along with the security controls they implement and how well they monitor the environment. But they also depend on the controls the enterprise itself puts in place and how well it communicates those controls to the IaaS provider.

Whether the concern is disgruntled workers inappropriately accessing resources and data, or external hackers, there must be a process and technology in place to detect such usage and shut it down immediately. Depending on the organization, its applications and rules, that may include security certificates, simple HTTP authentication or application programming interface (API) keys.

Most cloud services are accessed using API keys – basically, simple web service interfaces. Only qualified users know the API key for a specific service, thereby increasing security. Sometimes, protecting those API keys can be a concern. Usually API keys are protected via encryption or by storing them within a hardware security module.

Another concern is how to secure data in transit. It's best to ask the IaaS provider how it accomplishes this. In general, the provider should separate the network traffic of each user at the lowest level possible – the hypervisor level. This prevents individual users from viewing the traffic of other users. Another good way to ensure security is to separate private and public network traffic.

No matter what the security issue, it takes both parties to ensure that the necessary processes are in place and that data protection is ironclad. In every case, it is important for the cloud service provider to work hand in hand with the organization, pairing the IaaS provider's cloud service monitoring with its own governance framework. The give and take that this requires isn't always easy, but it is critical.

With the second option, data is restored to virtual machines in the cloud. For mission-critical applications and resources that must be recovered quickly and completely, the best choice is often to replicate data to virtual machines.

Desktops as a service: DaaS is, in essence, an IaaS cloud created solely for hosting and serving virtual desktops. In a nutshell, it's pay-as-you-go computing that allows enterprises to quickly provision, access, run and deactivate virtual desktop machines as needed. Organizations can

choose to connect through a private network service instead of the public Internet.

In most cases, the service provider offers storage for the virtual computers, ensures security and data protection, and controls the network bandwidth to ensure uptime. Most solutions come with a self-service portal for provisioning and multitenant monitoring, reporting and billing.

For small organizations, desktop as a service is a way to make sure that there are always enough desktop environments available to new workers, with enough storage and all the right applications. And because the desktops can be accessed via the Internet, users can log in and access their familiar workspaces from any location.

Servers as a service: Accessing servers in the cloud means that no matter what the project, or even if it's the busy season, there will always be enough compute power to go around. It's useful for one-time projects that require additional capacity, or for handling spikes in business. And because it's a service, enterprises can rest assured that they'll never be paying for more server capacity than they need.

SaaS as a Path to IaaS

Small businesses interested in adopting cloud computing often start by moving one or more applications to the cloud. This option, called software as a service (SaaS), is so pervasive among small businesses that in its report on cloud computing last year, the IT association CompTIA found that nearly 70 percent are using some sort of SaaS.

The study, *Third Annual Small and Medium Business Technology Adoption Trends*, found that 97 percent of small- and mid-size businesses have put some operations in the cloud. Of those, 62 percent used e-mail services in the cloud, followed by document management, collaboration and customer resource management (CRM).

For many small businesses, SaaS is the easiest route to the cloud, because it involves moving only selected applications to the cloud while retaining the rest of the IT infrastructure in house. What's more, it tends to save organizations money because, like IaaS, it is a utility-based, pay-as-you-go model.

Once organizations are comfortable with the SaaS model, many dip another toe in the water by moving commodity-type infrastructure services (such as data backup) or services that straddle the line between SaaS and IaaS (such as security as a service) to the cloud. Once these have proved efficient, economical and secure, enterprises are ready to move more infrastructure to the cloud.

Accessing servers as a service also means organizations can cut their IT administrative, maintenance and service workloads. That's particularly important with servers, which can require complex and expensive system administration. The servers are restricted to secure, private areas dedicated to the organization's use, so security is ironclad.

Networking as a service: This is the newest entrant in the IaaS category. The idea is to offer networking resources on demand in order to support virtual networks – resources such as firewalls, load balancing and wide-area acceleration services. NaaS provides unified connectivity across storage, networking and servers that changes to meet the demands of virtualized infrastructures.

In some cases, a networking service can support quality of service (QoS) and other network-based auditing and monitoring services. As with other IaaS-based services, NaaS involves no upfront costs and supports full scalability, flexibility and security.

When IaaS Makes Sense

By their nature, small enterprises tend to run lean and mean. They have small workforces, and employees tend to perform a variety of tasks during the workweek. Small businesses also are usually dedicated to a core mission – selling a product or performing a service. They tend to have a skeletal IT staff, if they have one at all.

Because of these factors, small businesses often don't have the expertise to run complex computer systems, ensure data backups are working properly, troubleshoot system malfunctions, or spend time provisioning new computing resources for users. The IaaS framework takes those mundane IT tasks out of the hands of these enterprises so they can focus on more strategic projects.

Cash flow is another reason why some small businesses turn to IaaS. Owning a computing infrastructure means buying, upgrading and maintaining equipment, as well as paying for IT staff to run it. With the pay-as-you-go utility model, organizations pay only for the capacity they use and don't have to worry about service contracts or equipment purchases.

Small businesses also must work hard to react to market changes. Fast-changing requirements mean being able to stand up a system, create or troubleshoot a product, or get new employees up to speed quickly. That's possible with an in-house infrastructure, but not without some fast thinking around repurposing and repositioning equipment. With

infrastructure in the cloud, the capacity is always there when they need it.

It makes sense to consider IaaS when an organization is due for a complete refresh or overhaul of the data center. That's the time to consider if it makes sense to continue managing the organization's own data center. Is that the best use of salaried employees? If an organization is not in the IT business, chances are good that it may not be in its best interest to spend the money on new infrastructure.

Saving money is a popular reason for moving to IaaS – or any type of cloud computing. But depending on the situation, that may not always be the case. It's worth taking the time to do a complete cost/benefit analysis. That means considering every angle – the money an enterprise would save by not buying, maintaining and upgrading its own equipment, as well as the cost of the labor used to manage an internal infrastructure.

Those are the hard costs, and they are fairly easy to quantify. The bigger issue is determining the soft costs. For example, if an organization is anticipating significant growth but can't be sure how much computing capacity it will need, it's difficult to run the numbers.

However, just knowing that it is entering a major growth stage is good information for a total-cost-of-ownership (TCO) calculation. Because IaaS can be scaled up or down quickly, it's not as important to know how much the organization will grow as it is to know that it will grow significantly.

But perhaps the most difficult costs to determine are "missed opportunity" costs, as Laurie McCabe, a partner at SMB Group, calls them. In other words, if an enterprise can operate faster and better using an external IaaS provider, will it gain some type of business advantage that it currently can't imagine?

Preparing for Migration

Although making the leap from a physical infrastructure to an IaaS environment may seem overwhelming, there is a logical way to structure the move. The first step is to virtualize the current environment, if the enterprise hasn't done so already (generally servers first, followed by applications, then desktops).

By virtualizing as a first step, data and applications wind up separated from the physical machines on which they reside. This gives IT managers and executives a clearer understanding of which applications and data are most important, along with the interdependencies among them.

IaaS vs. PaaS

If infrastructure as a service is a way to provide virtual machines, servers, storage and other infrastructure services via the cloud, what is platform as a service (PaaS)? There has long been confusion between the two – and for good reason.

Both offer computing via the cloud, but at different layers. The difference is this: The PaaS model provides both a computing platform, consisting of application building blocks such as databases and file sharing, along with applications that run on the platform, while IaaS provides the infrastructure building blocks only – storage, hardware and networking components.

Clearly, PaaS and IaaS are closely related, because applications, platforms and infrastructure can't work without each other. This has led some to speculate that the two eventually will become one layer of service.

In the past year, Microsoft added an IaaS platform on top of its Azure PaaS platform, while Amazon added PaaS functions to its IaaS platform. And just recently, HP announced plans to launch a cloud service that will combine PaaS, IaaS and SaaS (software as a service). It will offer both structured and unstructured databases, along with data analytics as a service. It will also offer tools for developers to use software languages such as Ruby, Java and PHP, as well as ways for users to provision and manage workloads remotely.

Combining two layers – or even three – of cloud services is a trend that may grow over time. By adopting some cloud infrastructure earlier rather than later, enterprises will be better prepared to move more services to the cloud – in whatever form they happen to take.

Through this process, it becomes clear which applications make sense to port to the IaaS environment, which is itself based on a virtual infrastructure.

At the same time, the virtualization process begins the culture shift that will lead workers to access applications and data through virtual machines, and will train IT staff to deal with services-based, elastic, metered and scalable computing. The entire organization will begin moving toward a service-based, shared resources mindset – the same mindset and processes used in all cloud deployments.

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

Once that information has been gathered, it's important to collect and measure data about each application's resource

utilization levels – how much CPU power and memory does each application use? Organizations 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, and 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 redeployed or recompiled for the new platform. If the operating systems are different, other changes may have to be made when the enterprise migrates its systems.

Finally, it's important to prepare the IT staff for its changing role. Although it might be tempting to think that the IT function will no longer be needed once an organization moves infrastructure to the cloud, that's not the case.

Instead, the IT staff's role will change 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 their work and making sure the organization gets the best value.

Infrastructure as a service makes a great deal of sense for many small businesses. Agility and productivity are key to surviving and thriving in a challenging economy. So anything that conserves cash and gives organizations the chance to do what they do best is worth considering.

Choosing among the many options available today may seem an overwhelming task. But by asking the right questions, talking to the right vendors and consulting with trusted advisers, enterprises are much more likely to make the right decision – a decision that will propel the business forward securely, quickly and profitably.

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