Microsoft®

IT as a Service

Transforming IT with the Windows Azure Platform

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Contents

Cloud computing is changing how all of us—Microsoft and our customers—think about information technology. New deployment options, new business models, and new opportunities abound.

To Microsoft, cloud computing represents a transformation of the industry in which we and our partners work to deliver *IT as a Service*. This transformation will let you focus on your business, not on running infrastructure. It will also let you create better applications, then deploy those applications wherever makes the most sense: in your own data center, at a regional service provider, or in our global cloud. In short, IT as a Service will let you deliver more business value.

To make this transformation possible, Microsoft provides the Windows Azure platform, complementing our existing Windows Server platform. Together, these two platforms allow enterprises, regional service providers, and Microsoft itself to deliver applications across private and public clouds with a consistent identity, management, and application architecture. By increasing business value and lowering costs, this foundation for IT as a Service will transform how organizations use information technology.

Understanding IT as a Service

To think about IT today, we need to start with the cloud. It's common to divide cloud computing into three categories:

- Infrastructure as a Service (IaaS), which provides flexible ways to create, use, and manage virtual machines (VMs).
- Platform as a Service (PaaS), focused on providing the higher-level capabilities—more than just VMs—required to support applications.
- Software as a Service (SaaS), the applications that provide business value for users.

Along with this familiar three-part breakdown, there's another categorization that's also important for thinking about IT in the cloud era. These categories describe where software runs, and there are again three choices:

- Global providers, firms that offer public cloud services for running software in data centers around the world. Examples include Microsoft, Google, and Amazon.
- Regional providers, hosters that offer cloud services for running software in regional data centers. Many firms provide this service in many countries.
- Enterprises, which run software on machines in their own on-premises data centers.

Combining both of these categorizations produces the view of IT shown in Figure 1.

	Global Providers	Regional Providers	Enterprises
SaaS			
PaaS			
IaaS			

Figure 1: IT today can be summarized in a three-by-three grid.

Taking this broad view makes perfect sense. While IT people have traditionally thought of SaaS as referring only to applications that run in the cloud, for instance, the truth is that business users see even on-premises applications as a service. Similarly, many organizations are creating private clouds that provide IaaS in their own data center. Viewing all of IT through this three-by-three grid illuminates the true choices that your organization faces.

Many IT vendors today address parts of this grid. Among cloud vendors, for example, both Google and Salesforce.com concentrate on SaaS—providing applications—with some support for PaaS. These offerings are provided only from their own global data centers, with no ability for regional providers or enterprises to run them. Amazon, another global cloud vendor, focuses largely on IaaS, again available only in its own data centers. VMware has taken a different path, choosing solely to provide software—primarily IaaS with some PaaS-like offerings—that regional providers and enterprises can run in their data centers. The company doesn't act as a global provider.

Yet for customers, all nine boxes in this grid are important, and all will continue to be important for years to come. Microsoft believes that any vendor who is in only a few of the boxes in Figure 1 is providing an insufficient solution for customers. Rather than individual offerings providing Infrastructure as a Service or Platform as a Service or Software as a Service, enterprises need a cohesive approach to all three across global providers, regional providers, and their own data centers. They need IT as a Service, as Figure 2 shows.
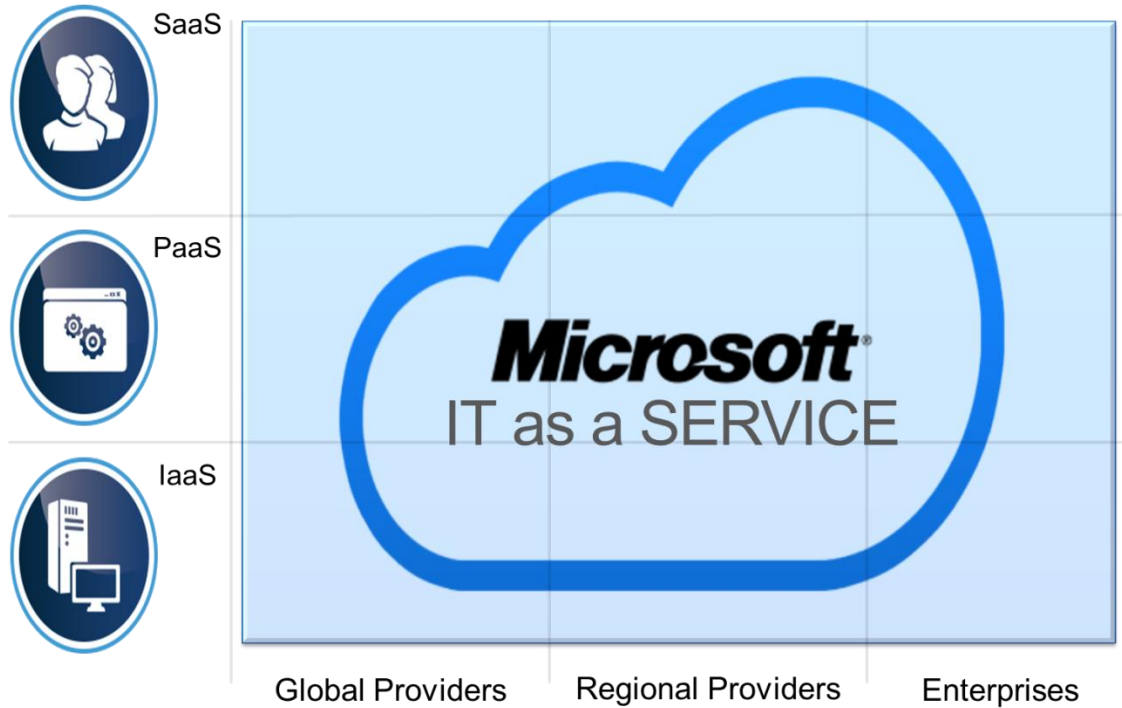
Figure 2: Microsoft is the only vendor able to provide every aspect of IT as a Service.

Microsoft is uniquely positioned to provide this. To see why, it's useful to review Microsoft's offerings in each column:

- As a global provider, Microsoft offers a range of SaaS applications running in its own data centers, including Exchange Online, SharePoint Online, Dynamics CRM Online, and others. Microsoft also provides PaaS (and a form of IaaS) with the Windows Azure platform.
- For regional providers, Microsoft provides hosted versions of Exchange, SharePoint, and other applications, along with the ability for hosters to offer IaaS services using Windows Server with Hyper-V, System Center, and the Dynamic Data Center Toolkit for Hosters.
- For enterprises, Microsoft provides on-premises applications and an application platform built on Windows Server and SQL Server. Customers can also implement on-premises IaaS using Windows Server with Hyper-V, System Center, and the Self-Service Portal.

The customer benefits of a comprehensive solution are very real. Moving applications gets easier, for example, since all three deployment options—enterprise, regional provider, and global provider—are based on a common software foundation. This common foundation also makes adopting cloud technologies easier, since they echo familiar on-premises solutions. Moving people between different areas is simpler, too—the same tools and skills are used everywhere. And because a consistent identity and management infrastructure is used across the entire grid, user access is simplified and management costs are lower.

Because only Microsoft covers all nine boxes, we are the only vendor capable of offering the breadth that IT as a Service requires. Providing this full solution brings other benefits as well, including these:

- Because we offer a full spectrum of platforms and applications, we can exploit the virtuous circle this provides. As we improve our platforms, our customers can create better applications. The knowledge we derive from those applications—and from our own—then lets us build better platforms.
- Offering both IaaS and PaaS is vitally important. Both have value, and both will be with us for years to come. Giving you the choice lets you work in whatever way is best for you.
- The coupling of SaaS with PaaS is especially powerful. Extending and customizing SaaS applications is common, and a PaaS platform is the best way to do this.
- Acting as both a global provider and a supplier of software for regional providers and enterprises gives us unique knowledge. Running our own world-class data centers gives us deep insights into how to build better on-premises and hosted platforms. There's no substitute for doing this yourself.

One more important benefit of Microsoft's approach to IT as a Service stems from our support for any deployment option. We believe that where you choose to run your application—in your own data center, at a regional provider, or in our global cloud—should be dictated entirely by what's best for your business. Different applications have different goals and different constraints, and so the best option varies. Some applications are a perfect fit for Windows Azure running in our data centers, for instance, while others make more sense running on Windows Server inside your enterprise or at a regional provider. Unlike any other vendor, Microsoft is entirely agnostic about this decision—we support all of the options equally well. You can even change your mind; you're not locked in to your initial deployment choice.

The breadth of our offering makes Microsoft uniquely able to lead a transformation in computing, a change that will let your organization devote more of its IT budget to creating business value and less to supporting infrastructure. Even more important, it will let IT organizations create better custom applications, then deploy and update those applications more effectively. Understanding this transformation requires first understanding the true value of Platform as a Service, then seeing how your organization can benefit from PaaS—both in the cloud and on-premises—with the Windows Azure platform.

Realizing IT as a Service: The Importance of PaaS

The value of IT flows through applications, and applications are built on platforms. But what does a general-purpose platform for IT as a Service look like? It's not the same as what we're accustomed to in the on-premises world today. To understand this coming transformation, you need to understand how the PaaS approach can simultaneously increase business value and lower costs. But first, you need to understand what PaaS really means.

What is PaaS?

In a nutshell, PaaS is about one thing: letting you focus on your business, not your IT infrastructure. To do this, a PaaS platform must provide a quite specific set of services. Here are the key attributes of PaaS:

- PaaS lets you concentrate on your applications. Rather than thinking about how to structure and configure VMs and storage and networks, a PaaS platform provides all of this for you. If you're managing virtual machines, you're not using PaaS.
- PaaS provides a standardized environment. Most data centers today are inconsistent, with diverse sets of technologies that have grown over time. A PaaS platform isn't like this. Instead, it provides a consistent hardware and software infrastructure aimed entirely at running your applications.
- PaaS maintains your software environment for you. Many necessary updates, such as operating system patches and new service releases, don't provide direct business value. Rather than require you to handle these yourself, a PaaS platform takes care of them on its own.
- PaaS provides ready-made services for your applications. Rather than making you assemble the right software environment—creating a VM image, choosing the right runtimes, and more—a PaaS platform offers scale-out services that are ready to use. This helps you be more productive, letting you make your applications available more quickly.
- PaaS provides on-demand scale. Rather than building out a data center to handle peak application loads, a PaaS platform provides more computing resources only when they're needed.
- PaaS is built to withstand failure. Organizations today devote enormous amounts of time and money to handling hardware and software failures. Because fault tolerance isn't built into the platform as a whole, people must pick up the slack. PaaS starts from a different design point: It assumes that failures will happen. Rather than expecting people to fix these, a PaaS platform automatically recovers from hardware and software faults, keeping applications running.

Because it lets you focus solely on what really matters to the business—your applications—PaaS is a truly attractive approach. Given this, Microsoft expects that many vendors will claim to provide a PaaS offering. Don't be fooled—without all of the attributes just listed, you won't be getting the true benefits of PaaS.

Increasing Business Value with PaaS

How can a better application platform provide more business value? The answer stems from one simple fact: While email and other core services are important, strategic business value—true differentiation—comes from custom applications. And custom applications depend on application platforms.

The connection is clear: Better application platforms let you create custom applications with more business value. And the PaaS approach of the Windows Azure platform certainly is a better kind of application platform. Here's why.

First, the Windows Azure platform running in Microsoft data centers—the public cloud— offers a number of business advantages to organizations that create custom applications. They include these:

- New kinds of applications can be created addressing new business needs. Because of its scale, the Windows Azure platform lets organizations build software that handles millions of users and vast amounts of data. It also allows creating applications that scale up and down easily. In fact, some applications, such as those that must deal with occasional large peaks in demand, are economically feasible only on this kind of elastic platform.
- Applications can be deployed more rapidly, providing immediate business value. Rather than wait for an internal IT department to provision servers and software, the creators of a Windows Azure application can deploy it in minutes to Microsoft's public data centers.
- Spending gets more flexible. Rather than making an up-front investment in servers and software licenses, organizations can instead pay only for the computing services they use. What was a capital expense becomes an operating expense.
- The risk of business innovation is significantly lower. Rather than commit to paying for a fixed set of computing resources, an application can start small, then grow only as needed. By lowering the cost of failure, the Windows Azure platform can help increase the number of successful business innovations a firm can create.
- Expanding into new markets and new geographies gets easier. Because the Windows Azure platform runs in data centers around the globe, the applications it supports can provide responsive service to users anywhere in the world. Achieving global reach is straightforward.

The Platform as a Service approach supported by the Windows Azure platform brings other benefits as well. They include the following:

- Developers can create applications more quickly with PaaS. Because it provides a higher level of service than platform styles such as IaaS, the Windows Azure platform lets developers focus on creating business logic rather than worrying about infrastructure.
- Developers can deploy applications more quickly with PaaS. Unlike IaaS, which relies on administrators to do some set up, PaaS requires essentially no administrative intervention.
- Developers can update new applications more effectively. The Windows Azure platform automates updates, letting a new version of an application be deployed with the click of a mouse. Making updates easier also makes them safer, letting applications adapt more quickly as business needs change.
- Applications can be more reliable. The Windows Azure platform handles routine tasks such as patching system software without taking down a running application. This lets

applications provide a much higher level of reliability than is possible with non-PaaS platforms.

The business benefits of PaaS are significant. Especially for the custom applications that most determine whether your organization succeeds or fails, building on PaaS is the way to go.

Lowering Cost with PaaS

Over the past several years, both Microsoft and our customers have gone through a series of changes in how we use servers to support applications. To a great degree, those changes have been driven by the quest for lower costs. Figure 3 illustrates this evolution.
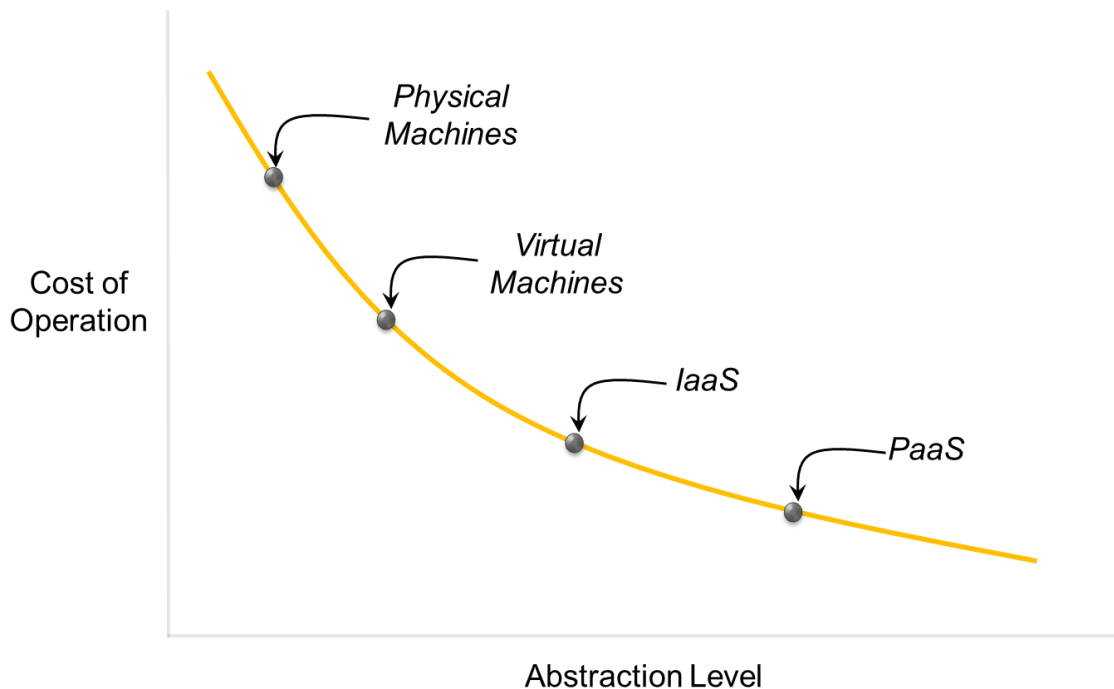

Figure 3: Raising the abstraction level of an application platform lowers the platform's cost of operation.

For many years, organizations ran applications directly on physical machines. Once virtualization technology appeared, however, it spread rapidly. Rather than devote an entire physical server to a single application, leaving that server woefully underutilized, multiple applications could run in multiple VMs on a single machine. This higher level of abstraction raised server utilization and lowered costs, making server virtualization a popular technology.

Yet the way VMs are allocated and managed can be somewhat inflexible. IaaS technology changes this. By adding capabilities such as a way for users to allocate VMs themselves through a Web portal, IaaS can make running applications even less expensive. While this technology first appeared in the public cloud, today it's also provided in private clouds built on Windows Server with Hyper-V.

IaaS is a step in the right direction, and many organizations are implementing it today in their data centers. But it's not the end of the road—costs can be reduced even further. The way to do this is to raise the level of abstraction once more, moving beyond IaaS to PaaS. Unlike IaaS, PaaS solutions don't require administrators to configure and manage VMs. Instead, the platform itself automatically provides and manages whatever resources are required. The cost advantages of this approach are significant, since much less administration is required.

Along with PaaS, there's another important path to lower IT costs: public clouds. Over the long term, Microsoft believes that the economics of public clouds will be compelling for our customers. There are three main reasons for this:

- Because they rely on very large data centers, public clouds can attain enormous economies of scale. This gives them lower costs per server than can be achieved anywhere else.

- Because they aggregate the demand for computing across different industries and different locations, public clouds see less variability, which allows higher server utilization. For example, some customers have peaks at the end of each quarter, some around Christmas, and others at particular times of day. Aggregating across this diversity gives public clouds a smoother usage pattern, giving them higher server utilization than any of these customers could achieve on its own.

- Since applications written for public clouds often use a multi-tenant model, the management cost for each application can be significantly reduced. Rather than updating multiple copies of a particular application, for instance, a single copy can be updated and made available to all users.

Yet while public clouds will offer the lowest costs, there are good reasons for continuing to run on-premises data centers. Data sovereignty issues, for example, are a significant concern in many organizations, both inside and outside of governments. Issues like these mean that while public clouds are likely to dominate in the long run, data centers run by enterprises and regional providers will be with us for many years. We will live in a mixed world for the foreseeable future, an environment that Microsoft is fully committed to support.

Providing IT as a Service: PaaS Everywhere

PaaS technology began in the public cloud. But why limit this useful idea? Why not offer the benefits of PaaS everywhere? Making this a reality is exactly what Microsoft is doing with the Windows Azure platform.

The Windows Azure Platform Today

When it was first made commercially available in early 2010, the Windows Azure platform ran only in Microsoft's data centers—it was purely a public cloud technology. Yet going forward, Microsoft will also make the Windows Azure platform available for both enterprises and regional providers, extending the benefits of PaaS to their data centers as well.

Doing this requires more than just shipping software. The Windows Azure platform is designed to run on particular hardware configurations, with specified compute, storage, and networking resources—it doesn't run on arbitrary systems. To expand PaaS technology to a broader audience, Microsoft is providing the Windows Azure Platform Appliance. This pre-packaged set of hardware and software brings the Windows Azure platform to any data center. In its first version, this technology targets large organizations, those capable of buying a thousand server machines at once. Over time, the minimum number of servers required will shrink, making the Windows Azure Platform Appliance suitable for a broad range of our customers.

Whether it's running in Microsoft data centers or in those of regional providers and enterprises, the Windows Azure platform offers the same PaaS benefits. One way to understand this PaaS technology is by comparing it to Microsoft's current Windows Server platform. Figure 4 summarizes this comparison.

	Windows Server Platform	Windows Azure Platform
Operating System	Windows Server	Windows Azure
Relational DBMS	SQL Server	SQL Azure
Hardware Configuration	Specified by customer	Specified by Microsoft
Update Model	Customer applies updates	Microsoft applies updates
Business Model	Buy servers and licenses	Buy subscription to a service
Application Infrastructure	.NET Framework, AppFabric, PHP, Java, others	
Development Tool	Visual Studio	
Management	System Center	
Identity	Active Directory	
Hypervisor	Hyper-V	

Figure 4: Microsoft's Windows Server platform and Windows Azure platform have much in common, but they differ in important ways.

Each of the rows in this figure is worth looking at in more detail:

- Operating system: Millions of people today rely on Windows Server. Soon, millions will also rely on Windows Azure, both on- and off-premises. Designed for the cloud era, this PaaS operating system makes it easier to create more reliable, more scalable, and more manageable applications.

- Relational DBMS: The Windows Server platform relies on SQL Server, while the Windows Azure platform provides SQL Azure. Built on a SQL Server foundation, SQL Azure adds built-in data redundancy and other features for improved reliability and scalability.
- Hardware: With the Windows Server platform, the customer decides what hardware to use. With the Windows Azure platform, Microsoft specifies the valid hardware configurations. In the public cloud, the hardware is what Microsoft chooses for its own data centers. For enterprises and regional providers, the hardware is the Windows Azure Platform Appliance, including computers, storage, and networking. Multiple hardware vendors will provide these pre-packaged combinations, letting enterprises and hosters choose the packages they prefer.
- Update model: In the Windows Server platform, customers apply updates to the operating system and other software. In the Windows Azure platform, Microsoft manages the system software itself, including applying updates. While organizations using the Windows Azure Platform Appliance will have some control over this—a retailer won't be forced to accept changes during an annual sale, for example—Microsoft will eventually apply necessary updates.
- Business model: Customers of the Windows Server platform buy software licenses and hardware. With the Windows Azure platform, a customer buys a subscription to the service, offering a pay-as-you-go model.
- Application infrastructure: Microsoft provides a consistent environment for applications across both the Windows Server and Windows Azure platforms. On both, developers can use the .NET Framework, Microsoft's AppFabric offerings, and other Windows development technologies. Both platforms are also open to non-Microsoft technologies, letting developers use PHP, Java, and more.

- Management: Both the Windows Server platform and the Windows Azure platform use System Center management tools. With both, the customer is responsible for managing applications and the hardware. In the Windows Server platform, the customer also manages Windows Server, SQL Server, and other parts of the software infrastructure. In the Windows Azure platform, however, management of the platform software isn't required—it's done by Microsoft.
- Identity: Both the Windows Server platform and the Windows Azure platform use the same identity technologies, rooted in Active Directory. This gives users single sign-on to applications running on either platform.
- Development tool: Applications for both the Windows Server platform and the Windows Azure platform can be created using Visual Studio. The programming model isn't exactly the same between the two environments, but the great majority of a developer's skills are applicable to both.
- Hypervisor: The Windows Server platform and the Windows Azure platform both support VMs. They're used differently—only Windows Azure provides PaaS—but those VMs rely on the same underlying hypervisor, Microsoft's Hyper-V.

While the differences between the Windows Server and Windows Azure platforms are important, it's also important to understand the consistency across both environments. Investments today in Hyper-V, System Center, Active Directory, Visual Studio, .NET, and other technologies make sense regardless of where you decide to run your applications—they're common across both worlds.

The Windows Azure platform is moving from being solely a public cloud technology to providing a broad foundation for IT as a Service across enterprises, regional providers, and Microsoft's global cloud. In fact, Windows Azure represents the next generation of the Windows programming model, both on- and off-premises. Look for a new class of applications to rise on the Windows Azure platform that provide new capabilities and new kinds of business value for Microsoft customers and partners.

This raises an obvious question: How does the new world of the Windows Azure platform fit into the current Windows Server world? The answer is that both can co-exist, as described next.

Windows Azure or Windows Server? It's Your Choice

Going forward, should you continue to adopt the Windows Server platform? Or is it better to move ahead with the Windows Azure platform, given the significant business value that PaaS provides? The answer depends on what best matches your needs. The table in Figure 5 summarizes the options.

	Windows Server Platform	Windows Azure Platform
Traditional Datacenter - **Enterprise or Regional Provider**	Traditional computing, Traditional hardware	
Private Cloud - **Enterprise or Regional Provider**	IaaS, Traditional hardware	PaaS, Windows Azure Platform Appliance
Public Cloud - **Regional Provider**	IaaS, Traditional hardware	PaaS, Windows Azure Platform Appliance
Public Cloud - **Microsoft**		PaaS, Global Foundation Services

Figure 5: Customers can choose the Windows Server platform, the Windows Azure platform, or both, moving between on-premises and off-premises options as desired.

Each row in the table summarizes how both the Windows Server platform and the Windows Azure platform apply to a particular deployment option. Those options are:

- A traditional datacenter in either an enterprise or a regional provider: The Windows Server platform can be used with traditional hardware—servers, storage, and networking—to provide traditional computing. An organization using this option might be using VMs, but those VMs aren't managed in the more flexible ways provided by IaaS. As the empty box in the upper right shows, the Windows Azure platform doesn't apply here. Since it's entirely focused on providing PaaS, it can't be used as a foundation for traditional computing.
- A private cloud in either an enterprise or a regional provider: The Windows Server platform, together with traditional hardware, can be used to provide an IaaS private cloud. All of the VMs that belong to this cloud might exist in an enterprise's datacenter, or some might run in the datacenter of a regional provider. In either case, they comprise a private cloud because they're all used by a single customer. The Windows Azure platform can be used to provide a PaaS private cloud, either on-premises or at a regional provider. Doing this relies on the Windows Azure Platform Appliance rather than the traditional hardware used by an IaaS cloud.
- A public cloud offered by a regional provider: The Windows Server platform can be used with traditional hardware to offer an IaaS public cloud, one that's available to many customers. A regional provider can also use the Windows Azure platform with the Windows Azure Platform Appliance to offer a PaaS public cloud.
- A public cloud offered by Microsoft: Microsoft doesn't provide public cloud services based on the Windows Server platform, as the empty box in the bottom row indicates. We do provide a PaaS public cloud based on the Windows Azure platform running on our Global Foundation Services.

Most Microsoft customers today have a traditional data center, and many are implementing an IaaS private cloud. Similarly, many regional providers offer IaaS public clouds. Both groups have significant (and growing) investments in the Windows Server platform. Yet the PaaS approach of the Windows Azure platform has clear benefits, both on-premises and in public clouds. Here's what Microsoft recommends today:

- Organizations with traditional data centers should continue to transform those data centers into IaaS private clouds using the Windows Server platform. Getting the most out of these data centers means creating a highly dense, highly utilized private cloud infrastructure that runs current applications effectively. Doing this lets traditional Windows Server-based environments offer IT as a Service at the lowest possible cost.
- Whenever possible, build new applications on the Windows Azure platform. Today, this means building those applications on Microsoft's public cloud, the only place this PaaS technology is currently available. Because so much is common across the Windows Azure platform and the Windows Server platform, including the Visual Studio development environment, management with System Center, and identity via Active Directory, these new applications fit well with the current world.

- When the Windows Azure Platform Appliance becomes available, deploy the Windows Azure platform alongside your existing Windows Server investments. Once this is done, even new applications that must remain on premises can take advantage of the greater functionality and lower cost this PaaS technology provides.

Combining public cloud economics with the cost-savings of PaaS, the option in the bottom right of Figure 5, will yield the lowest costs and thus provide the most ability to focus IT spending on business value rather than infrastructure. Yet every other alternative in the figure is also important, and all will be with us for years to come. Microsoft is continuing to invest in both the Windows Server platform and the Windows Azure platform to deliver IT as a Service across all of these options.

Winning with Microsoft

Microsoft believes that PaaS provides the best foundation for creating, running, and managing custom applications. With the Windows Azure platform, Microsoft stands alone as a PaaS provider. Here's why:

- Only Microsoft offers a PaaS platform that grows out of the widely used Windows Server environment. This common foundation makes adopting PaaS easier, since it echoes familiar on-premises solutions.

- Microsoft is the only PaaS platform provider that runs the same software across all three deployment options: your internal cloud, clouds offered by regional providers, and our own public cloud. This makes it easy to move applications as costs and other considerations require, since all three use the Windows Azure platform.

- The Windows Azure platform is today's only open and comprehensive PaaS offering. Other approaches to PaaS, such as Google App Engine and Salesforce.com Force.com, offer much narrower solutions that target a subset of what Microsoft offers. Compared to the Windows Azure platform, for example, both of these alternatives impose stricter limits on the languages and tools that developers can use. Also, neither of them offers a true relational database, a severe limitation for many applications.

These advantages make Microsoft uniquely able to lead this transformation in computing. Because PaaS offers a higher-level service, the Windows Azure platform makes it easier to create, deploy, and update the custom applications that differentiate your business. And because Microsoft takes on more of the administrative burden, this platform gives you the lowest costs for new applications wherever they run. At the same time, private and public clouds created using the Windows Server platform can provide an optimized foundation for running applications now and in the future.

Information technology is the underpinning of virtually every successful organization. IT as a Service gives you a holistic view of the entire area, letting you make the best possible decisions. By addressing every aspect of IT—every box in the grid—Microsoft is the only

vendor that offers a complete solution across enterprises, regional providers, and the global cloud.

With IT as a Service, you can use technology on your terms. If you want to consume IT from Microsoft's global data centers, you can. If you want IT delivered from a regional provider, that's also fine—Microsoft is the technology supplier. And if you want to run your own IT in your on-premises data centers, you can do that, too.

Looking across the broad technology landscape, there's only one vendor that covers the full spectrum of IT as a Service: Microsoft. And because we are fully committed to driving this vision forward, you can look forward to seeing your organization's IT investment yield even more business value.