



# Windows Azure Pack for Windows Server

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# Introduction

**The advent of cloud computing is rewriting many of the long-established rules and assumptions for enterprise information technology (IT). The four walls of the corporate datacenter no longer restrict workloads and applications as administrators and developers look to service providers and public clouds for more efficient and agile ways to deliver value back to the business.**

As with all technology shifts, the era of the cloud presents opportunities to those willing to embrace the new model, offering the ability to solve problems, drive efficiencies, compete more effectively, and discover new business opportunities.

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## Enterprise

Enterprises are learning from the widespread, organic adoption of self-service public cloud services, choosing the agility and usage-based pricing of the public cloud over their own in-house IT operations. As a result, enterprise IT departments are looking more and more to an internal service provider model as a means of getting 'back in the game'.

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## Service providers

For service providers, there's a huge opportunity to host enterprise workloads now freed from the corporate datacenter. Service providers that can overcome enterprise concerns regarding their unfamiliar technology platform and workload mobility will stand a greater chance of winning enterprise business.

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## Windows Azure Pack

The Windows Azure Pack for Windows Server provides a solution for enterprises looking to act as service providers and service providers keen to attract enterprise workloads. Running on top of Windows Server and System Center, The Windows Azure Pack for Windows Server delivers the power of Windows Azure into your datacenter, enabling you to offer a rich, self-service, multi-tenant cloud with Windows Azure-consistent experiences and services.

Available to Microsoft customers at no additional cost, The Windows Azure Pack comes as a collection of Windows Azure technologies that install in enterprise and service provider datacenters, integrating with their existing System Center and Windows Server environments.

*NOTE: Microsoft announced "Windows Azure Services for Windows Server" in July 2012 with general availability in January 2013. This whitepaper discusses the Windows Azure Pack (for Windows Server) which includes a superset of the capabilities and supersedes Windows Azure Services for Windows Server for use with the R2 versions of Windows Server 2012 and System Center 2012.*

# The Cloud OS vision

**We are in the midst of a transformation – one that has had a big impact on Microsoft strategy as well as many organizations' IT investments.**



*Figure 1: Transformational trends.*

Over the last few years we have seen a massive increase in the use of social networks and applications. Most companies today incorporate their social presence on Facebook or Twitter and/or their own mobile application into their marketing and advertising collateral.

This rise in social networks and mobile apps has led to a massive data explosion. Organizations now have more information than ever before to mine and use. For example, many organizations get instant feedback on their products and services from social sites as well as see what customers say about their competitors. To effectively compete in the marketplace, organizations need to collect, store, and process this big data.

The transformation of the tablet and mobile phone from a nice gadget into a productivity tool has challenged many IT departments. Workers want to use devices they are familiar with, the ones they use outside the office. IT departments need to embrace this consumerization of IT and provide workers with more flexible working options.

Furthermore, the entire computing process is changing. Cloud computing models have replaced the traditional approach of tying specific applications to specific servers. Because we can pool resources, IT organizations can deploy applications as elastic self-service services.

Along with these changes come innovations in computing technology that help enable and support these scenarios. More powerful multi-core

chips are increasing memory density while driving costs down. Storage tiering technologies and solid state drive (SSD) costs are also coming down, providing a huge opportunity for the datacenter to take advantage of industry-standard hardware while providing enterprise-grade capability. Then there's networking, where fast interconnects between storage and computing nodes are driving amazing amounts of innovation.

At Microsoft, we understand that the world is different now. That's why we've committed ourselves to helping our customers not only survive this transformation but thrive within it. The key to this co-evolution of storage, computing, and network is the software that unlocks the value of this innovation for our customers. This concept forms the foundation for a modern platform: the Microsoft Cloud OS vision.

The Microsoft Cloud OS vision aims to provide customers with one consistent platform for infrastructure, applications, and data. This single platform spans across customer datacenters, hosting service provider datacenters, and the Microsoft public cloud.



Figure 2: Microsoft's Cloud OS vision.

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The Cloud OS enables customers to have a unified strategy and a consistent platform that can achieve the following:

**Transform the datacenter:** The traditional unit of computing is moving from the single server to the datacenter level. Customers need an infrastructure that provides a generational leap in agility, elasticity, and scalability across a set of shared resources and delivers more automation and self-service.

**Unlock insights on any data:** With the explosion of data, customers need a platform that gives them the tools to unlock data insight and better compete. Customers need to tap into growing data volumes, especially with unstructured data, or big data, to ask new questions and discover new data sources, which they can combine with existing data for new insights.

**Empower people-centric IT:** The proliferation and range of new devices means that companies need to embrace the use of personal devices and empower people-centric IT. Today's users expect to be productive wherever they choose, on whatever device they choose. IT departments need to be able to easily manage these devices and securely deliver apps and data in an extended, mobile environment.

**Enable modern apps:** Today's applications need to interact with other applications built on multiple platforms and languages. These applications also need to live on-premises or off-premises and be delivered to multiple devices.

At Microsoft, we've learned, by delivering global scale services from our datacenters, what this new era of IT requires. We've taken these experiences and combined them with trends and technology innovations, to build our core products to deliver the Cloud OS. The Cloud OS offers a unique experience where you can run massive online services and on-premises solutions from the same, familiar monitoring tools you already have in place today. We engineer these products from the cloud up, which means every customer benefits from what we have learned.

This platform is about more than the software that Microsoft provides to our customers to run in their IT environments. Fundamentally, the Cloud OS is about consistency. With the Windows Azure Pack, only Microsoft provides a consistent platform across customers' datacenters, the Windows Azure datacenters run by Microsoft, and hosted IT environments run by service providers.

This consistency spans many facets including the following:

- Developing applications in a flexible way that includes Microsoft and open source platforms
- Providing a unified and consistent management approach across these datacenters
- Offering a comprehensive data platform
- Delivering a common identity and security approach
- Providing integrated virtualization

These consistent capabilities along with our first-hand experience running 200+ cloud services for 1+ billion customers and 20+ million businesses around the world, makes the Cloud OS a unique proposition.

# Service providers and enterprises

**In the era of cloud computing and the Cloud OS, enterprise application and IT workloads have moved beyond the four walls of the corporate datacenter. Increasingly, more and more corporations are looking to move development, test, and production workloads to hosted and public clouds as a means of achieving flexibility and agility while reducing costs. In the end, these companies are willing to trade capital expenditure invested in hardware for operational expenditures with service providers or public clouds subscriptions, paying only for what they use.**

As a result of this changing practice, service providers have seen a huge growth opportunity. In order to capitalize on this opportunity however, they need to reposition their business and technology platform to attract enterprise workloads.

Core to this repositioning is the ability to have a familiar technology stack that enterprises can trust and integrate with their on-premises datacenters.

For many service providers, Infrastructure-as-a-Service (IaaS) offers the most appealing service to enterprise customers. That's because IaaS provides straightforward comprehension, ease and speed of deployment, and lack of lock-in.

Usage billing is essential for service providers. The low-margin, high volume nature of a service providers' business means that automation is essential along with any other capability that can optimize the revenue generated from every piece of hardware. Service providers also want a free entry-level offering to acquire customers and then a mechanism for easy upsell to higher-margin offerings. In addition, customization, integration, and branding offer valuable opportunities to align cloud resources with existing business and processes.

As the following table shows, the symmetry between the needs and wants of service providers and enterprises that want to act as service providers opens the door for a single solution that simply and easily provides a multi-tenant, self-service cloud offering on top of existing software and hardware investments: Windows Azure Pack.

Service providers want	Enterprises want
To win and easily on-board more enterprise customers' business.	Flexibility and agility around cloud choice for financial, business or compliance reasons (no lock-in).
A multi-tenant, self-service IaaS offering similar to Azure Virtual Machines.	A multi-tenant cloud that they control; one that's as easy for users as Azure.
Usage billing	Usage billing
Extreme automation	Simple, automated operations
Optimized hardware monetization	More effective use of existing hardware assets; the use of low-cost hardware
Opportunities to upsell and increase customer usage	To provide flexibility in how tenants choose to use capacity
Customized offerings and public cloud differentiation.	Commodity and custom cloud offerings
Portal integration and branding	Interoperability with existing systems.

*Figure 3: The different needs of service providers and enterprises.*

# Windows Azure Technology

**The cloud-based Windows Azure, hosted at Microsoft datacenters, offers subscribers a series of self-service capabilities.**

Windows Azure customers access the public cloud through a website, known as the management or customer portal. This portal acts as a gateway to a range of IT services delivered on top of compute, storage, and network resources at Microsoft datacenters located across the globe.

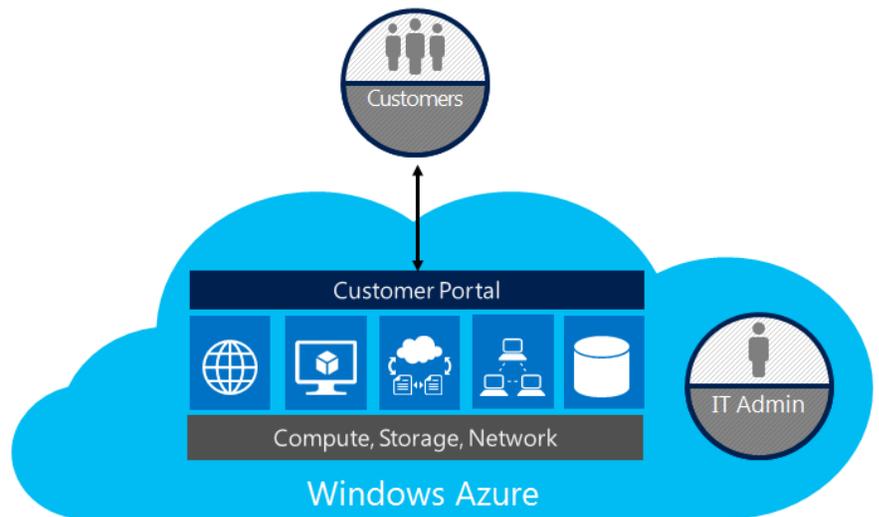


Figure 4: Windows Azure self-service overview.

Microsoft employs IT administrators to manage the resources at the datacenters, allocate those resources to the various services, and manage the tenant subscriptions and billing for services consumed by the tenants.

Enterprise or service provider datacenters offer an experience similar to the Microsoft one with parallel services.

In this example, the customers could be employees within your organization or, if you're a service provider, they could be hosting customers (individuals or organizations that pay you to provide IT services).

Within your datacenter, your administrator performs the same role as in the Microsoft datacenter – configuring and defining resources to support the tenant services and to manage customer access to the services. For service providers, this role includes pricing and billing. Enterprise companies can employ chargeback or cross-charge mechanisms in a similar fashion.

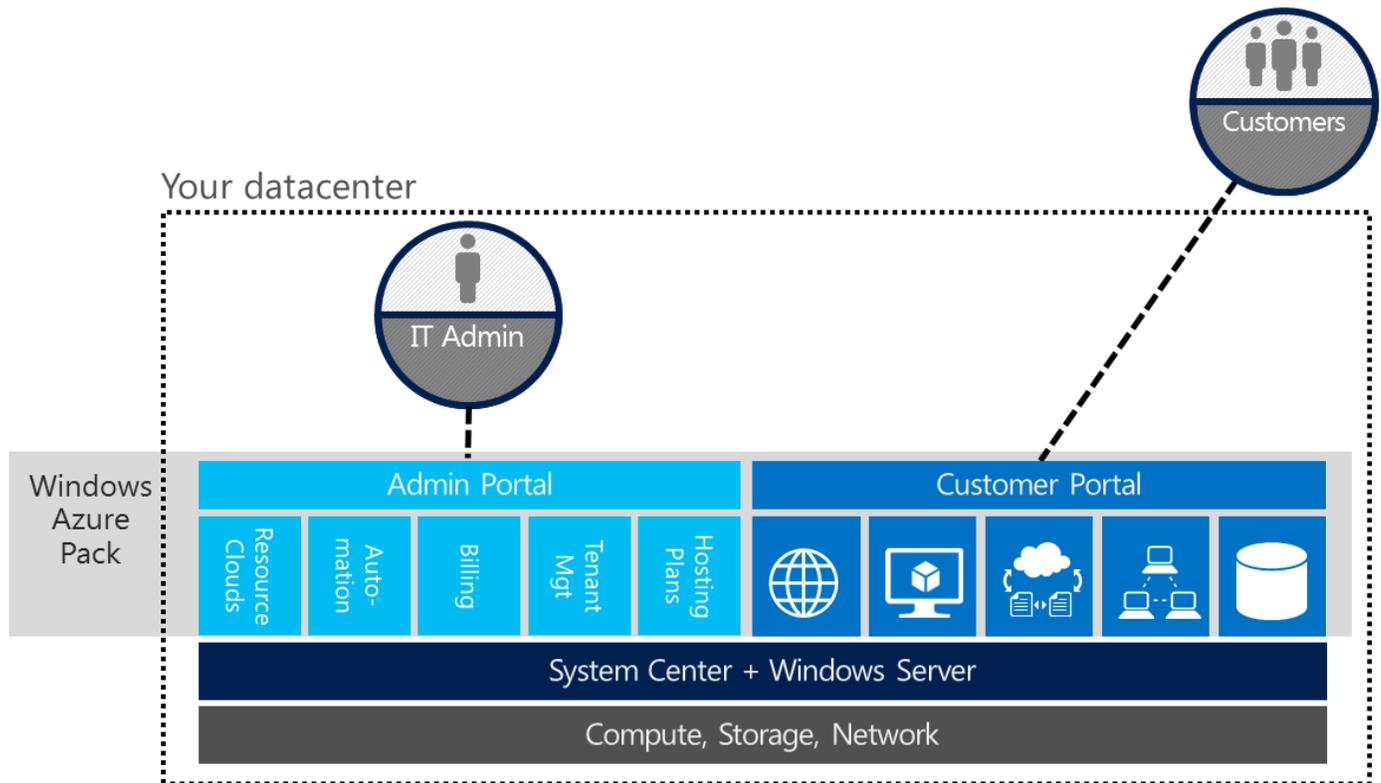


Figure 5: Windows Azure technology in your datacenter.

For enterprise organizations, this model presents a shift away from the traditional non-self-service provisioning one. The cost savings and resulting agility however, can redefine the value of IT to the business in an internal service provider model. Integration with enterprise IT resources such as Active Directory help make a friction-free experience for tenant and administrators.

Windows Server and System Center, found in the majority of enterprise and service provider datacenters, form the foundation for delivering Windows Azure-consistent customer services. IT administrators also can deliver similar type services by having their own dedicated administration portal be consistent with the customer portal.

By using the portal, administrators gain a range of management capabilities such as the following:

- **Building resource clouds.** Administrators define the compute, storage, network and other resource clouds that underpin each of the tenant services.
- **Automation.** Administrators create Windows PowerShell runbooks to define a range of processes that should run under specific circumstances, reducing the need for human intervention and driving down the cost of managing the cloud.

- **Billing.** With billing, administrators can define pricing structures associated with customer services.
- **Tenant Management.** Administrators can handle tasks associated with managing tenant user accounts and reporting against activity.
- **Hosting Plans.** Hosting plans enable administrators to establish various combinations of services, resource clouds, and quotas and make them available for subscription to specific tenant groups.

All of the aforementioned capabilities combine to form Windows Azure-consistent experiences and services under one banner – the Windows Azure Pack. The Windows Azure Pack includes the Customer Portal, Admin Portal, and customer and admin services built on Windows Server and System Center. This pack is available free of charge to Windows Server and System Center customers.

In the rest of this document we'll examine in detail the portal and services enabled by the Windows Azure Pack.

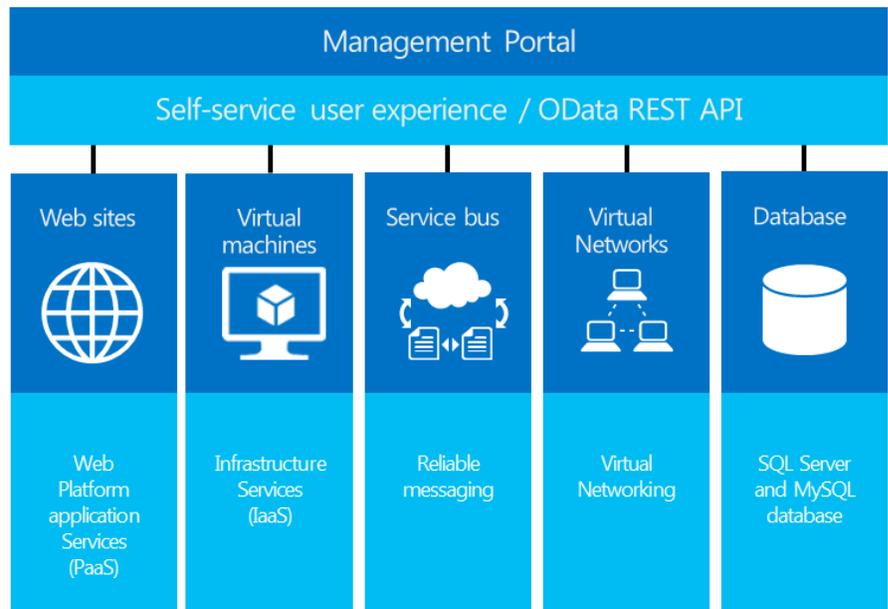


Figure 6: Windows Azure technologies.

## Management Portal

Also known as the Developer Portal, the Management Portal offers a familiar, self-service interface that every subscriber uses to provision and manage services such as the Web Sites service and the Virtual Machines service.

### **Service Management API**

Underlying the Management Portal is an OData Rest application programming interface (API) known as the Service Management API. Service Management API provides access to the underlying services and enables automation and replacement of the existing Management Portal.

### **Web Sites service**

The Web Sites service provides a high-density, low-cost, multi-tenant web application service. In addition to supporting a broad range of programming languages and template web applications, The Web Sites service also integrates with developer tools and popular source control repositories.

### **Virtual Machines service and Virtual Networking**

The Virtual Machines service enables a rich, self-service experience to provision and manage virtual machines running Windows Server or Linux operating systems. To further illustrate this point, consider the Virtual Machines service as the equivalent to renting a virtual server on which the tenant can install their own operating system and administer the server themselves. A customizable virtual machine gallery enables consistent workload deployment and hosting. Virtual Networking enables customers to use existing IP address schemes while remaining protected from other tenants and the underlying network infrastructure IP configuration.

### **Service Bus**

The Service Bus service enables the reliable, asynchronous passing of messages between applications where a synchronous hand-off is not possible but the sender needs assurance that the message will reach the recipient, eventually. Applications may be within the same cloud, across clouds, clouds and devices, or many other supported scenarios.

### **Database**

The Windows Azure Pack also enables you to offer your customers multi-tenant access to your existing SQL and MySQL databases for use with their applications.

### **Windows Azure Pack: Windows Azure technology in your datacenter**

The previously mentioned services run in Microsoft datacenters on the Windows Azure platform. How does this help enterprise and service providers meet their goals?

Core to delivering on the Cloud OS promise is enabling parity of application owner experiences irrespective of where the underlying infrastructure may reside; on premises, in a hosted environment, or on Windows Azure. Application parity requires ensuring that tenant end-users have uniform self-service and management experiences to

consume the infrastructure needed by their application services for both Windows Azure and Windows Server environments. Enterprises and service providers are already running a sophisticated operating system, virtualization, and management platform in Windows Server with System Center on their own computing, storage, and network infrastructure in their own datacenters.

The Cloud OS vision drives consistency across Windows Azure, enterprise, and service provider environments. The Windows Azure Pack takes Windows Azure technology, developed for Microsoft datacenters built on System Center and Windows Server, and repurposes it to provide the same capabilities on a customers' own infrastructure. Azure is a great environment for developing and testing highly distributed cloud services. As a result, Microsoft is bringing all this technology to hosting service providers as part of the technology found in Windows Server and System Center.

The Cloud OS vision offers consistency in portal, API, and select services across Microsoft, service providers and enterprises. Why is this useful?

The Cloud OS vision meets the following criteria:

- An enterprise-friendly, frictionless cloud
- Multi-tenant IaaS based on Windows Azure
- Usage billing
- Automation
- Maximizing of hardware utilization
- Tenant choice
- Management
- Portal integration and branding

With Windows Azure Pack, enterprise or service providers can have Azure technology running in your datacenter today. Best of all, you can deploy these services on your current infrastructure, building on existing investments and skills.

# Management Portal

**A core component of the Cloud OS vision is enabling parity of application owner experiences irrespective of where the underlying infrastructure may reside: on premises, in a service provider cloud, or on Windows Azure. To achieve this capability, Microsoft built the Windows Azure Pack to ensure that tenant end-users have consistent experiences and services across the hybrid cloud.**

The Management Portal replicates the Windows Azure Developer portal experience found in Windows Azure, along with a subset of the services available in Windows Azure. The capabilities available in the Management Portal can also be accessed programmatically through the Service Management API, an OData/REST API. This accessibility enables you to completely replace the portal, for example, if a service provider has their own portal, which they want to integrate with Azure services.

By bringing the Windows Azure Service Management Portal experience and API to Windows Server, Microsoft enables service providers to administer websites and virtual machine services on Windows Server while also offering their customers the rich, self-service experience for provisioning and managing websites and virtual machines. Because this Management Portal is built on a REST-based Service Management API, these portal experiences are customizable and extensible including possibilities such as partner branding, billing integration, incorporation of incremental solutions and scenarios, and integration with existing portals.

## Management Portal for Tenants

The Management Portal for tenants offers a similar look and feel to the Windows Azure Developer portal. Tenant users can list items, view their status, and provision new items.

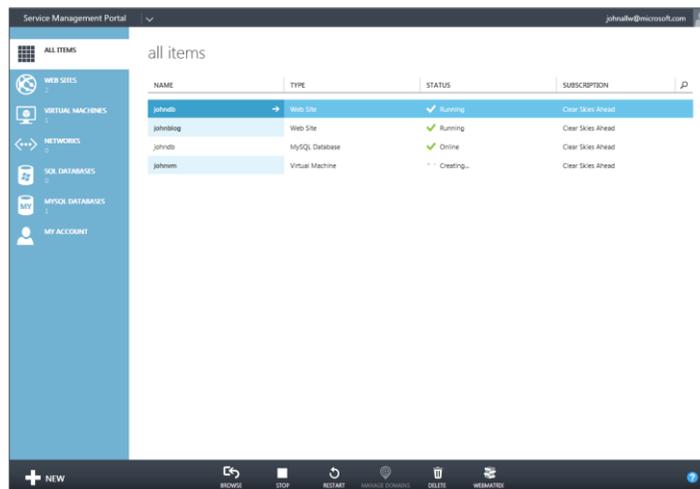


Figure 7: Management Portal showing provisioned services.

Once you provision the virtual machine, the tenant portal offers a rich set of information to help manage the environment. The tenant can track usage data as well as perform some configuration of the virtual machine based on the permissions of their subscribed plan. This dashboard also easily provides the ability to stop, start, and pause the virtual machine as well as connect remotely to it.

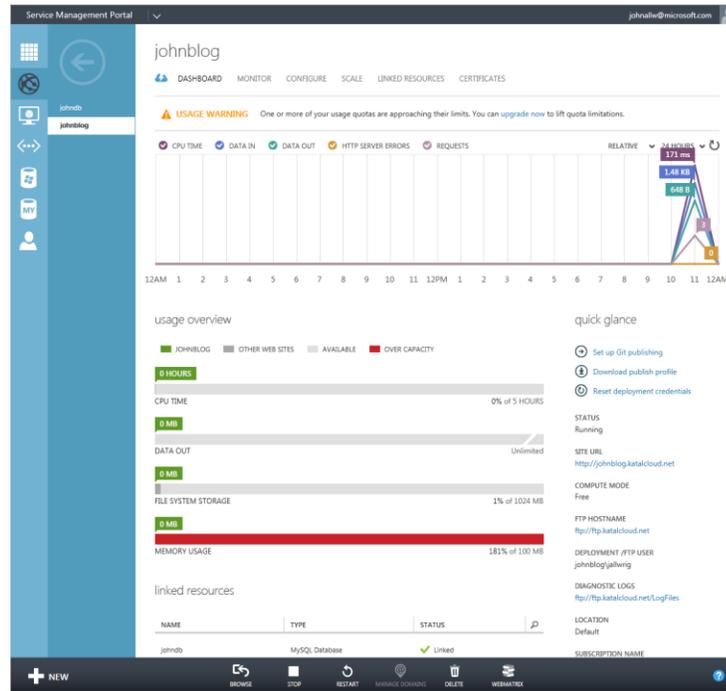


Figure 8: Management Portal showing dashboard for a website running WordPress..

## Management Portal for Administrators

The Windows Azure Pack provides a unique portal experience that enables administrators to configure and manage the services and resources that are made available to tenants. Administrators start by creating resource clouds that harness the raw computing, network, and storage resources in the datacenter and support finished services such as websites, databases, and virtual machines. Combinations of these services are added to plans along with usage quotas and add-ons, which provide tenant-controlled, incremental quota increases.

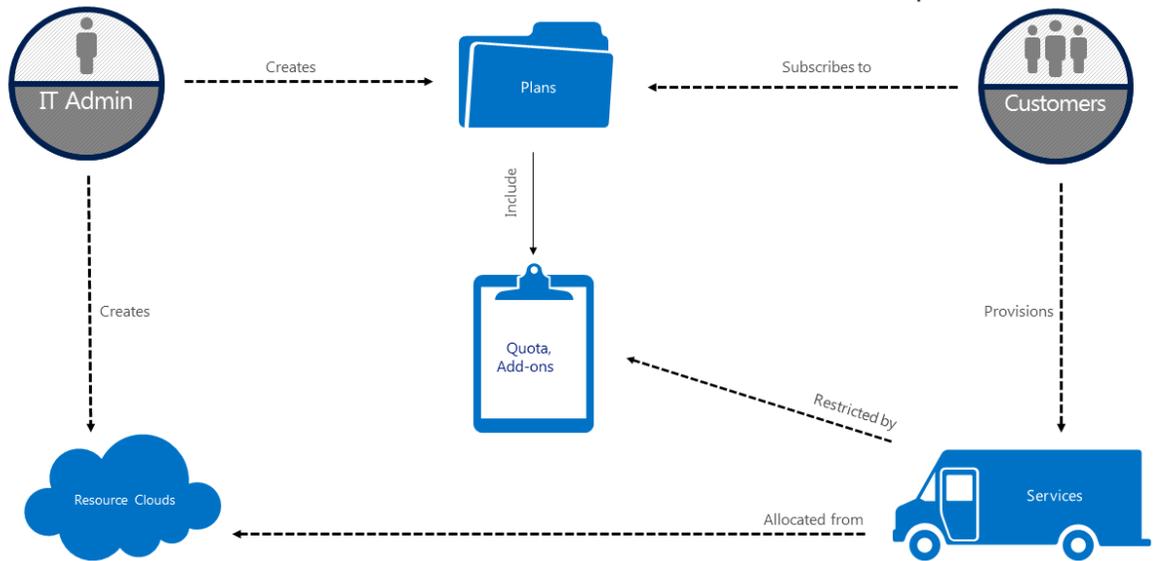


Figure 9: Relationship between service administrator and tenants.

Tenants must subscribe to a plan to start using services. Once subscribed to a plan, the tenant is able to provision services against a resource cloud based on the quota and add-ons for that cloud defined in the plan.

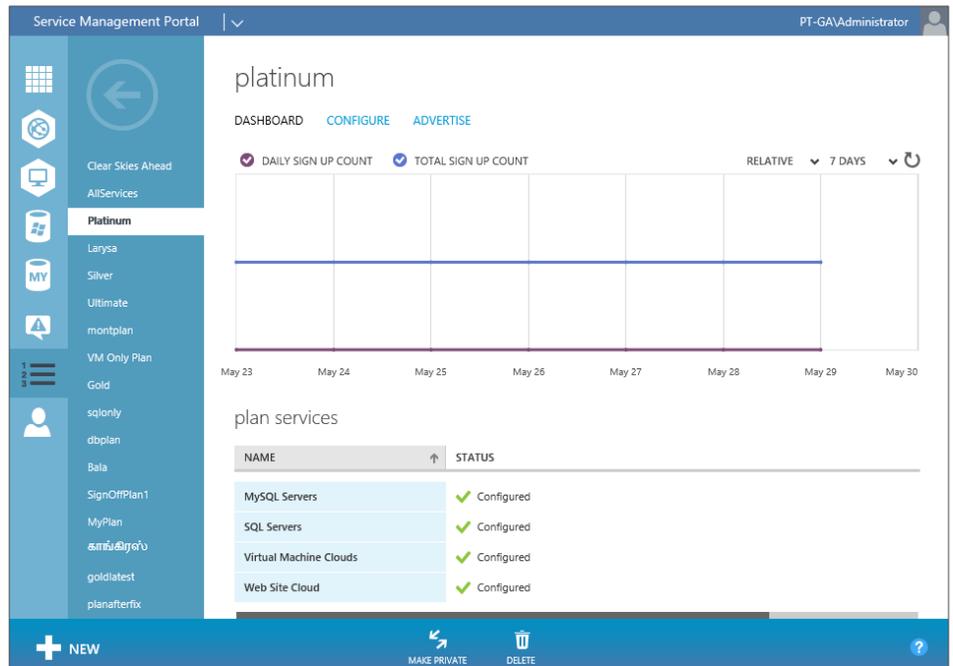


Figure 10: Service administrator view of a plan.

# Web Sites service

**The Web Sites service is a high-density web application PaaS (Platform-as-a-Service), optimized for cloud-hosting economics and integrated with many of the world's most popular open source web applications, frameworks, and tools. The Web Sites service helps you achieve the following:**

- Create high-density, scalable website hosting services that are simple to deploy and administer, helping you to scale to tens of thousands of sites in a single web farm.
- Support application frameworks including ASP.NET, Classic ASP, PHP, and Node.js with full GitHub, BitBucket, DropBox, and Team Foundation Server integration for source code control.

The Web Sites service simplifies deploying and administering scalable web application hosting at high density, similar to the experience on Windows Azure. Out-of-the-box automation lowers customer onboarding costs and streamlines upselling from a shared to a reserved infrastructure, while metering and throttling of resources helps tailor customer offerings. This solution fully integrates into the Web App Gallery, enabling customers to deploy the most popular web applications in seconds without incremental coding. Out-of-the-box integration with many popular tools and frameworks streamlines customer adoption. In addition, the Web Sites service can easily operate tens of thousands of sites in a single web farm and scale an individual customer's footprint with the click of a mouse.

The Web Sites service also offers self-service capabilities that enable service provider customers to be in control. This interface reduces onboarding costs and also drives down the potential need for direct interaction, which can increase operating margins. Taking advantage of new metering and throttling technologies, service providers deploying Web Sites service can confidently offer more customized services based on customer need. This scenario completely automates the transition of a customer from a low-margin shared infrastructure to a high-margin reserved instance.

In addition, The Web Sites service offers end customers broad choice in how they build and manage their websites. Because the solution supports many frameworks such as ASP.NET, Classic ASP, PHP, and Node.js, customers can easily deploy many of the most popular web apps with the click of a mouse. You can also build on Windows, Mac, or Linux and publish using the tools of your choice – Visual Studio, GitHub, Bitbucket, DropBox, Team Foundation Server, WebDeploy, FTP, or WebMatrix. The Web Sites service even enables customers to easily scale their number of instances as well as move from a shared infrastructure to a reserved one with a single mouse click.

The primary design point of the Web Sites service was to provide a cloud service that could operate at large scale. Windows Azure Pack makes this capability deployable on Windows Server and able to work in conjunction with IIS. The high-density solution primarily functions through the Dynamic Windows Process Activation Service, which centralizes web farm configuration into a SQL Server database and enables dynamic site binding and configuration. The solution also incorporates resource metering for incorporating in billing services. In addition, the Web Sites service takes advantage of enhancements in Windows Server 2012, such as resource throttling, to enable more fine-grained customer offers that guarantee capacity availability.

## Scalability

The primary challenge service providers encounter is applications that have an affinity to a single server. This limitation can cause many problems for a large-scale, multi-tenant web farm. A typical web application consists of application content stored in a file directory, one or more application databases, and configuration metadata required by the web server. This model works well for a relatively small number of web applications. Developers and administrators can easily keep track of a handful of web applications and ensure that various external resources and supporting configuration data stay in sync.

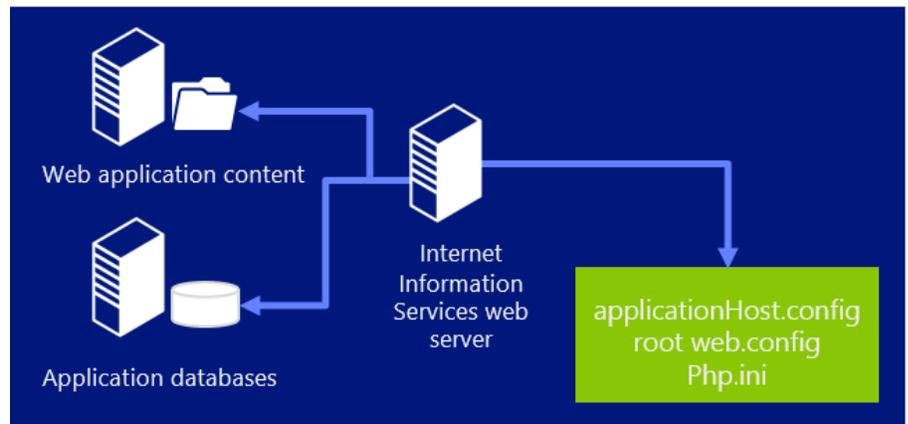


Figure 11: Traditional non-scalable web server configuration.

This model, however, quickly becomes unwieldy as the number of web applications running in a single environment increases. Such growth causes the amount of underlying hardware and virtual machines to grow, causing management complexity to skyrocket.

When the number of web applications increases into the low thousands, traditional command-driven management approaches, optimized for bulk-application management, become difficult to scale and maintain. As you increase the number of web applications even further, to tens of

thousands of web applications running in a single virtual web farm, existing traditional web application hosting models simply can't scale.

## Scalable architecture

At the most granular level, a cluster allocates a web application to a specific process or processes. Instead of configuring a web server to run a given web application, a cluster configures a worker process to run a given web application. In the following diagram, the web server has been replaced with a worker process.

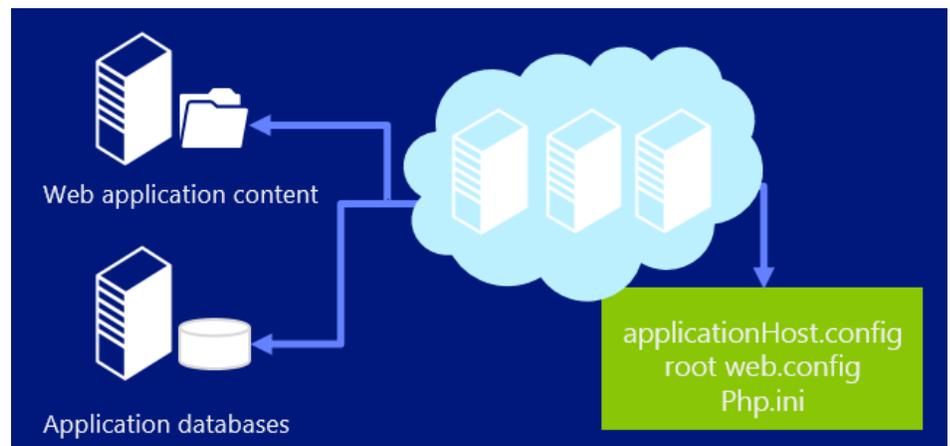


Figure 12: A cloud-based scalable web server farm.

From the standpoint of the web application, nothing has changed. The web application still has read-and-write file access to its content directories in addition to database access to required database servers. Nothing changes in the web application's code —the standard APIs that developers use to gain access to external resources, such as files and databases, continue to work as expected.

The worker process responsible for running the web application is supplied with all of the standard configuration files required by web applications. For example, settings specific to Internet Information Services are available in an `applicationHost.config` file that is accessible to the worker process. Similarly, technology-specific settings (such as ASP.NET or PHP) are available from files such as `root web.config` and `php.ini`.

Both the web application and the worker process are unaware that they are running on a cluster, as opposed to a traditional Internet Information Services web server.

You can use the Management Portal to scale websites and to specify whether they can run in Free, Shared, or Reserved mode.

### **Free mode**

When you first create a website, the site runs in Free mode, meaning that it shares available computing resources with other subscribers that are also running websites in Shared mode. This is the entry level offering, designed for service providers to on-board customers prior to upgrading to a paid service with Shared or Reserved mode. Free mode offers no scaling capability.

A single instance of a website configured to run in Free mode will provide somewhat limited performance when compared to other configurations, but can still provide sufficient performance to complete development tasks or proof-of-concept work.

If you configure a website to run in a single instance using Shared website mode and put it into production, the resources available to the website may prove to be inadequate as the average number of client requests increases over time. If this causes the site to exceed CPU-time quota, all websites in the same subscription stop. Because website instances normally unload after going idle for 20 minutes, the websites should start again at the next quota interval.

Before putting a website into production, you should estimate the load that the website can be expected to handle and consider scaling up or scaling out the website by changing configuration options available on the website's Scale management page.

### **Shared website mode**

A website upgraded to Shared mode uses a low-cost scaling model that provides more performance than Free mode. Tenants can dynamically change a website to Shared mode in the Scale tab of the Management Portal. These changes only take seconds to apply and do not require changing code or redeploying the application.

A website in Shared mode deploys in the same multi-tenant environment as in Free mode, but it can have flexible scaling and resource allocation as defined by the administrator.

Unlike Free mode websites, a website running in Shared mode supports the ability to receive mapping for multiple custom Domain Name System (DNS) domain names, adding another benefit to upgrading from the Free mode.

### **Reserved website mode**

When you change a website's mode from Shared to Reserved, the website scales up to run on a single dedicated core with access to additional memory, disk space, and bandwidth. A website configured as Reserved will provide more consistent performance than a website configured as Free or Shared.

With Reserved website mode, you specify the size of the website (small, medium, or large). A website configured with a larger Reserved Instance Size will perform better under load.

In addition, you also specify a value for Reserved Instance Count. Increasing the value for Reserved Instance Count will provide fault tolerance and improved performance through scale out.

### Flexibility

Windows Azure Pack enables you to quickly create and deploy a web application created from the gallery. You can deploy websites from remote computers using WebDeploy, FTP, WebDeploy, GIT, BitBucket, DropBox, or Team Foundation Server. Many development tools provide integrated support for publication using one or more of these methods and may only require that you provide the necessary credentials, site URL, and host name or URL for your chosen deployment method.

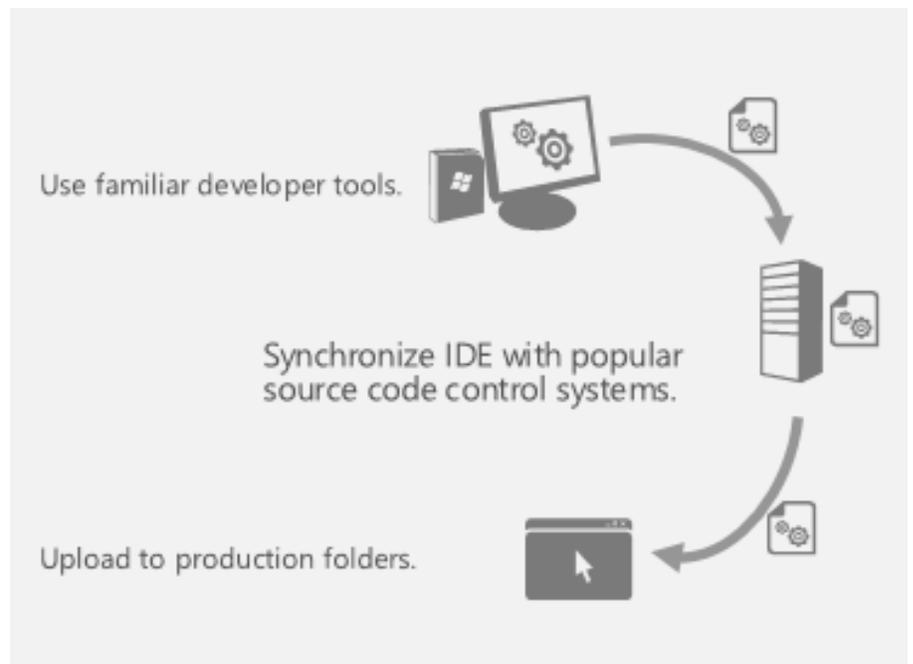


Figure 13: Developer tools and workflow automation using the Web Sites service.

The Web App Gallery supports a wide range of popular web applications developed by Microsoft, third party companies, and open source software initiatives.

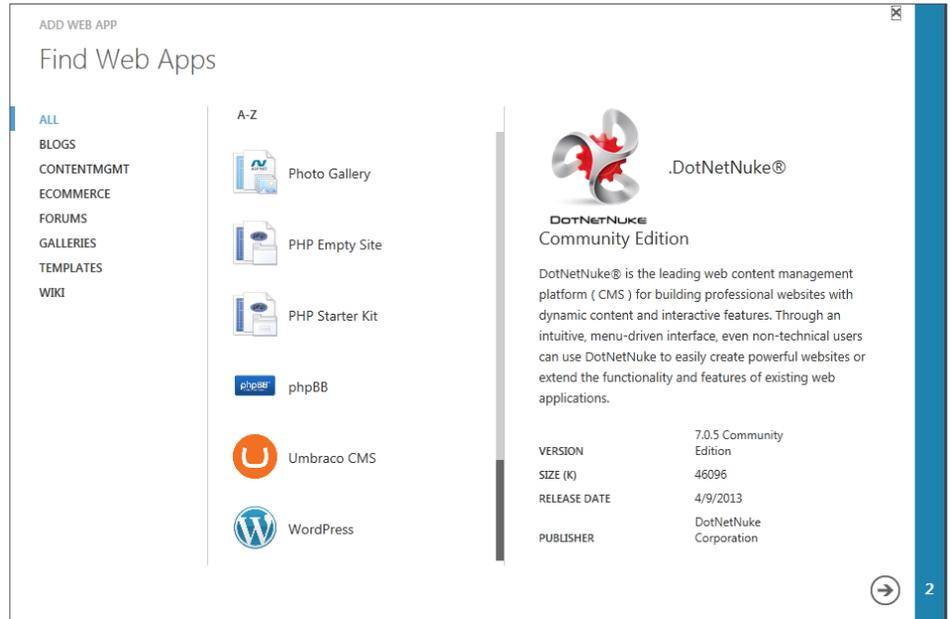


Figure 14: Selecting from a gallery of popular web applications for a new website.

# Virtual Machines and Virtual Networking

## The Virtual Machines service takes advantage of the power of System Center and Windows Server to easily create an Infrastructure as a Service (IaaS) solution.

The Virtual Machines and Virtual Networking capabilities in the Windows Azure Pack use the new Service Provider Foundation (SPF) provided with Microsoft System Center 2012 to enable service providers and large enterprise organizations to offer IaaS capabilities to tenants.

The Virtual Machine service in the Windows Azure Pack is compatible with Windows Azure Virtual Machines, providing the same consistent experience and workload portability. Service providers and large enterprise organizations can offer both customized service offerings as well as standardized parameters for tenants. Virtual Machines offers customers the ability to choose from a library of virtual machine templates based on Windows Server and Linux guest operating systems. Windows Azure Pack offers the ability to create your own custom virtual machine templates, store them in a System Center Virtual Machine Manager library, and select which ones to make available to each tenant.

Windows Azure pack also supports provisioning Virtual Machine Roles from a gallery. Virtual Machine Roles are a dynamically scalable load-balanced tier of Virtual Machines that offer resilience and scalability compared with standalone Virtual Machines

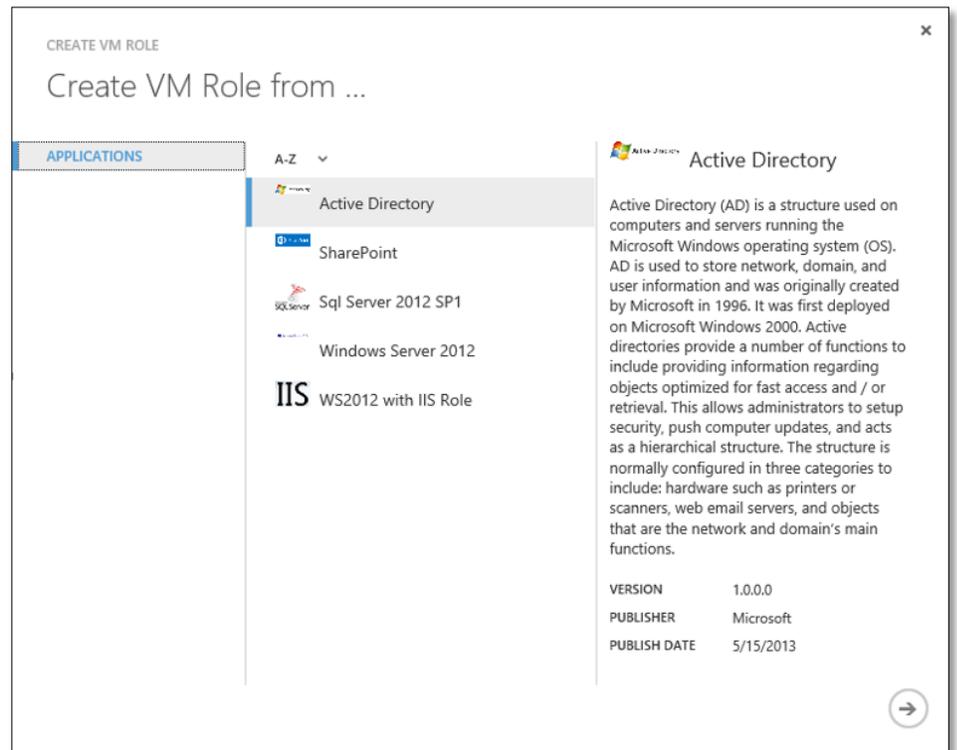


Figure 15: Creating a new scalable virtual machine from a gallery of virtual machine roles.

## IaaS deployment

To deploy a Virtual Machines IaaS solution, you start with Fabric stamps, each one managed by an instance of System Center Virtual Machine Manager (VMM). In the figure below, there are three stamps with three different VMM servers. The Service Provider Foundation provides a REST OData API, aggregates across VMM server stamps, and can be extended with automation that works with other systems.

Tenants can access the virtual machines through the Portal or the Service Management API.

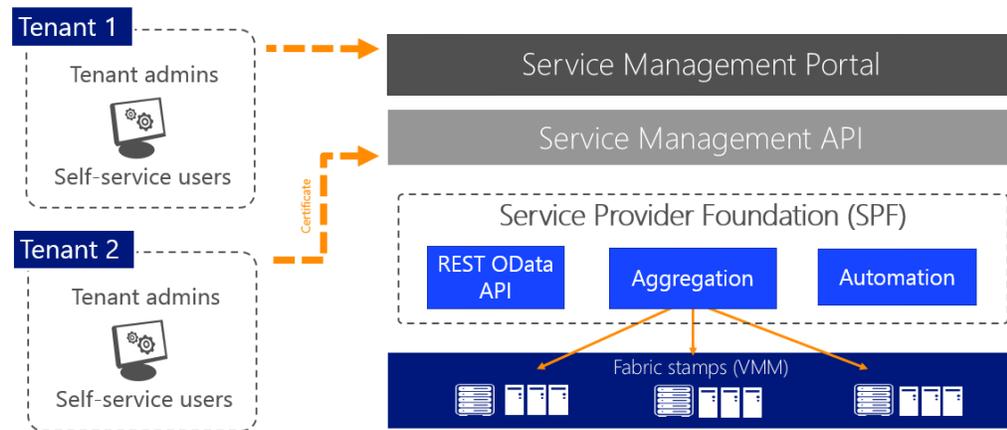


Figure 16: Deploying infrastructure as a service.

## Virtual Networking

Virtual Networking enables customers to use existing IP address schemes while remaining protected from other tenants and the underlying network infrastructure IP configuration.

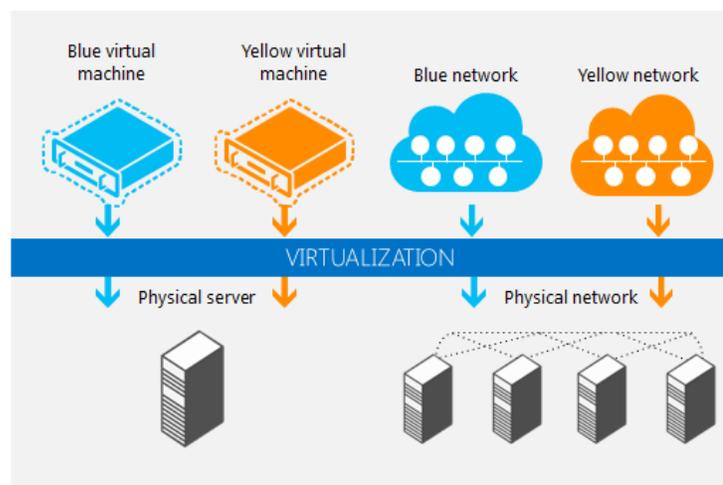


Figure 17: Hyper-V virtualized network.

# Service Bus

**Whether applications run in the cloud or on premises, they often need to interact with other systems and applications. Windows Azure Pack offers the Service Bus to enable tenant applications to reliably integrate applications using a messaging bus.**

The Service Bus service offers two solutions: Service Bus queues and Service Bus topics.

## Service Bus queues

Service Bus queues provide load-leveling by enabling the message receiver to process messages at its own pace. In addition, Service Bus queues have multiple competing receivers that can accept messages from the same queue, providing additional load-leveling.

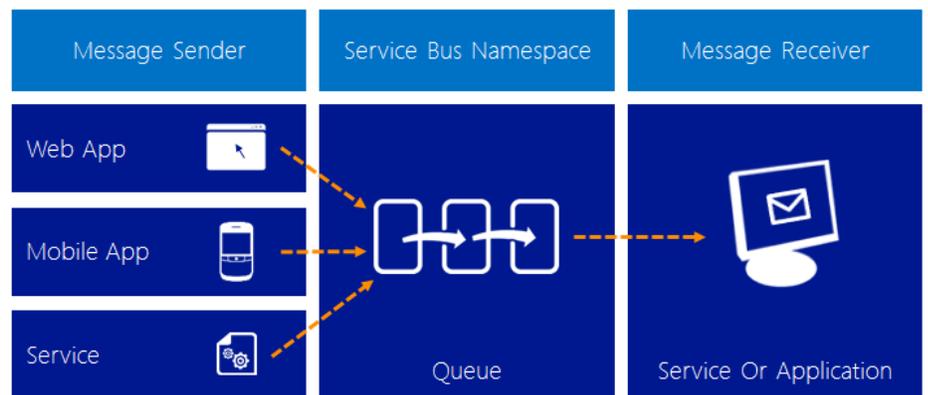


Figure 18: Service Bus Queues.

Service Bus queues support a brokered messaging communication model. When using queues, components of a distributed application do not communicate directly with each other. Instead the components exchange messages through a queue, which acts as an intermediary. A message producer (sender) hands off a message to the queue and then continues processing. Asynchronously, a message consumer (receiver) pulls the message from the queue and processes it. The producer does not have to wait for a reply from the consumer in order to continue to process and send further messages. Queues offer First In, First Out (FIFO) message delivery to one or more competing consumers. In other words, receivers typically intake and process messages in the order that they are added to the queue. Only one message consumer receives and processes each message. Using queues can enable you to scale out your applications more effectively and bring more resilience to your architecture.

## Service Bus topics

In addition to queue features, Service Bus topics and subscriptions provide rich publish-subscribe capabilities that enable multiple,

concurrent subscribers to independently retrieve filtered or unfiltered views of the published message stream.

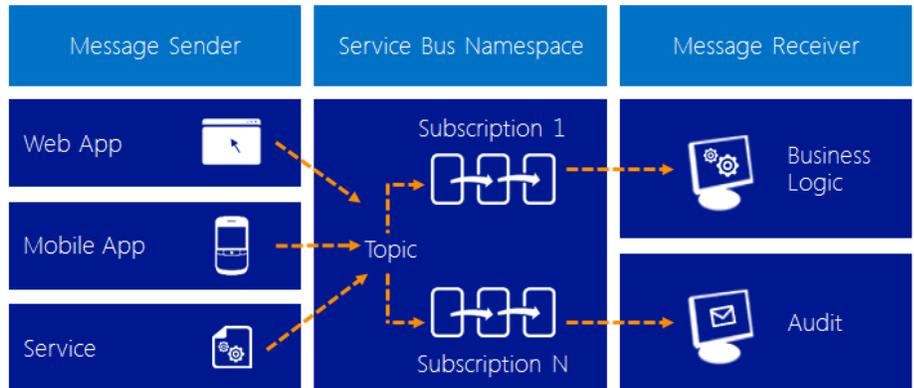


Figure 19: Service Bus topics.

Service Bus topics and subscriptions support a publish-subscribe messaging communication model. When using topics and subscriptions, components of a distributed application do not communicate directly with each other. Instead, they exchange messages through a topic, which acts as an intermediary.

In contrast to Service Bus queues, topics and subscriptions provide a one-to-many form of communication, taking advantage of a publish-subscribe pattern. You can register multiple subscriptions to a topic. When a message is sent to a topic, the message becomes available to each subscription to handle and process independently.

A topic subscription resembles a virtual queue that receives copies of the messages that were sent to the topic. You can optionally register filter rules for a topic on a per-subscription basis, which enables you to filter or restrict which messages a topic receives by which topic subscriptions.

Service Bus topics and subscriptions help tenant applications to scale to process a very large number of messages across a very large number of end users and applications.

# Extensibility

## We designed Windows Azure Pack to integrate tightly with your environment.

Whether you're an enterprise or a service provider, Windows Azure Pack has built-in extensibility to ensure that you can integrate it into your existing systems for maximum convenience.

Active Directory Federated Services (ADFS) integration ensures that existing enterprise users can authenticate in the Management Portal without the creation of a new user database.

The OData Rest API that supports the Management Portal enables replacement of some or all of the capabilities of the supplied portal by an existing customer portal. Administrative functions are also exposed through the same API for automation or integration into a custom admin portal.

For billing or chargeback, usage data is also available through the Management Portal API for integration into in-house or third-party billing vendors' solutions, some of which have already built Windows Azure Pack integration.

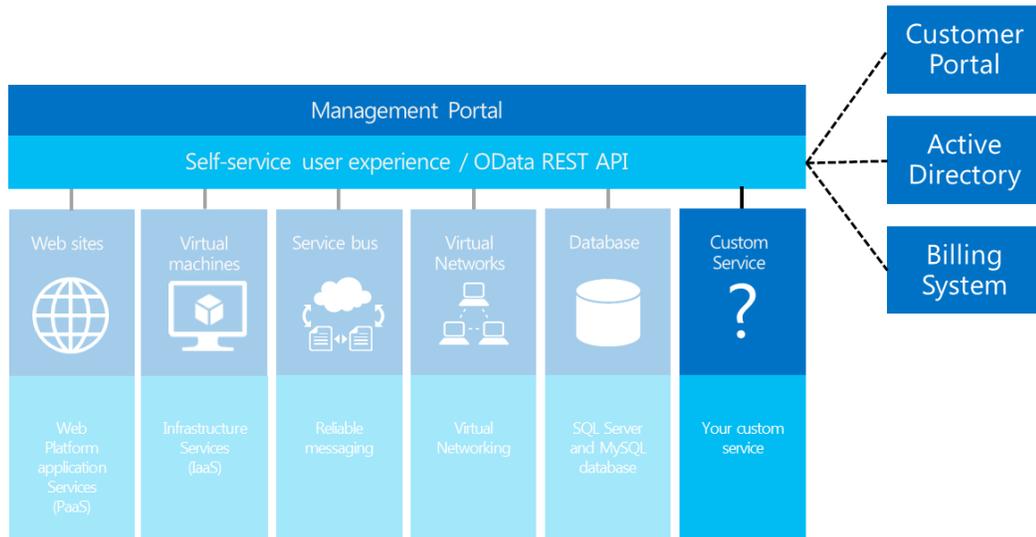


Figure 20: Relationship between service administrator and tenants.

# Summary

**Windows Azure Pack brings Windows Azure technologies to the datacenter, addressing a number of key requests that service providers and enterprise customers have presented to Microsoft. Building on a familiar foundation of Windows Server and System Center, Windows Azure Pack delivers an enterprise-class, cost-effective solution for multi-tenant cloud infrastructures services. Service providers and enterprise customers can build customizable solutions using industry-standard hardware, broad application platform support, and open technologies.**

## **Enterprise-class**

The Windows Azure Pack is built on the foundation of Windows Server and System Center — trusted by enterprises the world over, responsible for delivering computing power, virtualization, and management to support critical application workloads.

Windows Azure consistency in both end user experience and services ensures that IT administrators can reuse their skills and automation across the Cloud OS destinations and move workloads that use the common set of services offered across the Cloud OS.

The Web Sites service provides a consistent, scalable, reliable application platform for running websites and web applications.

## **Easy and cost effective**

The multi-tenant infrastructure of the Windows Azure Pack enables efficient, shared usage of commodity computing, storage, and network resources. Load-balancing for web applications and virtual machine roles enables you to directly control the scale-out resources required by their application workload.

Out-of-box capabilities enable the Windows Azure Pack to help provide a ready-built web PaaS and IaaS solution for enterprises and service providers to offer self-service provisioning and management of IT services.

Using the advanced features in Windows Server and System Center, you can build the solution on inexpensive, industry-standard hardware.

## **Open and interoperable**

The Windows Azure Pack provides a wide range of customization and integration possibilities. The Management Portal can be branded or completely replaced using the Service Management API. Billing can be integrated through the supplied API.

The Web Sites service supports popular web application platforms including ASP.NET, Node.js, and PHP. In addition, the Web Sites service

supports popular development tools and integrates directly with source control systems including GitHub, Bitbucket, DropBox, and Team Foundation Server.

To try the Windows Azure Pack today, visit the Windows Azure Pack website, <http://www.microsoft.com/en-us/server-cloud/products/windows-azure-pack>