Microsoft

Azure Stack: An extension of Azure

Version 3.1

2/09/2018

CONTENTS

BUSINESS CHALLENGES AND THE NEED FOR A HYBRID CLOUD PLATFORM

Every company in every industry around the world is being challenged to transform from an organization that uses digital technology, to a digital organization. Application modernization is at the heart of digital transformation, with the opportunity to help companies engage customers, empower employees, optimize operations and transform products. Azure provides a rich platform for developers to build modern applications, and in fact most applications are moving to public cloud quickly. Some applications however face obstacles; latency, intermittent connectivity, and regulation being primary examples. Azure Stack provides a way to run the same applications in on-premises environments. With a consistent cloud platform, organizations can confidently make technology decisions based on business requirements, rather than business decisions based on technology complications.

HYBRID APPLICATION INNOVATION WITH AZURE AND AZURE STACK

Azure Stack is an extension of Azure, bringing the agility and fast-paced innovation of cloud computing to on-premises environments. Organizations can now build modern applications across hybrid cloud environments, balancing the right amount of flexibility and control. Developers can build applications using a consistent set of Azure services and DevOps processes and tools, then collaborate with operations to deploy to the location that best meets the business, technical, and regulatory requirements. Developers can speed up new cloud application development by building on application components from the Azure Marketplace, including open source tools and technologies.

USE CASES: AZURE AND AZURE STACK

Azure and Azure Stack unlock new hybrid use cases for both customer facing and internal line of business applications:

Edge and disconnected solutions: Customers can address latency and connectivity requirements by processing data locally in Azure Stack and then aggregating in Azure for further analytics, with common application logic across both. There's lots of customer interest in this edge scenario across different contexts, including factory floors, cruise ships, and mine shafts.

Cloud applications that meet varied regulations: Customers can develop and deploy applications in Azure, with full flexibility to deploy on-premises on Azure Stack to meet regulatory or policy requirements, with no code changes needed. Illustrative application examples include global audit, financial reporting, foreign exchange trading, online gaming, and expense reporting. Many customers are looking to deploy different instances of the same application to Azure or Azure Stack, based on business and technical requirements. While Azure meets most requirements, Azure Stack complements the deployment approach where needed.

Cloud application model on-premises: Customers can use Azure services, containers, serverless, and microservice architectures to update and extend existing applications or build new ones. You can use consistent DevOps processes across Azure in the cloud and Azure Stack on-premises. We're seeing broad interest in application modernization, including for core mission-critical applications.

AZURE STACK PROMISE

Azure and Azure Stack enable three core promises for customers:

CONSISTENT APPLICATION DEVELOPMENT

Maximize developer productivity by empowering them to build and deploy applications the same way whether they run on Azure or Azure Stack. Implement a common DevOps approach across hybrid cloud environments. With a consistent platform for application development, customers can:

- Go faster by using the same application model, self-service portal, and APIs, as enabled by Azure Resource Manager.
- Easily transfer existing skills through a consistent development and deployment experience with Visual Studio.
- Adopt modern DevOps practices with support for open source tools (e.g., Jenkins) and Visual Studio.
- Rely on powerful automation tools, such as and Azure PowerShell DSC extensions.
- Speed up new cloud application development by using a range of open-source and community-driven software components from the Azure Marketplace in Azure Stack.
- Choose from multiple Linux distributions, Docker-integrated Containers (Linux and Windows Server), and Mesosphere.
- Use Pivotal Cloud Foundry and open source Cloud Foundry consistently across Azure and Azure Stack to rapidly build, deploy, and operate cloud applications that are easily portable across hybrid cloud environments.
- Just like Azure, Azure Stack supports a broad choice of open source application platforms, languages, and frameworks including Java, Python, Node.js, and PHP.

AZURE SERVICES AVAILABLE ON-PREMISES

Adopt hybrid cloud computing on your terms. Meet business and technical requirements, with the flexibility to choose the right combination of cloud and on-premises deployment models. With Azure Services available on-premises, customers can:

- Use the cloud computing model for Azure IaaS services that go much beyond traditional virtualization. For instance, Virtual Machine Scale Sets enable rapid deployments with scaling options for modern workloads (e.g., containerized applications).
- Incorporate consistent Azure PaaS services that simplify development and enable hybrid deployment choice and portability for cloud applications. Run high-productivity PaaS (Azure App Service) and Serverless computing (Azure Functions) in on-premises environments.
- Adopt common operational practices across Azure and Azure Stack: Deploy and operate Azure IaaS/ PaaS services using the same administrative experiences and tools as Azure.
- Use an Azure Active Directory (AAD) subscription to administer Azure Stack identities, including secure multitenant access (i.e., enabling users across multiple AAD tenants to access Azure Stack resources).
- Build for the future as Microsoft delivers continuous Azure innovation to Azure Stack, including new Azure services, updates to existing services, and additional Azure Marketplace applications.

INTEGRATED DELIVERY EXPERIENCE

Focus on optimizing business applications and services, with integrated systems that are designed to deliver consistent Azure innovation in a predictable manner. With an integrated delivery experience, customers can:

- Get up and running quickly with purpose-built Azure Stack integrated systems. They can be procured from HPE, Dell, and Lenovo initially (with Cisco and Huawei coming soon after) so you have flexibility and choice of hardware. These systems come fully ready to run and offer consistent, end-to-end customer support no matter who you call.
- Consume continuous innovation from Azure in a reliable manner with pre-validated software updates. These updates will be delivered to a predictable schedule and can be applied within a flexible time window, so they can be consumed to organizational maintenance schedules.
- Easily integrate Azure Stack into the datacenter, be it monitoring (System Center Operations Manager Management Pack or Nagios extension) or identity (with Active Directory Federation Services support).
- Ensure availability for workloads running on Azure Stack through integration with Azure Backup (for protection) and Azure Site Recovery (for BC/DR)

- Start as small as 4-server production systems and scale your environment over time.

ONE AZURE ECOSYSTEM

Customers can speed up their Azure Stack initiatives by leveraging the rich Azure ecosystem:

- Our goal is to ensure that most applications and services that are certified for Azure will work on Azure Stack. Several ISVs – including Bitnami, Docker, Kemp Technologies, Pivotal Cloud Foundry, Red Hat Enterprise Linux, and SUSE Linux – are extending their solutions to Azure Stack.
- Customers have the option of having Azure Stack delivered and operated as a fully managed service. Several partners will have in-market managed service offerings across Azure and Azure Stack shortly. These partners have been delivering managed services for Azure via the Cloud Solution Provider (CSP) program and are now extending their offerings to include hybrid solutions.
- Systems Integrators (SI) can help accelerate application modernization initiatives by building end-to-end Azure solutions for customers. They bring in-depth Azure skillsets, domain and industry knowledge, and process expertise (e.g., DevOps). Every Azure Stack cloud is an opportunity for an SI to design the solution, lead and influence system deployment, customize the included capabilities, and deliver operational activities.

HOW AZURE STACK WORKS

The graphic below provides a simplified view of the Azure Stack product architecture.
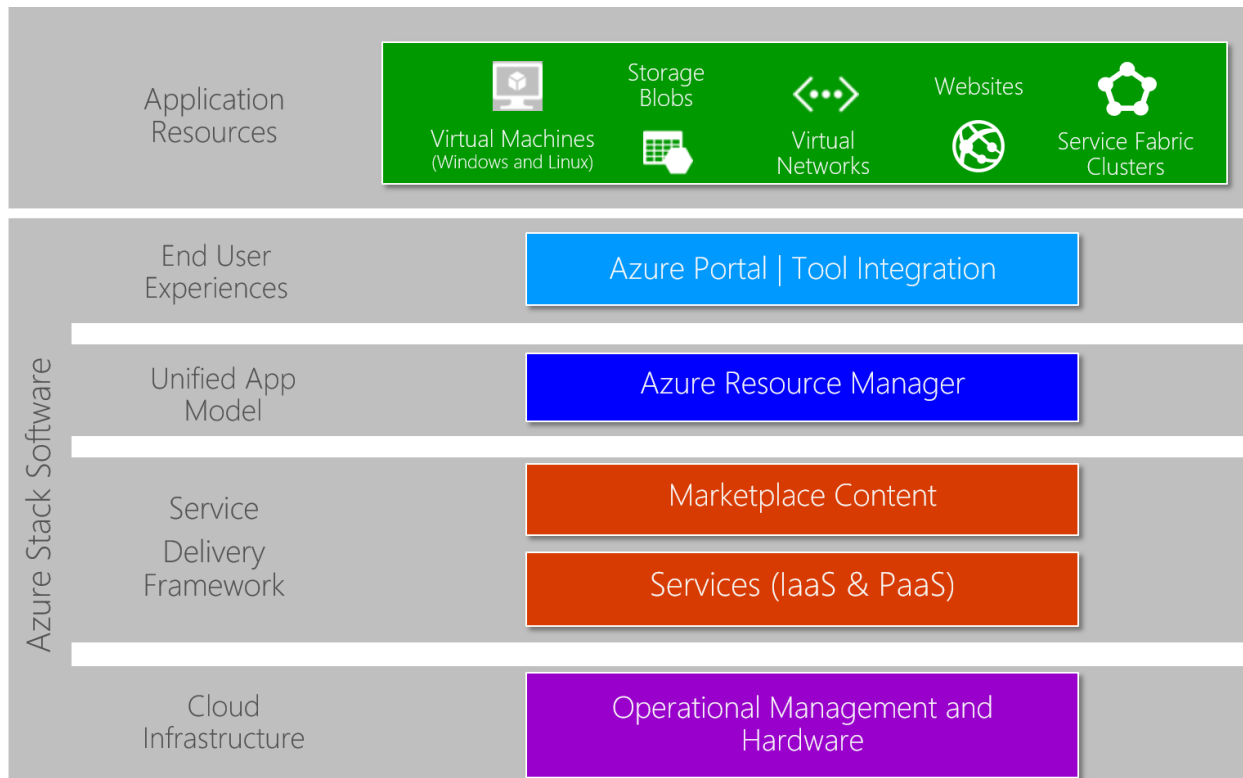
DEVELOPER AND IT PROFESSIONAL EXPERIENCES

Developers and IT pros have an experience with Azure Stack that is consistent to that which they experience in Azure. This is fundamentally made possible because the Azure Stack portal environment is the same code as Azure. However, the real innovation of Azure Stack is the implementation of a consistent cloud API as Azure, so there is a consistent experience across clouds. Simply connecting to a portal to choose from preconfigured patterns is not enough; the definition of self-service has evolved to include programmatic access to the cloud API for the creation, deployment and operations of workloads in a cloud.

A consistent API surface area between Azure and Azure Stack is the path to a set of *experiences*, *tools*, *application patterns*, a*utomation capabilities, deployment and configuration,* and *operations* that work across clouds.

- **Experiences**: The first engagement with Azure and Azure Stack usually comes through the portal which provides a web-accessible conduit into the system.
- **Tools**: Customers can use the tools they use in Azure and know they will work in Azure Stack. Developers and Application teams can focus on solving business problems, rather than constant tooling and deployment transitions.
- **Application Patterns**: Programmatic and abundant access to resources are changing the way that applications are being designed, developed and operated. You can work with the resources in your application as a group – mixing resources *across* IaaS and PaaS services.
- **Automation Capabilities**: Having a consistent API means that developers and operations teams can invest in automating development, deployment and operational activities knowing that they will not have to be rewritten to be used with a cloud supplier that offers Azure services.
- **Deployment and Configuration**: Deployment and configuration can be simplified by using a single code base for apps and infrastructure.
- **Operations**: Templated deployments work for different environments such as testing, staging and production. Role based access control, usage and audit capabilities are standardized across all cloud resources in the deployment. Updates made to application resources can be performed in an incremental and non-destructive manner.

These are all examples of the breadth of impact enabled by this hybrid cloud platform. In each area, we believe Azure customers should be confident that their investments in people, processes and technologies will be transferable between Azure and Azure Stack.

UNIFIED APPLICATION MODEL

The key to our Azure cloud model is the **Azure Resource Manager**. In both Azure and Azure Stack, Azure Resource Manager plays two important roles. The first is by providing a single-entry point for users and tools to define their resources running in the cloud. The second is focused on enabling teams to create, organize and control their cloud application lifecycle.

SERVICE DELIVERY FRAMEWORK

A key principle of operating a cloud is constant innovation - new capabilities, new insights and new customer needs are the norm. Microsoft Azure is composed of over fifty services today and has an enormous amount of content in the Azure Marketplace. As Microsoft continues to innovate and release new Azure content and

services, a way to deploy and manage new functionality throughout Azure datacenters was needed. Azure is fundamentally designed to enable the release of innovation on a regular and on-going cadence.

With Azure Stack, the framework we use to install and publish new content and services is the same. The only difference is that we've tuned the requirements for success when operated by customers instead of Microsoft.

MARKETPLACE CONTENT

When running a self-service cloud, curating a differentiated Marketplace for users is a key part of the value to customers. With Azure Stack, cloud operators will be able to create their own custom Marketplace content and add items directly from the Azure Marketplace to make them available to their users. Key Windows and Linux distributions along with other technologies, such as Blockchain, Mesos, and Cloud Foundry can all be made available in an Azure Stack Marketplace.

SERVICES

Azure services power the next generation of cloud applications and are a key component of every Azure Stack deployment. Azure Stack begins with the initial services required for getting started with application innovation initiatives by providing modern compute, storage, networking, and security services, as well as platform services, such as App Service and Functions. In Azure Stack, there are services that ship in the integrated system and services that can be "optional" services that can be added to an Azure Stack deployment to add new functionality.

When an Azure Stack operator chooses to add a service to their cloud they're growing the capabilities they can offer to their application teams. Microsoft will grow the list of services that can be installed to Azure Stack over time.

It is important to keep in mind that in Azure, services take dependencies on other services – they layer on top of each other. Each service in Azure is a candidate for being distributed through Azure Stack and we will listen to customer input and consider technical feasibility in determining the roadmap. For a detailed list of Azure services at availability and thereafter, see the sections below.

CLOUD INFRASTRUCTURE

Like Azure, the cloud infrastructure with Azure Stack is a purpose built, preconfigured solution that provides the capacity and lifecycle management for the system. Our design point is to remove the complexity of building a cloud and focus on continuously delivering the services that applications depend on. Unlike Azure, Azure Stack is deployed, operated, and maintained by the customer. Accordingly, we have incorporated a set of principles in Azure Stack infrastructure design that simplify the operations experience so that operators and administrators can focus more on delivering Azure services and updates, rather than on infrastructure set-up and tuning.

INFRASTRUCTURE OPERATIONS AND MANAGEMENT

All the Azure Stack solution components such as machines, software infrastructure, services, and subscriptions exhibit management interfaces that are intuitive to the end customer.

Management Capabilities include:

- **Intuitive experiences**: A portal and command line experience surfaces the common actions an Azure Stack provider or operator needs to take, allowing them to make decisions quickly and intuitively.
- **Monitoring and diagnostics**: Monitoring, notifications and management capabilities that allow the management of infrastructure and service health, performance, and capacity that underlie tenant workloads.

- **Patching and updates**: Microsoft will provide customers with the ability to update their infrastructure software and firmware while minimizing the impact on business applications, services and workloads.
- **Business Continuity**: Azure Stack provides several capabilities that inform a broader business continuity strategy. This is applicable at two levels:
  - Guest / Tenant level protection and recovery for business applications and services
  - Infrastructure system backup, which stores metadata (e.g., subscriptions, tenant to host mapping) so customers can recover their cloud infrastructure (and workloads) from major failures
- **Security and Privacy**: Azure Stack has a secure by design approach across network, data and management.
- **Hardware lifecycle management:** Azure Stack will have validated workflows experience to enable incremental expansion and replacement of failed components.

SCALE MODEL

Azure Stack will provide scalability in multiple dimensions: This enables choice and flexibility to meet customer requirements and can grow with their needs. The approach to Azure Stack scale is derived from Azure. Customers will scale-out their deployments by adding capacity to a region, adding additional regions, while exposing unified access through ARM and portal.

Azure Stack has several entry points for scale and introduces new concepts that should be understood.

- **Cloud**: Azure Resource Manager spans across the entire system and provides a single-entry point to the cloud.
- **Regions**: Underneath Azure Resource manager are Regions that represents available capacity. Each region represents a set of physical compute and storage resources that share the same location. Multiple Regions make up the Cloud.
- **Scale Units**: A scale unit is a set of servers with identical CPU, Memory, Network, and Storage configuration. Each Scale Unit may have different/new hardware configurations. One or more Scale Units comprise a Region.
- **Servers**: individual nodes that populate a Scale Unit.
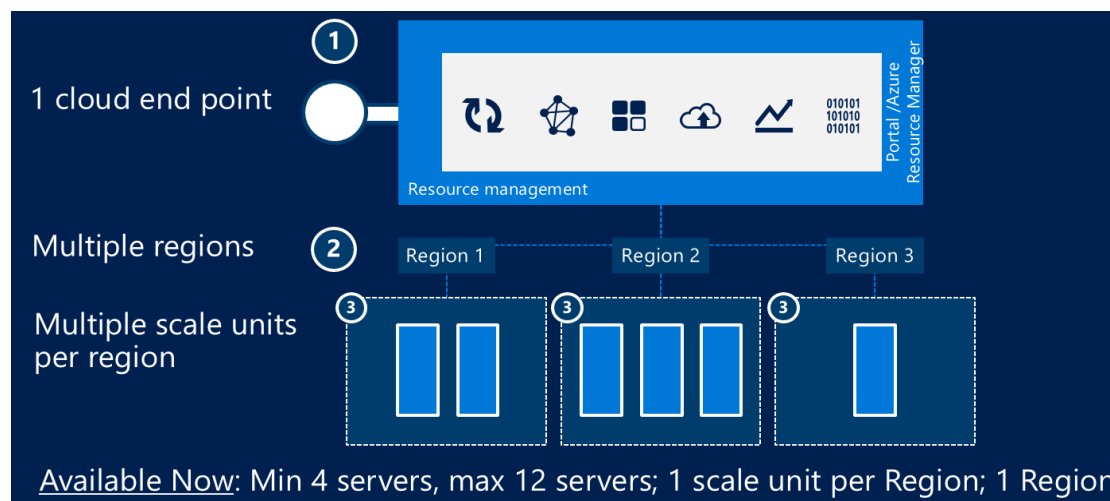
Scale for an Azure Stack cloud, then, is the formula of [#Regions] X [# of Scale Units per region] X [#Servers per Scale Unit].

Azure Stack is designed to stay consistent with Azure through continuous innovation. Like Azure, Azure Stack does planning and building at frequent intervals. This means that we prioritize capabilities based on customer feedback and deliver it as quickly as we can. These capabilities are grouped into 2 areas:

- **Azure capabilities on Azure Stack** - These focus on end-user facing functionality, such as Azure IaaS/PaaS services, Marketplace content, and DevOps tooling.
- **Azure Stack infrastructure capabilities** – These are focused on the infrastructure and operations lifecycle, and include scale and hardware configurations.

Microsoft will continuously deliver additional capabilities in regular updates. These updates will continue to expand customer choice of IaaS and PaaS technologies when developing applications, as well as improve manageability and grow the footprint of Azure Stack.

TYPES OF UPDATES

With Azure Stack, we will deliver two major types of updates:

- **Updates to Azure capabilities on Azure Stack** - These updates do not have a regular scheduled release pattern and can come anytime they are ready. They include new Marketplace content, DevOps tooling, updates to existing Azure services as well as new Azure Services that can be deployed to Azure Stack.
- **Updates to Azure Stack infrastructure** - These updates are more structured and regular. They include new and updated Infrastructure Management capabilities, firmware, drivers and expanded scale points. They focus on improving the operational excellence of Azure Stack. We will also add new integrated system partners to expand choice for customers.

In addition, we will also have monthly security updates.

AZURE STACK CAPABILITIES

The following table summarizes Azure Stack functionality at initial availability (unless spelled out otherwise):

Azure capabilities on Azure Stack	Azure IaaS services • Azure Virtual Machines (A, D, and Dv2 sizes), Azure Virtual Machine Scale Sets • Azure Storage (blobs, tables, queues) • Azure Networking – Virtual Networks, Load Balancer, VPN Gateway • Azure Key Vault Azure PaaS services • Azure App Service^: Web Apps, API Apps • Azure Functions^ • Standalone Azure Service Fabric clusters on IaaS VMs*, deployable to Azure Stack or Azure • Azure Container Service (ACS) Engine support (includes Docker Swarm, Mesosphere DC/OS, and Kubernetes container management templates)** • MySQL RP^ • SQL Server RP^ Azure Identity • Azure Active Directory (AAD) multi-tenant support • Active Directory Federation Services (ADFS) support Azure Marketplace Content - Key IaaS/PaaS workloads • Microsoft SQL Server • Cloud Foundry template • Cloud Foundry template

	• Blockchain template (will be available by end of CY17) • Bitnami (validated open source stacks such as Wordpress, LAMP) • Kemp Technologies – Load Balancer and Web Application firewall • More solutions from the Azure Marketplace*** Azure Marketplace Content – Images and extensions • LINUX: RedHat, SuSE, CentOS, Debian, Canonical Ubuntu, CoreOS • Windows Server • Azure Docker Extension • DSC Extension • Chef Automate DevOps Tooling integration • Visual Studio • Jenkins (open source) • PowerShell • Azure CLI 2.0 Protection and recovery of business applications and services (e.g., IaaS VMs) • Integration with multiple solutions (e.g., Azure Backup and System Center Data Protection Manager) for backup and restore • Integration with Azure Site Recovery (ASR) for replication and failover – this includes continuous replication with test failover and actual failover capabilities

Azure Stack infrastructure capabilities	Infrastructure
	• Scale: 4-12 nodes (physical servers) per Scale Unit; Single Region, Single Scale Unit
	• Certified and validated deployments, along with our hardware partners
	• Monitoring, diagnostics (REST APIs for integration with multiple monitoring toolsets, including System Center Operations Manager and Nagios)
	• Security and privacy: Below are some of the capabilities -
	    ○ Best practices from Microsoft Security Development Lifecycle, which takes a hardened-by-default approach
	    ○ Leverages several features from the recent Windows Sever 2016, such as credential guard, device guard, and Windows Defender (antimalware)
	    ○ Formal assessment with a 3rd party assessor organization, with documentation on how Azure Stack infrastructure meets applicable controls**** for multiple compliance standards (targeting PCI-DSS and the CSA CCM matrix)
	• Patch and updates: Capability needed to deliver pre-validated updates for Azure Stack software, including automated application that's designed to minimize disruption of customer workloads.
	• Business Continuity: Includes the ability to recover cloud infrastructure (and workloads) through the infrastructure backup capability that stores critical system meta-data (e.g., subscription information, tenant to host mapping)
	• Enabling field replacement of parts, along with our hardware partners

* Azure Service Fabric (delivered as a Service) estimated availability on Azure Stack in CY18 (see roadmap section)
*** We expect most single VM solutions with BYOL terms that use available services in Azure Stack to work without changes.
**** Timing subject to change, given third party dependency
^Optional services

To see the Azure Stack roadmap, go to https://azure.microsoft.com/en-us/roadmap/ and select Microsoft Azure Stack from the Product Category dropdown.

DELIVERY

Azure Stack has two deployment options:

- **Azure Stack Integrated Systems** – These are multi-server systems meant for production use, and are designed to get customers up and running quickly. Depending upon hardware preferences, customers can choose integrated systems from Dell EMC, HPE, and Lenovo (with Cisco and Huawei following later). These systems come ready to run and offer consistent, integrated customer support. They will initially be available in 46 countries covering key markets across the world.
- **Azure Stack Development Kit (ASDK)** – ASDK is a free single server deployment that's designed for trial and proof of concept purposes. The portal, Azure services, DevOps tools, and Marketplace content are the same across ASDK and integrated systems, so applications built against the ASDK will work when deployed to an integrated system.

The following table is a summary of the availability dates for Azure Stack.

	Availability Date	Country Availability
Azure Stack Development Kit	Available as web download in July	Global
Azure Stack Integrated Systems	Can be ordered from our hardware partners starting July with first systems beginning to ship in September: • Dell EMC • Hewlett Packard Enterprise • Lenovo Additional integrated systems will become available as follows: • Cisco: CY18 (exact timing TBD) • Huawei: Q1 CY18	46 countries (see section below for geo list)

GEO-AVAILABILITY

The following are the countries in which Azure Stack will be available initially:

- Americas: Argentina, Brazil, Canada, Chile, Colombia, Mexico, Peru, United States, Uruguay
- EMEA: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Israel, Italy, Luxembourg, Monaco, Morocco, Netherlands, Norway, Portugal, Russia, Saudi Arabia, South Africa, Spain, Sweden, Switzerland, Turkey, United Arab Emirates, United Kingdom
- APAC: Australia, Hong Kong, India, Indonesia, Japan, Korea, Malaysia, New Zealand, Philippines, Singapore, Taiwan, Thailand, Vietnam

EXTENDING CLOUD ECONOMICS TO ON-PREMISES WITH PAY-AS-YOU-USE PRICING

Aligned with the product promise, Azure Stack brings the cloud economic model to on-premises environments with pay-as-you-use pricing.

AZURE SERVICES PRICING

As in Azure, there are no upfront licensing fees for the usage of Azure services on Azure Stack; customers only pay when they use a service. Since customers take on the cost of ownership and operations, Azure Stack prices will be lower than Azure prices in many cases. The pay-as-you-use model can be added to existing Azure agreements, enabling customers to use the same subscriptions, monetary commitment, and invoice for both Azure and Azure Stack. The pay-as-you-use pricing is available for purchase in the Enterprise Agreement (EA) and Cloud Solution Provider (CSP) channels.

Azure services running on Azure Stack will be metered on the same units as Azure.

Service		Meters
Azure Virtual Machines	Base virtual machine (VM)	vCPU/hour
	Windows Server VM*	vCPU/hour
Azure Storage	Blob storage	GB/month *(no transaction fee)*
	Table and Queue storage	GB/month *(no transaction fee)*
Azure App Service	Web Apps, API Apps, Functions	vCPU/hour

Customers can deploy Windows Server and SQL Server VMs using their existing Windows Server and SQL Server licenses in conjunction with Azure Stack. They have the choice of using Azure Stack native hourly meters or existing Windows Server licenses to deploy Windows VMs. If existing Windows Server licenses are used, only the consumption fee on Base VM usage will be charged.

Organizations that aren't always connected to Azure or are otherwise unable to transmit metering information may choose to use Azure Stack in a disconnected mode. For disconnected operating mode, we offer a capacity model pricing package—a fixed fee, annual subscription based on the number of physical cores in your system. Two capacity packages are available: the App Service package, which includes App Service, base virtual machines, and Azure Storage; and the IaaS package, which includes base virtual machines and Azure Storage. With the capacity model, customers can use existing on-premises licenses to deploy Windows Server and SQL Server VMs. The capacity model is available via EA only.

For actual pricing details, please refer to the pricing and licensing datasheet.

INTEGRATED SYSTEMS
Azure Stack needs to be purchased as an integrated system, with software pre-installed on hardware. See below for standard hardware configurations that are available from our launch hardware partners.

	DELL EMC	HPE	LENOVO
Servers (min config)	4 Dell R730XD	4 HPE ProLiant DL380	4 Lenovo x3650 M5
Network switches	Dell S4048-ON (TOR) and S3048-ON (BMC)	HPE 59xx CTO and HPE 5900 AF (BMC)	Lenovo RackSwitch (TOR and BMC)
Storage	Mix of SATA HDD and SSD depending on configurations	Mix of SATA HDD & SSD depending on configurations	Mix of SATA HDD & SSD depending on configurations
Hardware support	Dell ProSupport	HPE Proactive Care	ThinkAgile Advantage (24x7 4hr response)

SUPPORT
Azure Stack enables a consistent, integrated support experience that covers the full system lifecycle. To fully support your Azure Stack system, customers need two support contracts— one with Microsoft (or their Cloud

Solution Provider) for Azure services support and one with the hardware provider for system support. Our integrated support experience provides coordinated escalation and resolution, so customers get a consistent support experience no matter whom they call first. For customers who already have Premier, Azure, or Partner support with Microsoft, Azure Stack software support is included.