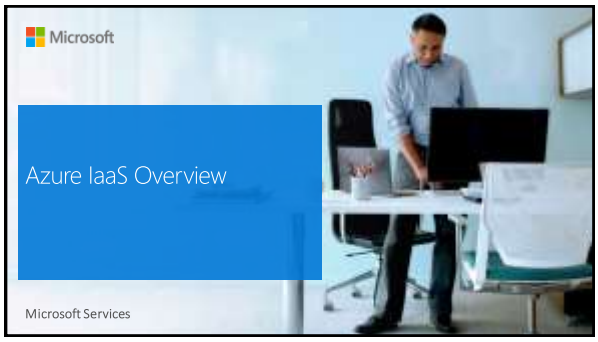
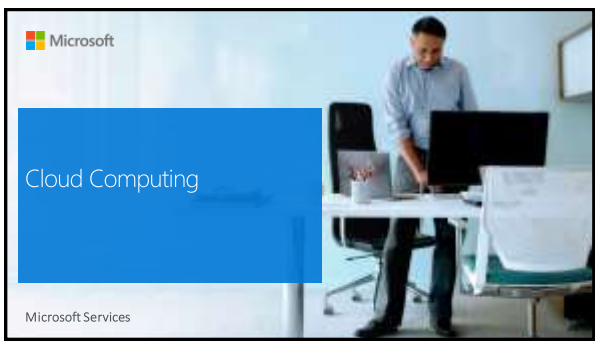


Agenda

- Cloud Computing
- Microsoft Azure
- Azure Compute
- Azure Storage
- Azure Networking



What is Cloud Computing?

- The term Cloud computing is used to describe Internet based computing, where services such as servers, storage and applications are delivered to an organization's computers and devices over the Internet as opposed to a LAN.

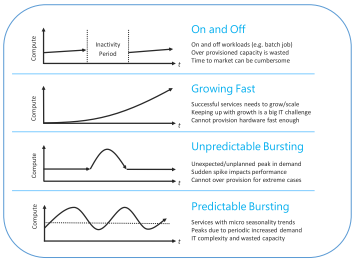
Cloud Computing Options

- Public Cloud
  - A public cloud is one in which the services and infrastructure are provided off-site and accessible over the Internet e.g. Microsoft Azure
- Private Cloud
  - A private cloud is one in which the services and infrastructure are maintained on a private network e.g. Microsoft Azure Stack
- Hybrid Cloud
  - A hybrid cloud includes a variety of public and private clouds with multiple providers e.g. Microsoft Azure & Microsoft Azure Stack

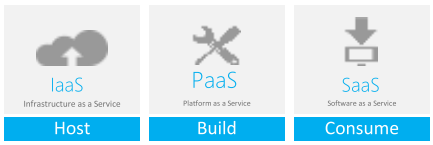
Benefits of Cloud Computing

- Lower Cost - Pay-as-you-go means that you pay only for the resources that you use
- More Flexibility – With unlimited resources, you are able to scale on the fly
- Reduced Management – Vendor managed hardware and software means less management overhead

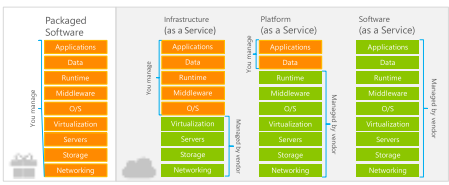
Benefits of Cloud Computing

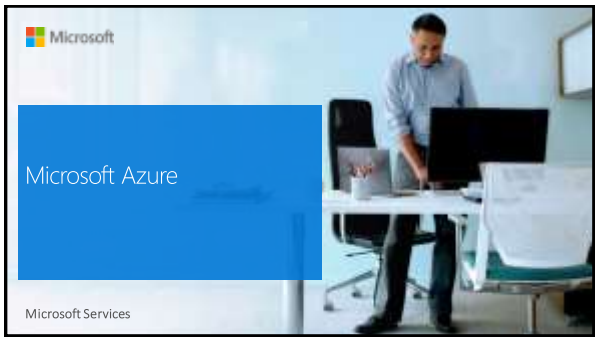


Cloud Computing Services



Cloud Computing Services





What is Microsoft Azure

- Microsoft Azure is Microsoft's public cloud computing platform
- Over 100 datacenters across 50 regions worldwide
- Hyper Scale Computing
  - Top 3 networks worldwide

Microsoft Azure

Hyper Scale Infrastructure

- 50 regions worldwide with 10 additional regions announced

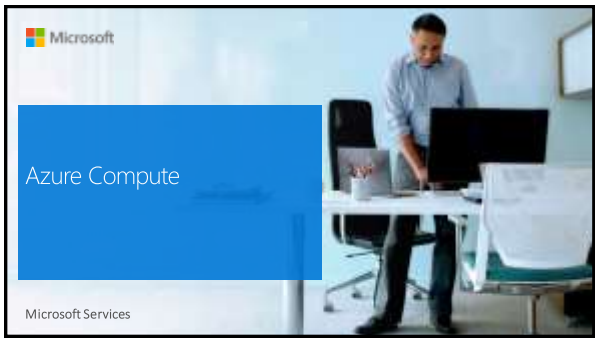
Microsoft Azure Infrastructure

- Over 2 million physical servers globally
- ~50 servers per rack
- ~20 racks make up a "cluster" which provides a unit of fault isolation
- 5 servers per rack are reserved for the Fabric Controller (FC)
  - The FC is the "kernel" of the Azure cloud operating system responsible for:
    - Datacenter resource allocation
    - Datacenter resource provisioning
    - Service lifecycle management
    - Service health management
- Using Software Defined Networking (Operating at Virtual Layer-2)

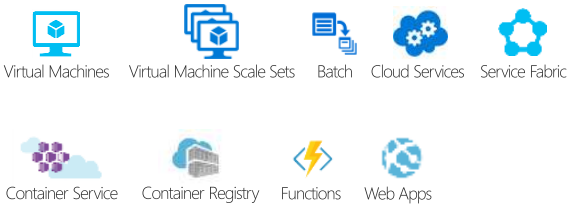
Microsoft Azure Billing

- Pay only for what you use*
- VM's usage is by the second
- Storage charges still apply to deallocated IaaS VM's
- Billing can be estimated at:
  https://azure.microsoft.com/en-us/pricing/calculator/

*Microsoft Azure Enterprise Agreement (EA) billing process differs



Microsoft Azure Compute



Microsoft Azure Virtual Machines

- Azure Virtual Machines is one of several types of on-demand, scalable computing resources that Azure offers.
- Flexibility of virtualization without having to buy and maintain the physical hardware that runs the virtual machine
- Virtual Machines lets you create and use VM's in the cloud providing what is known as Infrastructure as a Service (IaaS)
- Examples of VM workloads:
  - Development and testing
  - Running applications in the cloud
  - Extending your own datacenter into Azure
  - Disaster recovery

Microsoft Azure Virtual Machine Scale Sets

- Azure Virtual Machine Scale Sets is a compute resource used to deploy and manage a set of identical VMs.
- Designed to support true auto scale of IaaS VM's with no pre-provisioning.
- Integrated load balancing
- Built-in high availability
- Support for manual roll out of OS image updates without downtime.
- Visual Studio support
- REST, SDK, and command line support

Microsoft Azure Batch

- Azure Batch is a compute resource which at its core is a high-scale job scheduling engine that is available as a managed service.
- Running a large volume of similar tasks to get some desired result e.g. software testing, engineering stress analysis, financial risk modeling etc.
- Create and manage pools of virtual machines and schedule jobs and tasks to run on them.
- Batch API's, Batch PowerShell cmdlets, Azure CLI & Batch Management.NET can be used to communicate with the Batch service.

Microsoft Azure Cloud Services

- Azure Cloud Services is a compute resource that is used as a container to store roles.
- A role is a container for an instance and is also used to define the type of workload and configuration of the instance that will be running inside it e.g:
  - A Web Role (An instance of Windows Server 2012 R2 virtual machine running IIS)
  - A Worker Role (An instance of Windows Server 2012 R2 virtual machine)
  - A Virtual Machine Role (An instance of any virtual machine)
- An instance is the virtual machine running inside a role.
- Web & Worker roles are PaaS & Virtual Machine roles are IaaS.
- RDP can be configured for all roles with limited control over Web & Worker roles.

Microsoft Azure Service Fabric

- Azure Service Fabric is a compute resource that is Microsoft's next generation Platform as a Service offering.
- Provides software developers with a platform on which they can develop their applications composed of microservices.
- Microservices are small, independent components that communicate with each other to form complex applications.
- Platform consists of a number of underlying components e.g: virtual machines, operating systems, networking, storage etc. that are managed by Microsoft.

Microsoft Azure Container Service

- Azure Container Service is a compute resource that makes it simpler to create, configure, and manage a cluster of virtual machines that are preconfigured to run containerized applications.
- Containerization is a lightweight alternative to full machine virtualization that involves encapsulating an application in a container and projecting its host operating system into the container.
- Leverages the Docker container format to ensure that application containers are fully portable.
- Container hosting environment is exposed by API endpoints.
- Configure deployment by using either DC/OS or Docker Swarm.

Microsoft Azure Container Registry

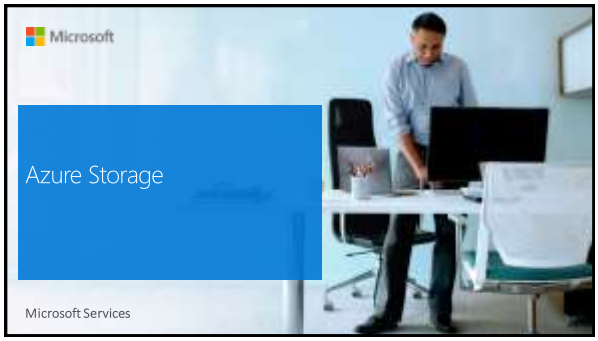
- Azure Container Registry is a compute resource that is used to store and distribute Docker images.
- Serves as a target for your Docker push and Docker pull commands.
- Can be used to build a continuous integration and deployment workflow using Visual Studio Team Services and Azure Container Service.
- Manages both Windows and Linux container images.

Microsoft Azure Functions

- Azure Functions is a compute resource that allows you to run small pieces of code, or "Functions," in the cloud.
- Provides the underlying platform i.e. Virtual Machine and Operating System to run your code.
- Supports C#, F#, Node.js, Python and PHP programming languages.
- Pay only for the time your code runs.
- Depending on your hosting plan, can automatically scale up or down to address load.

Microsoft Azure Web Apps

- Azure Web Apps is a compute resource that provides a fully managed platform which is optimized for hosting websites and web applications.
- Provides the underlying platform i.e. Virtual Machine, Operating System and IIS Server to run your web application or website on.
- Supports ASP.NET, Node.js, Java, PHP, and Python programming languages.
- Can also run Windows PowerShell and other scripts or executables on Web App VM's.



High Level overview of Azure Storage

- Azure storage is a scalable, durable, and highly available cloud storage solution
- Uses an auto-partitioning system that automatically load-balances your data based on traffic.
- Accessible from anywhere in the world, from any type of application.
- Three types of storage accounts:
  - **General-purpose Storage Accounts v1**
    - Access to Tables, Queues, Files, Blobs & virtual machine disks under a single account.
    - Two tiers, Standard & Premium.
  - **General-purpose Storage Accounts v2**
    - Includes v1 features plus access to Hot and Cool storage tiers
  - **Blob Storage Accounts**
    - Specialized storage account for storing your unstructured data as blobs (objects) in Azure Storage
    - 100% API consistency for block blobs and append blobs.

High Level overview of Azure Storage

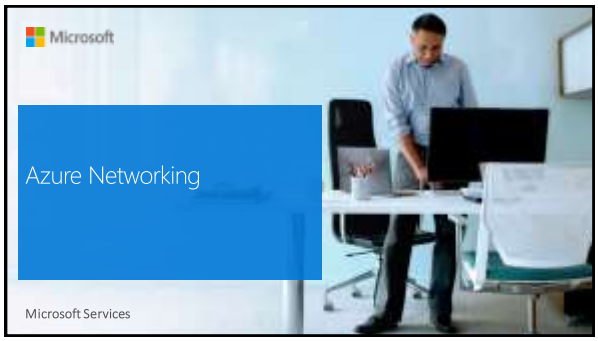
- Blob Storage Account Access Tiers:
  - **Hot**
    - Indicates that the objects in the storage account will be more frequently accessed.
    - Store data at a lower access cost.
  - **Cool**
    - Indicates that the objects in the storage account will be less frequently accessed
    - Store data at a lower storage cost.

Azure Storage Services

- **Blob Storage** stores unstructured file data e.g. a text or .vhd file. **Two** types of blobs:
  - A **Page Blob** is optimized for high activity, i.e. continued read and write actions e.g. a VHD
  - A **Block Blob** is optimized for transfer and storage e.g. SQL backup
- **Table Storage** stores structured datasets e.g. a NoSQL key-attribute data store.
- **Queue Storage** provides a reliable messaging system for e.g. Azure Service Bus.
- **File Storage** offers shared storage for legacy applications using the standard SMB protocol e.g. an SMB file share and supports SMB 2.1 and 3.0.
- **Disk Storage** provides persistent VHD disk storage without the overhead of managing a storage account.

Durability and High Availability

- Data in an Azure storage account is always replicated to ensure durability and high availability.
- Four different replication options:
  - Locally redundant storage (LRS)
    - Maintains three copies of your data by replicating it three times within a single facility in a single region.
  - Zone-redundant storage (ZRS)
    - Maintains three copies of your data by replicating it across three storage clusters in a single region.
  - Geo-redundant storage (GRS)
    - Maintains six copies of your data by replicating the local three copies to another region.
  - Read access geo-redundant storage (RA-GRS)
    - Maintains six copies of your data by replicating the local three copies to another region and allowing read access to data at the secondary region.



Azure Networking

- Azure networking is made up of different components, most commonly:
  - Virtual Networks (VNets)
  - Virtual Private Networks (VPN's)
  - VPN Gateways
  - VNet Peering
  - Load Balancers
  - ExpressRoute
  - Network Security Groups
  - Traffic Manager
  - Azure DNS
  - Application Gateway
- Each component is region based and does not span across regions – excl. VPN's & Traffic Manager.
- Hard and soft limits vary across each networking component with default and maximum soft limits.

Virtual Networks

- An Azure virtual network **(VNet)** is a representation of your own network in the cloud.
- A **VNet** is a logical isolation of a defined network address space.
- Address spaces can contain both **public** and **private** IP address ranges; **Excluding:**
  - 224.0.0.0/4 (Multicast)
  - 255.255.255.255/32 (Broadcast)
  - 127.0.0.0/8 (Loopback)
  - 169.254.0.0/16 (Link-local)
  - 168.63.129.16/32 (Internal DNS)

- VNet's can be further segmented into subnets.
- VM's or services within the same VNet have full network connectivity to each other and the Internet.

Virtual Private Networks

- Azure supports four types of virtual private network connectivity options:
  - **Site-to-Site** IPSec/IKE VPN
  - **VNet-to-VNet** IPSec/IKE VPN
  - **Point-to-Site** Certificate VPN
  - **ExpressRoute**
- A site-to-site VPN is a secure connection between your on-premises site and your virtual network over the internet.
- A VNet-to-VNet VPN is a secure connection between two Azure virtual networks.
- A point-to-site VPN is a secure connection between your Windows-based computer and your virtual network without having to deploy any special software.
- ExpressRoute is a private connection between an Azure datacenter and an on premises datacenter over a leased line.

Virtual Private Network Gateways

- An Azure VPN Gateway is used to send network traffic between networks e.g. VNet to on-premises or VNet to VNet.
- There are six different **VPN Gateway Sizes**:
  - Basic
  - Standard
  - High Performance
  - VpnGw1
  - VpnGw2
  - VpnGw3

- A **VPN Gateway Type** is specified in order to define how the VPN gateway will connect to other networks, there are two different types:
  - VPN
  - ExpressRoute

Virtual Private Network Gateways

- A **VPN Gateway Routing Type** is specified in order to define how the VPN gateway will route network traffic between networks and has two different types:
  - Policy-based
  - Route-based
- A **VPN Gateway Connection Type** is specified in order to define the type of VPN connection that will be established by the VPN gateway and has four different types:
  - IPsec
  - Vnet2Vnet
  - ExpressRoute
  - VPNClient

Virtual Network Peering

- VNet peering is a feature that connects two virtual networks (VNets) in the same or different regions through the Azure backbone network
- Virtual machines in these virtual networks can communicate with each other directly by using private IP addresses
- Can be used for transit connections from on-premises to peered VNets
- A low-latency, high-bandwidth connection between resources in different virtual networks
- Connect Azure Resource Manager (ARM) VNets to classic VNets

Azure Load Balancers

- Azure load balancer is a Layer 4 (TCP, UDP) load balancer that distributes incoming traffic among healthy service instances in cloud services or virtual machines defined in a load-balanced set.
- There are two SKU's: Basic and Standard
- Can be configured to:
  - Load balance incoming Internet traffic to virtual machines.
  - Load balance traffic between virtual machines in a virtual network, between virtual machines in cloud services, or between on-premises computers and virtual machines in a cross-premises virtual network.
  - Forward external traffic to a specific virtual machine.
- Load balancer features include:
  - Hash-based distribution, Port forwarding, Automatic reconfiguration, Service monitoring and Source NAT.

Network Security Groups

- A Network security group (NSG) contains a list of Access Control List (ACL) rules that allow or deny network traffic via network ports to your VM instances in a Virtual Network.
- Can be associated with either subnets and or VM network adapters.
- When associated with a subnet, the ACL rules apply to all the VM instances in that subnet.
- Rules only allow for protocols TCP or UDP.
- Can only be applied to resources within the region it is created in.
- Contain two sets of rules: inbound and outbound.
  - The priority for a rule must be unique within each set

Traffic Manager

- Azure Traffic Manager allows you to control the distribution of user traffic to your specified endpoints, which can include Azure cloud services, websites, and other endpoints.
- Works by applying an intelligent policy engine to Domain Name System (DNS) queries for the domain names of your Internet resources.
- Four traffic routing methods:
  - Priority – a single target endpoint for all traffic
  - Weighted - to distribute traffic across multiple endpoints
  - Performance – target endpoints with the lowest network latency
  - Geographic – target endpoints with the closest geographic location
- Includes continuous monitoring of endpoint health and automatic endpoint failover.

Azure DNS

- Azure DNS is a hosting service for public DNS domains, providing name resolution using Microsoft Azure infrastructure.
- DNS domains in Azure DNS are hosted on Azure's global network of DNS name servers.
- Uses Anycast networking so that each DNS query is answered by the closest available DNS server.
- Domains and records can be managed via the new Azure portal, Azure PowerShell cmdlets, and the cross-platform Azure CLI.

Application Gateway

- Azure Application Gateway provides an Azure-managed layer 7 load-balancing solution for application level load balancing.
- Create routing rules for network traffic based on HTTP protocol.
- Application level load balancing of the following:
  - HTTP protocol
  - Cookie-based session affinity
  - Secure Sockets Layer (SSL) offload
  - URL based content routing
- Offered in three sizes: Small, Medium, and Large.
- Automatically monitors the health status of back-end application servers.