Azure virtual network and Azure virtual machines

Review

Azure Virtual Network

This is a private network on Azure. It helps to host Azure resources such as your Azure virtual machines.

Its like having a traditional network in your on-premises data center.

Region

A virtual network needs to be hosted in a particular region.

Subscription

A virtual network needs to be part of a subscription.

Address space

You need to specify an address space for the virtual network

Subnets

This helps to segment the virtual network into one or more sub-networks.

Azure Virtual Machine

This service helps you to provision virtual machines on the cloud.

Compute

This is your compute service on the Azure platform. Here you can create compute resources on-demand.

Operating system

You can choose from operating systems such as Windows Server 2019 and different flavors of Linux.

Lifecycle

You can create the machine whenever you want. You can also terminate the machine whenever required.

Workload

You can then install different workloads on the machine.

Azure Virtual Machine

Less Management

You don’t manage the infrastructure.

Less Investment

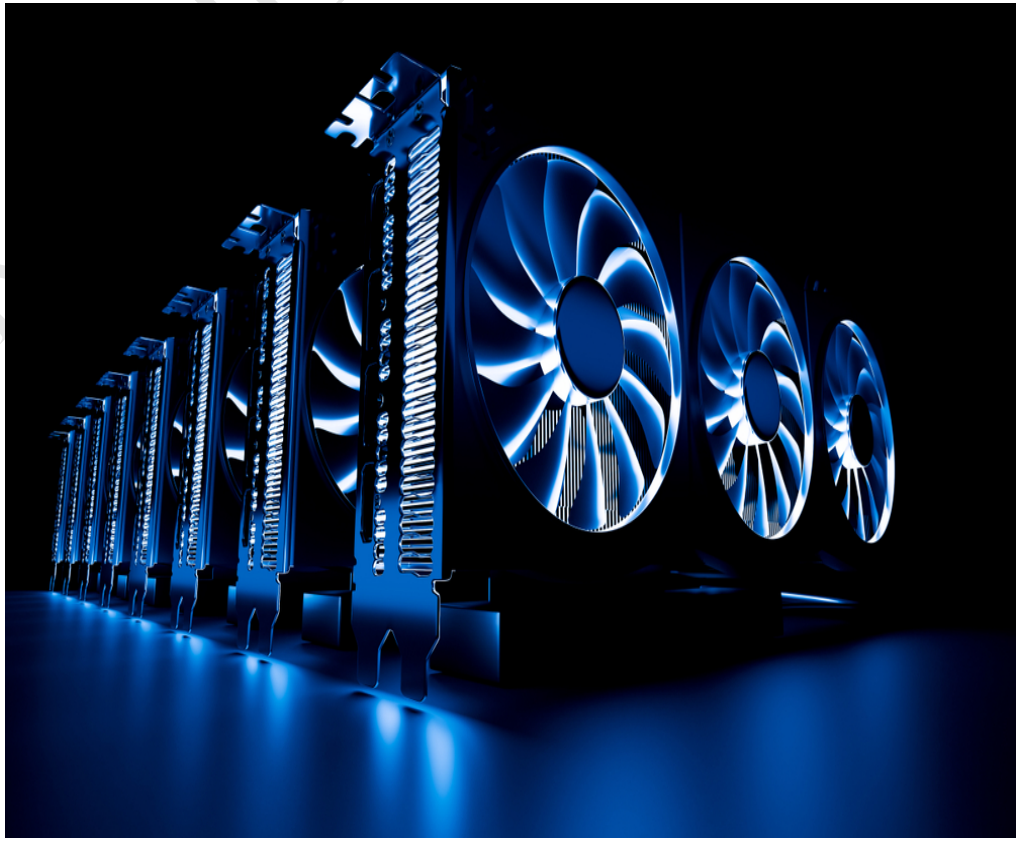
You only pay for how much you use.

Less operations

Don’t need to invest in managing the data center

Configure

You can configure various aspects of your virtual machine



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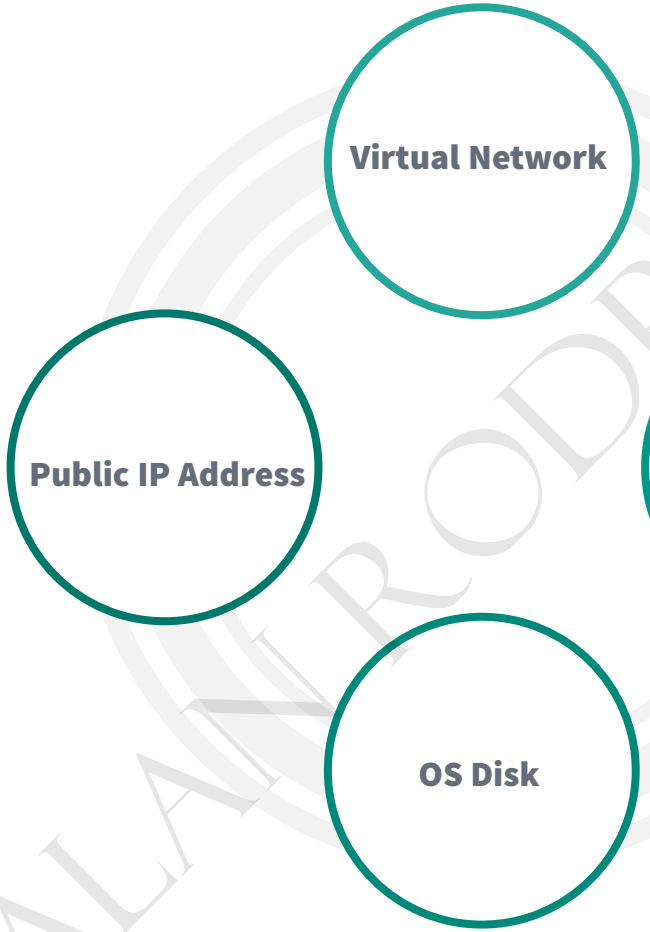

Isolated network on the cloud

Allows to contact the machine from the Internet

Filters traffic to and from the machine

Used to store the operating system

Private IP Address

- Azure assigns private IP addresses to resources from the address range of the subnet.
- The first four addresses of each subnet range are reserved by Azure.

- By default, Azure assigns a dynamic IP address.
- You can also mark a private IP address as static

Public IP Address

This allows internet resources to communicate with Azure resources

Here the allocation of the public IP address can be static or dynamic depending upon the SKU

Basic SKU – Dynamic or Static. Does not support availability zones.

Standard SKU – Only Static allocation. Does support zone-redundancy.

Azure Virtual Network

REVIEW

Azure Virtual Network

Isolation

This is a private network in Azure

Internet

All resources in the virtual network can communicate with the Internet by default

Subnet

This is a range of IP addresses within the virtual network. Subnets help to have better organization and security

Network Interface

This is the interconnection between the virtual machine and the virtual network.

IP addresses

Public IP address

This allows for outbound communication with the Internet.

Private IP address

This is used for communication within the virtual network.

Virtual Network peering

Connection

Helps to connect two or more virtual networks together. The traffic moves via the Microsoft backbone infrastructure.

Locations

You can connect virtual networks that are in the same region or across regions.

IP addresses

The virtual networks in the peering connection must have non-overlapping IP address spaces.

Peering Connection

A peering connection is created for each virtual network.

Azure DNS

DNS Zone

This is used to host the DNS records for a particular domain.

Public zone

Here Azure DNS can resolve host names in your public domain.

Private zone

Here domain names can be resolved within the virtual network.

Virtual Network link

To ensure that the virtual network can use the private DNS zone, you need to link the virtual network to the zone.

Autoregistration

Here DNS records for your virtual machines get automatically created in the zone.

Domain Name System

Review

Domain Name System

Domain Name Registrar

This is an organization that allows you to purchase a domain name.

DNS Zone

This is used to host DNS records for a particular domain.

Apex record

An apex record is a DNS record at the root of the DNS zone – e.g cloud2hub.com. By default @ is used to represent the apex records.

A record

This maps a name to an IPv4 address.

TTL

TTL – Time to live specifies how long each record is cached by clients.

Record types

DNS Record types – A, AAAA, CNAME, MX

Azure Private DNS

This provides a reliable and secure DNS service for your virtual network.

Here you can use your own custom private DNS zones

Virtual Network link

To resolve records, the virtual network needs to be linked to a zone

Autoregistration

Here DNS records get automatically registered for the virtual machines in the virtual network

Automatic updates

DNS records can be updated whenever a virtual machine gets created, changes its IP address or gets deleted.

Records

Supports the common DNS record types – A, AAAA, CNAME, MX , SOA, TXT.

Azure Public DNS

This is a hosting service that provides name resolution by using Microsoft Azure Infrastructure.

You can manage your records in Azure DNS

Reliability

Here you can make use of Azure's global network of DNS name servers.

Records

Supports the common DNS record types – A, AAAA, CNAME, MX , SOA, TXT.

Tools

You can use tools such as PowerShell to manage your DNS zones.

Domain name

Currently you can't buy a domain name when it comes to Azure DNS.

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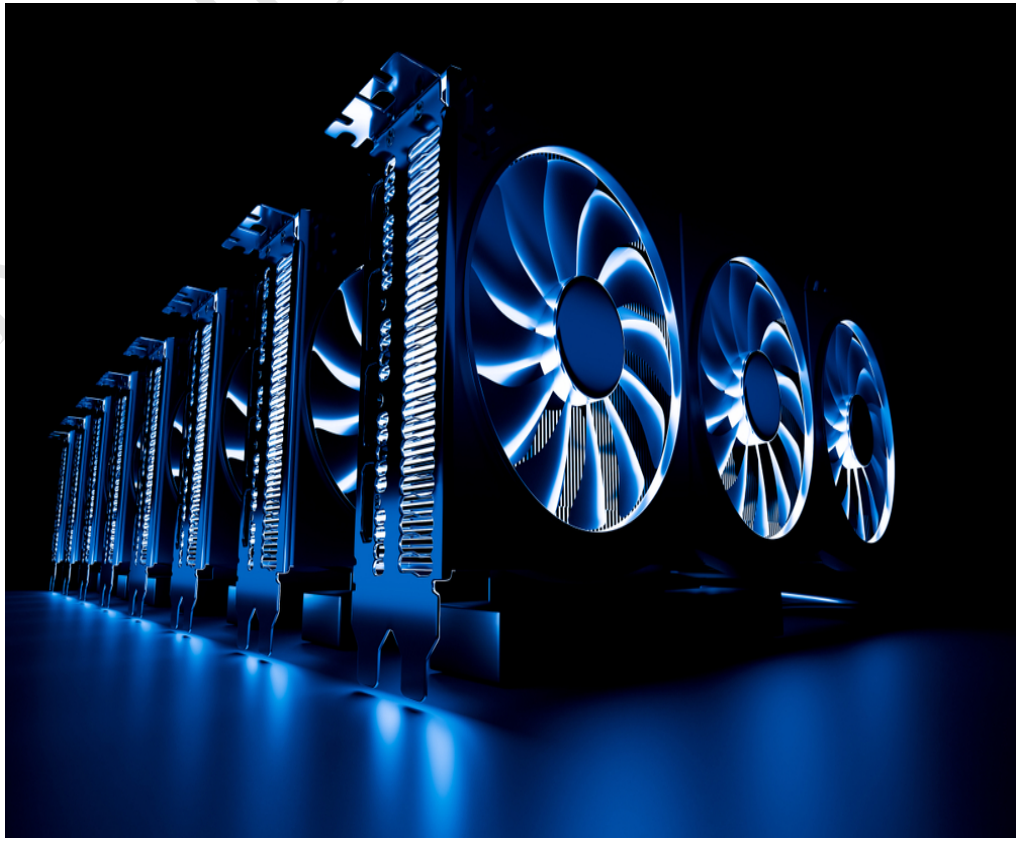

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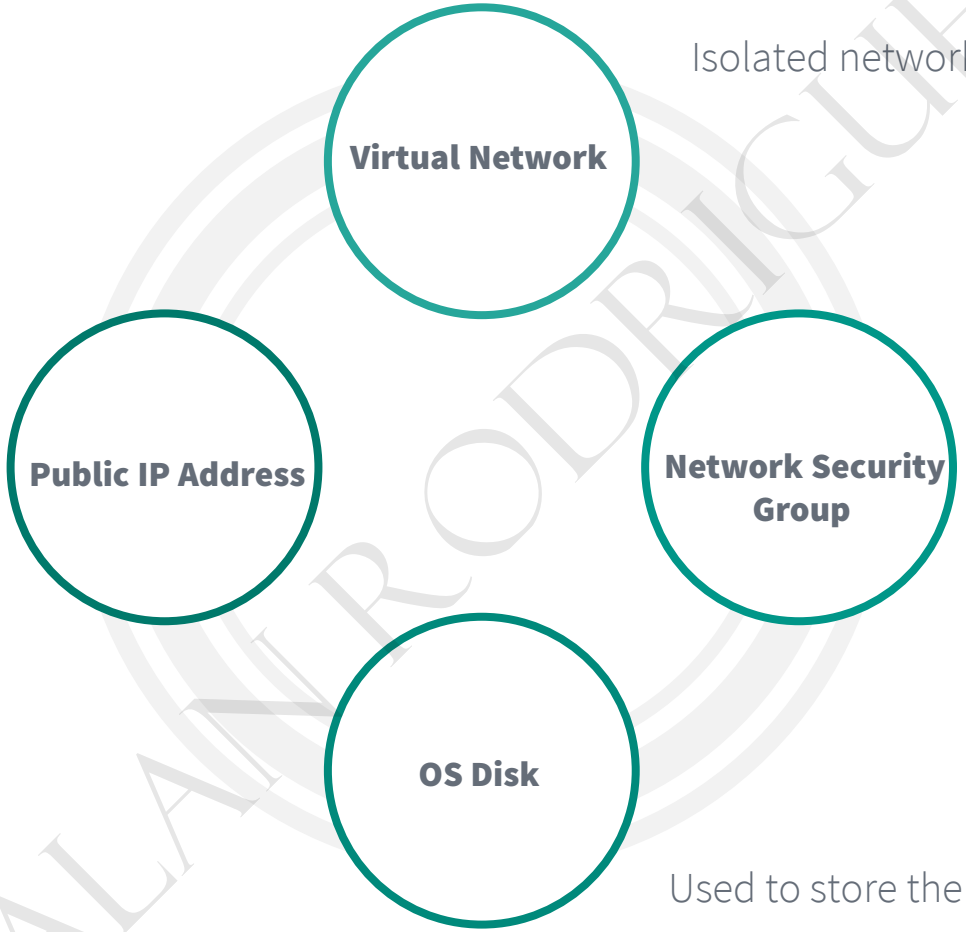

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Azure Load Balancer

Review

Azure Availability sets

Failure

This feature helps to protect against infrastructure level failures.

Unplanned events

This is when the underlying infrastructure fails unexpectedly. The failures could be attributed to network failures , local disk failures or even rack failures

Planned maintenance events

Here Microsoft needs to make planned updates to the underlying physical environment. In such cases , a reboot might be required on your virtual machine

Availability sets

Here when a machine is assigned to an availability set, it is assigned to a fault and update domain.

Azure Availability zones

Failure

This features help provides better availability for your application by protecting them from datacenter failures.

Zones

Each Availability zone is a unique physical location in an Azure region. Each zone comprises of one or more data centers that has independent power, cooling, and networking

Protection

Hence the physical separation of the Availability Zones helps protect applications against data center failures

Availability

Using Availability Zones, you can be guaranteed an availability of 99.99% for your virtual machines. You need to ensure that you have 2 or more virtual machines running across multiple availability zones.

Azure Load Balancer

This is a service that is used to distribute incoming traffic across a group of backend resources or servers.

This service operates at Layer 4 of the OSI model.

Public Load Balancer

This provides outbound connections for virtual machines inside the virtual network.

Internal Load Balancer

This is used to load balance traffic inside a virtual network.

Performance

The Load balancer provides low latency and high throughput.

Scaling

The Load Balancer can scale up to millions of flows for all TCP and UDP applications.

Azure Load Balancer SKUs

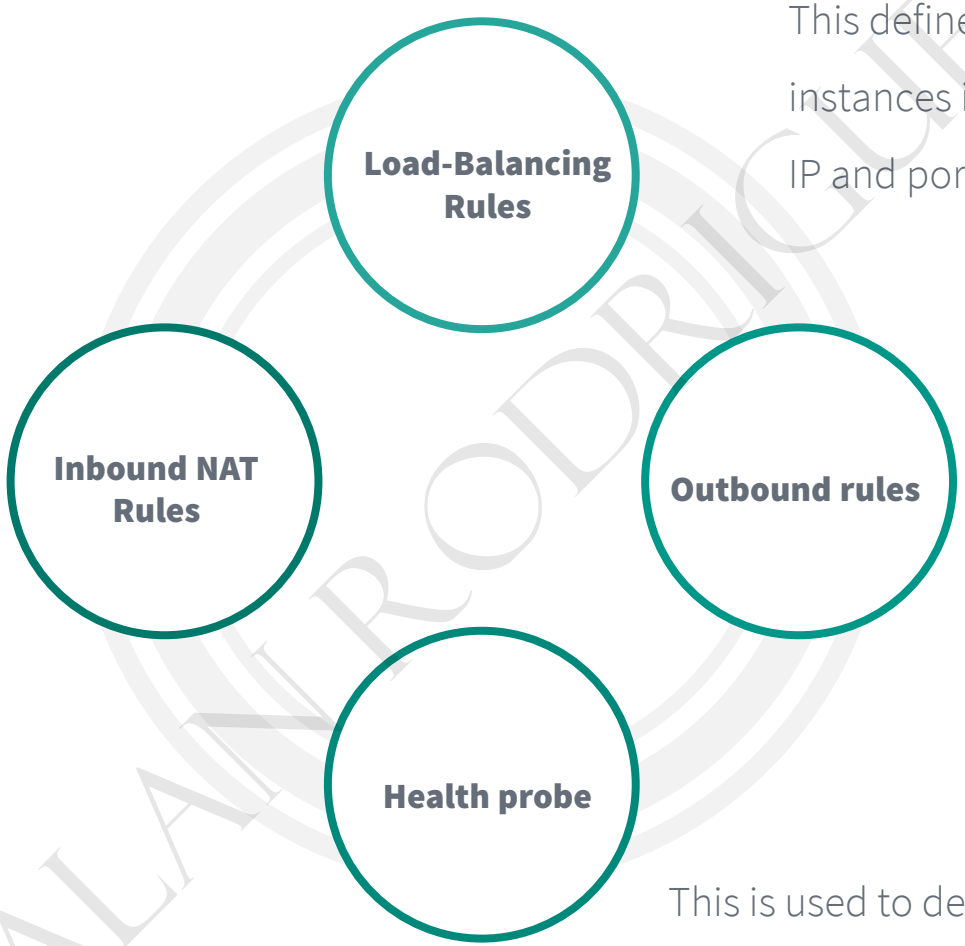
Basic SKU

- This is a free version of the Load Balancer
- The backend virtual machines need to be part of an availability set or scale set
- Supports health probes of TCP and HTTP
- Does not have an SLA

Standard SKU

- Here there is an hourly charge
- Here the backend virtual machines can also be independent machines that are part of a virtual network
- Supports health probes of TCP ,HTTP and HTTPS
- Has an SLA of 99.99%

Azure Load Balancer Components



This defines how incoming traffic is distributed to the instances in the backend pool. A rule maps a frontend IP and port to backend IP addresses and ports.

This forwards incoming traffic sent to frontend IP address and port to a specific virtual machine in the backend pool.

This enables instances in the backend to communicate with the internet

This is used to determine the health status of the instances in the backend pool.

Azure Virtual Machine Scale Set

This service helps to create and manage a group of load balanced VM's.

Here VM's can be created on demand.

Integration

This service can be used with the Load Balancer.

Rules

You can use rules and conditions to scale out or scale in the number of virtual machines.

Virtual Machines

Here VM's are created based on the base image for the machine.

Availability

This service can automatically distribute the virtual machines across Availability zones and Availability sets.

Azure Application Gateway

Review

Azure Application Gateway

Load Balancer

This is a web traffic load balancer. This makes routing decisions based on the attributes of the HTTP request.

Autoscaling

The Standard_v2 SKU supports autoscaling that can scale up and down based on traffic load patterns.

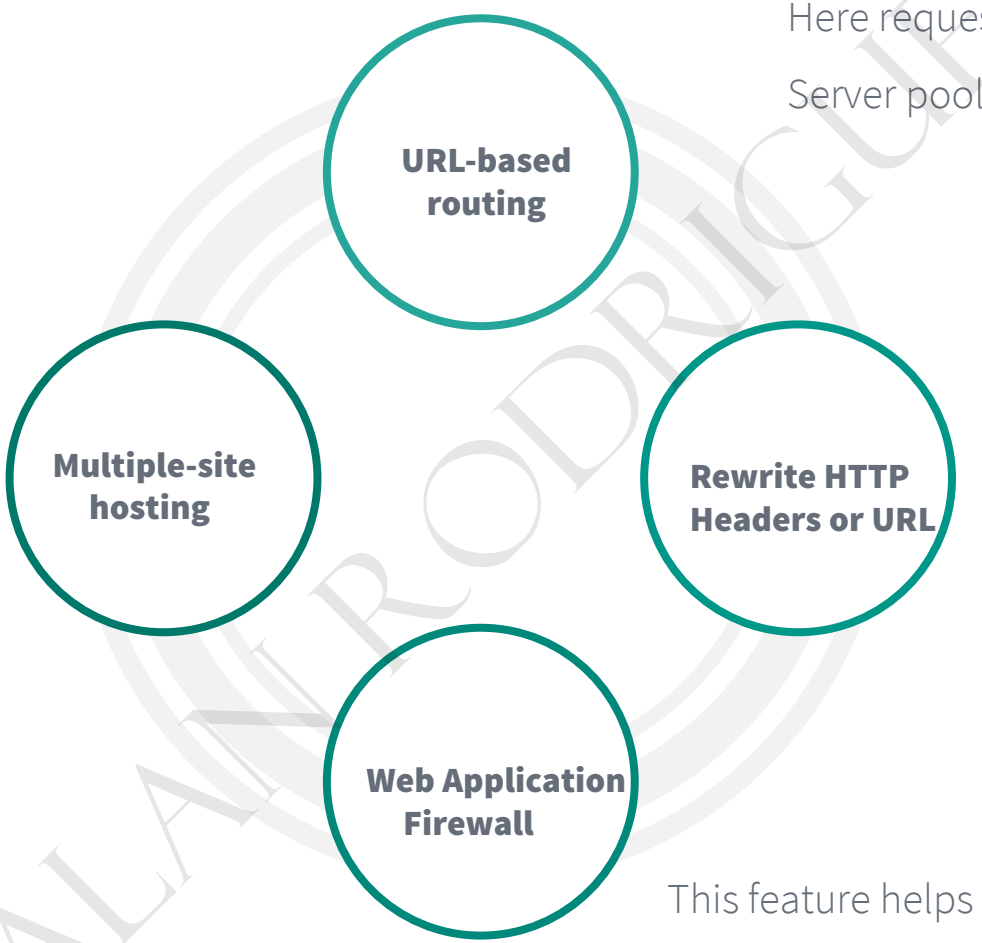
High Availability

For the Standard_v2 SKU , the gateway can span multiple Availability Zones.

Layer 7

This load balancer operates at Layer 7

Azure Application Gateway features



Here requests can be routed to the back-end Server pools based on the URL paths of the request.

Here you can configure routing based on the host name or domain name.

Here you can create rules to rewrite the headers and URLs.

This feature helps to protect your web applications.

Azure Application Gateway components

Frontend IP addresses

This is the IP address that is associated with the Application Gateway

Listeners

This is a logical entity that checks for incoming requests

Request Routing Rule

The rule binds the listener, the back-end server pool and the backend HTTP settings.

HTTP settings

The settings determine how requests are routed to the backend servers.

Backend pool

This contains the backend Servers.

Health probes

Here you can define your own custom health probes.

Azure Traffic Manager

Review

Azure Traffic Manager

Priority

Here you can direct users to a secondary endpoint if the primary one fails

Weighted

Here you can assign weights to each endpoint

Performance

Here users can be directed to the closest endpoint with the lowest network latency

Geographic

Here users are directed to endpoints based on their geographic location

Multivalue

Here multiple endpoints are sent to the user.

Subnet

Here the endpoint is decided based on the subnet the user is located in.

Endpoint Types

Azure endpoints

This can be PaaS cloud services, Web Apps, Web App Slots, Public IP Addresses that are assigned to virtual machines. Here the VM's need to also have a DNS name assigned.

Nested Endpoints

This can be another Traffic Manager profile

External Endpoints

This can be IP addresses or FQDN's that are located outside of Azure.

Azure Point-to-Site VPN Connections

REVIEW

Point-to-Site VPN

Secure Connection

Allows clients that run Windows, Linux or macOS to securely connect to an Azure virtual network.

Few clients

This is ideal when you have a few clients that need to connect to the Azure virtual network.

VPN Connection

The VPN connection is created over SSTP(Secure Socket Tunneling Protocol) or IKEv2.

Authentication

You have different authentication methods that can be used – Certificates, Azure AD

Point-to-Site VPN

Gateway subnet

Your virtual network needs to have a Gateway subnet in place. Here the VM's that will manage the VPN will be deployed here.

Virtual Network Gateway

This allows you to configure the Virtual Network Gateway connection.

Certificates

You can use self-signed certificates. The public key of the root certificate is uploaded to the Azure Virtual Network gateway.

Client

Each client needs to have the client certificate installed.

Point-to-Site VPN

Protocols

SSTP

Secure Socket Tunneling Protocol – Developed by Microsoft. Here the encrypted tunnel is created over TCP port 443. Uses SSL/TLS protocol.

OpenVPN

This is an open standard created to implement secure connections. Used the OpenSSL library.

IKEv2

Internet Key Exchange uses the IPsec protocol suite to establish a secure connection.

Azure Site-to-Site VPN Connections

REVIEW

Site-to-Site VPN

Secure Connection

Here the connection is established over IPsec/IKE VPN tunnel.

On-premises network

Here you connect your entire on-premises network to the Azure virtual network.

Public IP Address

The on-premises network needs to have a software or hardware device that has a public routable IP address

Site-to-Site VPN

Gateway subnet

Your virtual network needs to have a Gateway subnet in place. Here the VM's that will manage the VPN will be deployed here.

Virtual Network Gateway

This allows you to configure the Virtual Network Gateway connection.

Local Network gateway

This will be a representation of the on-premises network configuration.

Azure ExpressRoute

REVIEW

Azure ExpressRoute

Connection

Allows you to connect your on-premises networks to Microsoft cloud over a private connection.

Redundancy

Each ExpressRoute circuit has two connections for redundancy purposes.

Private peering

Azure private peering allows you to connect to your Azure virtual network resources.

Microsoft peering

This allows you to connect to public services such as Microsoft 365 and Azure PaaS services.

Azure ExpressRoute

Gateway

Your Azure virtual network needs to have a virtual network gateway in place that is configured to use ExpressRoute.

FastPath

This improves data path performance between on-premises network and the Azure virtual network. Virtual network gateway – Ultra Performance, ErGw3AZ.

Global Reach

This allows you to connect your on-premises networks together via their individual ExpressRoute circuits.

Azure ExpressRoute SKU's

Local

Here the circuit only gives access to one or two Azure regions in or near the same metro. Here you can save on costs. You only have Unlimited billing model.

Standard/Performance

You get more connections per second, better performance. You can connect to any Azure region. You get both Unlimited and Metered billing.

Section

REVIEW

Network Security Groups

Filter traffic

Filter traffic to and from Azure resources in an Azure virtual network.

Rules

Here you can create Inbound and Outbound Network Group Security rules.

Attachment

The Network Security Group can be attached to a network interface or to a subnet.

Default

Each Network Security Group has default rules that can't be edited or deleted.

Network Security Groups Rules

Priority

Here the rules with lower numbers are processed first. Once a matching rule is found, the processing is stopped.

Source/Destination

Can be an IP address, a service tag or an application group.

Protocol

TCP, UDP, ICMP etc.

Port Range

Here you can specify the port range for the traffic.

Direction

Whether it is an Inbound or Outbound rule.

Action

Allow or Deny.

Azure Firewall

Protection

Helps to protect your Azure virtual network resources. It has built-in high availability.

Application rules

You can restrict outbound traffic to fully qualified domain names.

Network rules

You can also limit traffic at the network layer.

Threat Intelligence

Can alert and deny traffic based on known malicious IP addresses and domains.

NAT Rules

Define Network address translation rules for resources in the virtual network.

Forced tunneling

Can route all Internet-bound traffic to a designated next hop instead of directly being routed to the Internet.

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