Microsoft

AZ-500

Tag 2

Secure cloud resources with Microsoft security technologies

Guten Morgen!

Feynman → Labs

Physik

AI

Security Copilot

NT 4.0

Thomas Jäkel

brainymotion

2011 Windows Azure

2013 Azure ARM

Heidelberg

Lead Trainer Cloud Infrastructure

Microsoft Certified Trainer since 1999

https://github.com/www42/az-500

Agenda

1 Secure identity and access

2 Secure networking

Labs Go Deploy

3 Secure compute, storage, and databases

4 Secure Azure using Microsoft Defender for Cloud and Microsoft Sentinel

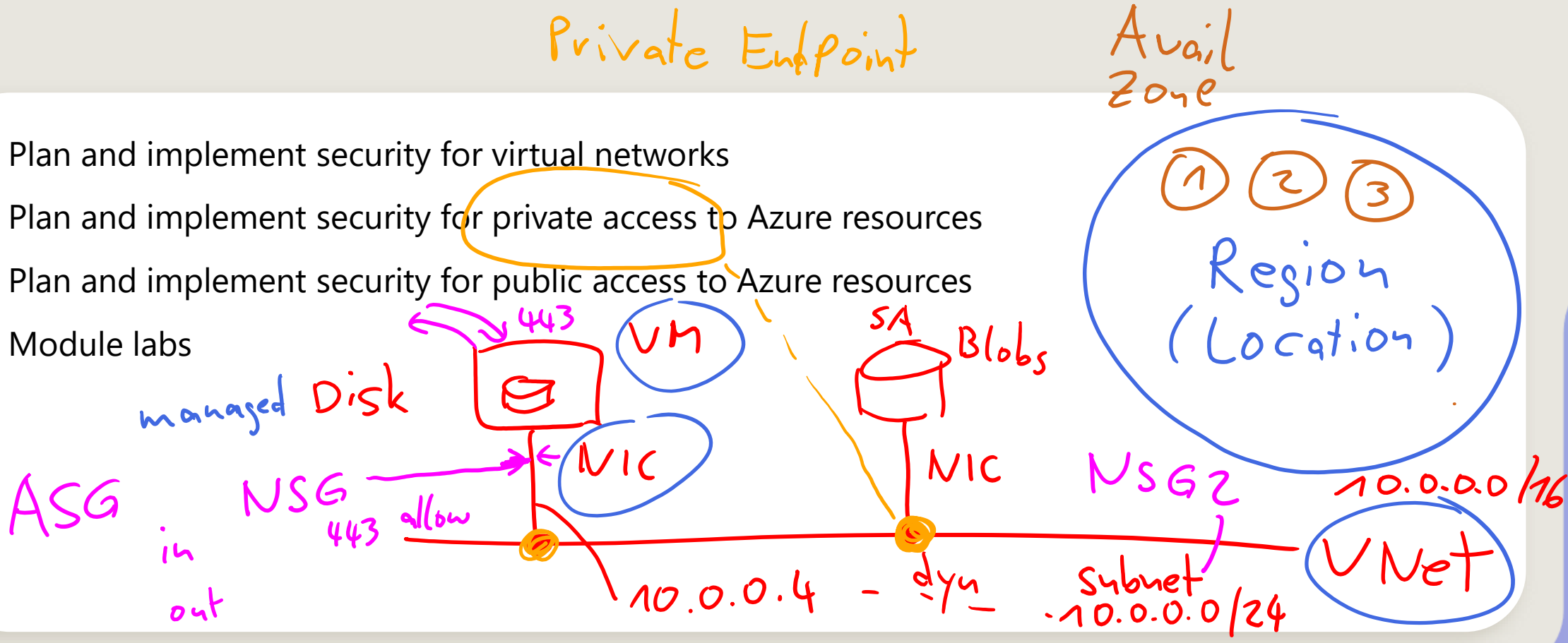
Learning path: Secure Networking

Plan and implement security for virtual networks

Plan and implement security for private access to Azure resources

Plan and implement security for public access to Azure resources

Module labs



Learning Objectives

After completing this learning path, you will be able to:

1. Plan and implement security measures for virtual networks, encompassing NSGs, ASGs, UDRs, VNET peering, VPN gateways, Virtual WAN, and network monitoring using Network Watcher.

2. Establish private access to Azure resources using Service Endpoints, Private Endpoints, Private Link services, and secure configurations for App Service, Azure Functions, and Azure SQL Managed Instance.

3. Implement security for public Azure access, including TLS application integration, Azure Firewall, Application Gateway, Front Door, WAF, and recommendations for Azure DDoS Protection.

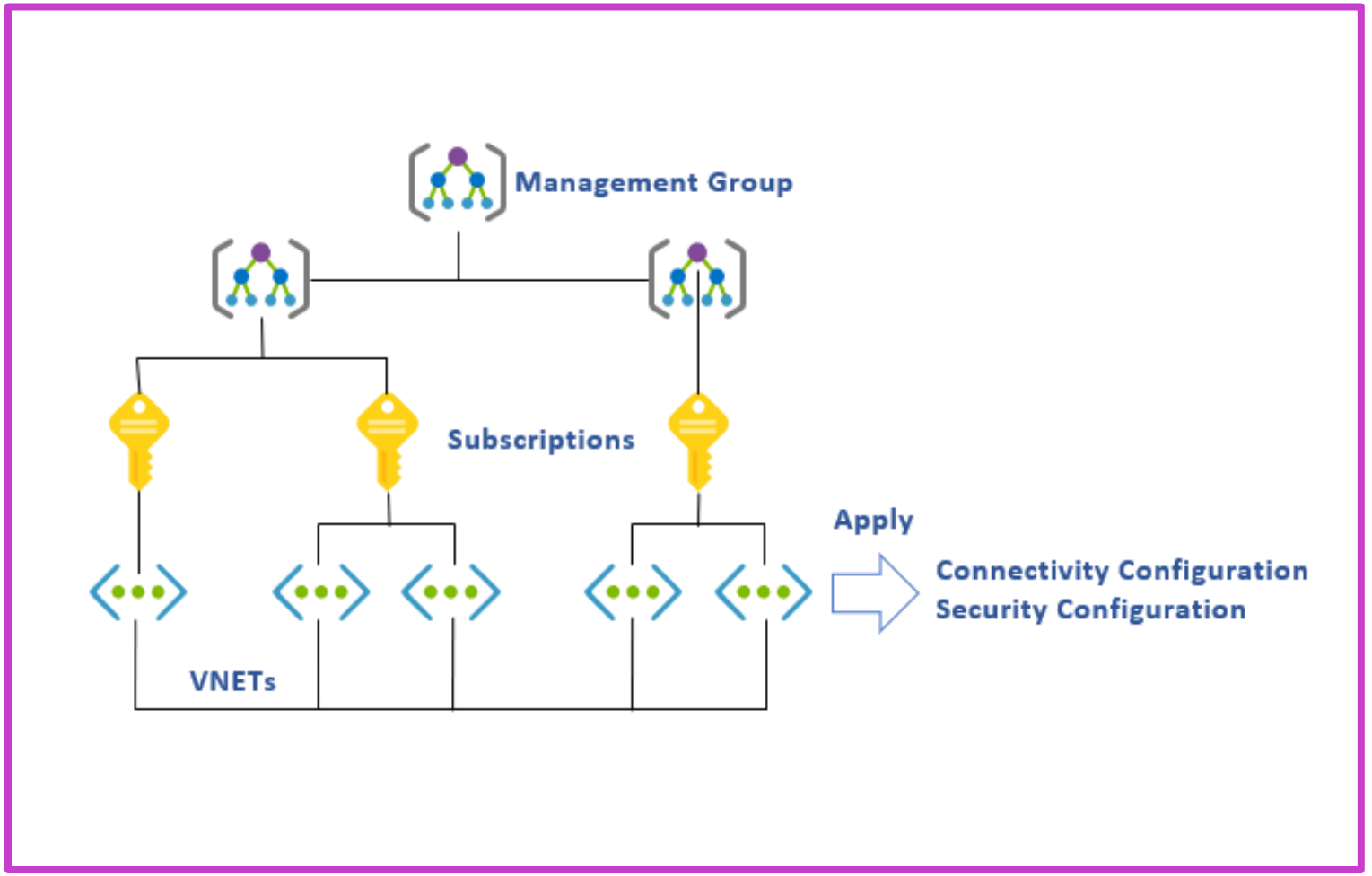
Plan and implement security for virtual networks

MCSB Security Controls: Data Protection, Logging and Threat Detection, and Network Security

- Network Segmentation: Establish boundaries and secure cloud-native services with network controls.
- Data Protection: Encrypt sensitive data in transit to prevent unauthorized access during transmission.
- Threat Defense: Deploy firewalls, DDoS protection, and web application firewalls to mitigate threats.
- Monitoring and Protocols: Enable network logging, disable insecure protocols, and use private network connections.

Manage virtual networks by using Azure Virtual Network Manager

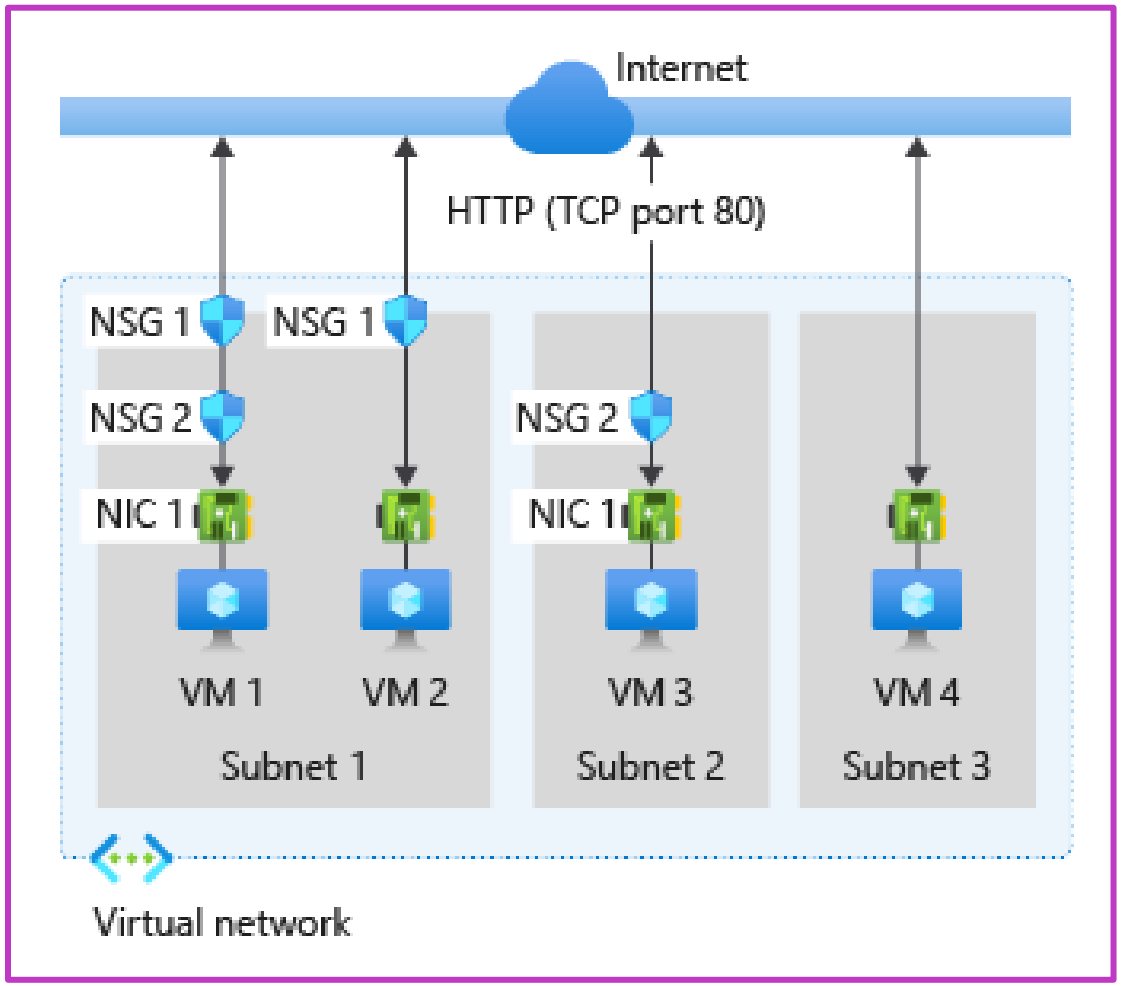
- Centralized Management: Group, configure, and deploy virtual networks globally across subscriptions with ease.
- Flexible Configuration: Define connectivity and security rules, including mesh or hub-and-spoke topologies.
- Scalable and Efficient: Ensure global availability, low latency, and override NSG rules for advanced security.



Plan and implement Network Security Groups (NSGs)

Network Security Groups

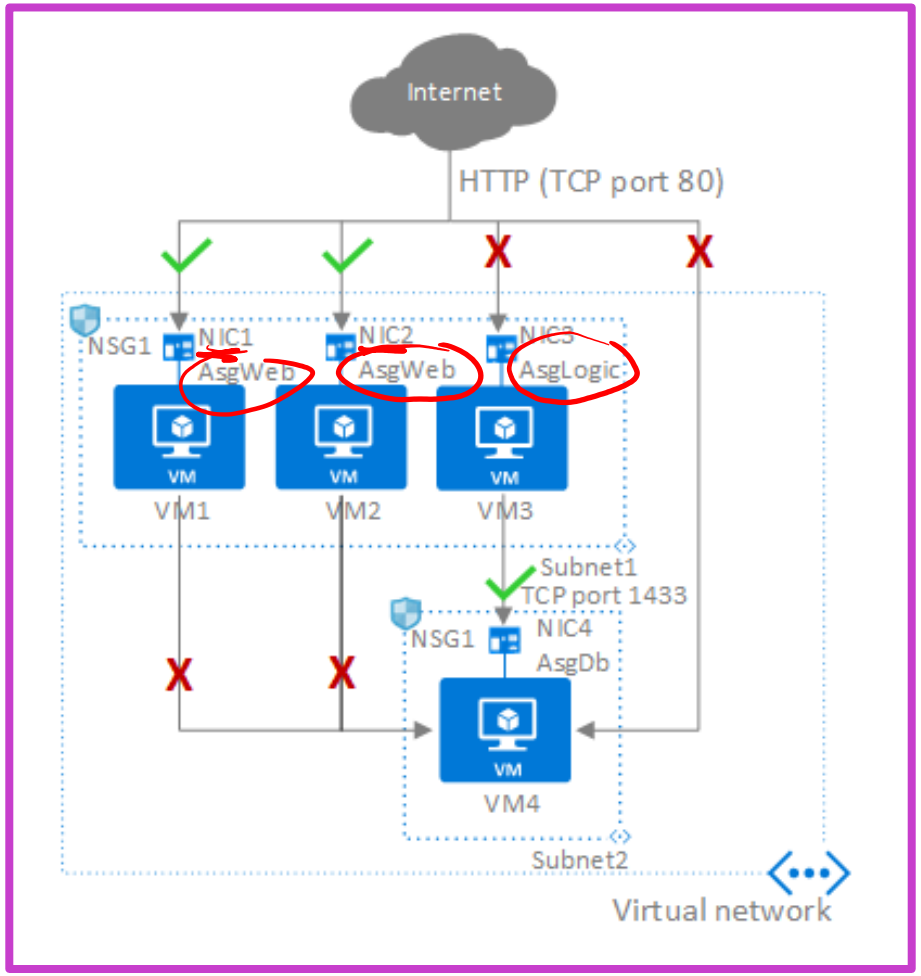
- Filter network traffic between Azure resources like a firewall.
- An NSG can contain any number of rules within Azure subscription limits.
- For each security rule, you can specify source, destination, port, and protocol.
- Rules are evaluated and applied based on the five-tuple (source, source port, destination, destination port, and protocol) information.
- Modifying NSG rules will only impact the new connections that are formed.
- Use augmented security rules to simplify security definition for virtual networks.



Plan and implement Application Security Groups (ASGs)

Application Security Groups

- ASGs enable you to reuse your security policy at scale without manual maintenance of explicit IP addresses.
- The rules that specify an ASG as the source or destination are only applied to the network interfaces that are members of the ASG.
- ASGs have some limitations, such as:
  - All network interfaces assigned to an ASG must exist in the same virtual network that the first network interface assigned to the ASG is in.



Plan and implement User-Defined Routes (UDRs)

You can create a route table and associate it to zero or more virtual network subnets.

Each subnet can have zero or one route table associated to it.

By default, the table's routes are combined with the subnet's default routes.

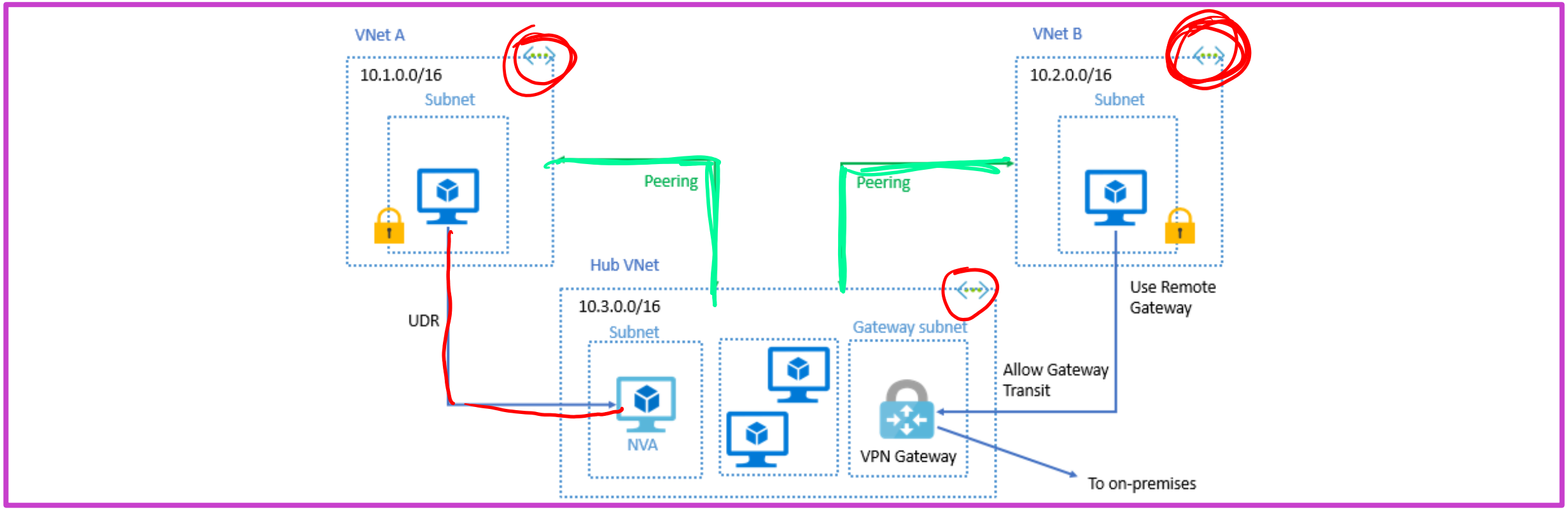
In case of conflicting route assignments, user-defined routes override the default routes.

You can specify the following next hop types when creating a user-defined route:

- Virtual appliance
- Virtual network gateway
- None
- Virtual network
- Internet

You can't specify VNet peering or VirtualNetworkService Endpoint as the next hop type in user-defined routes.

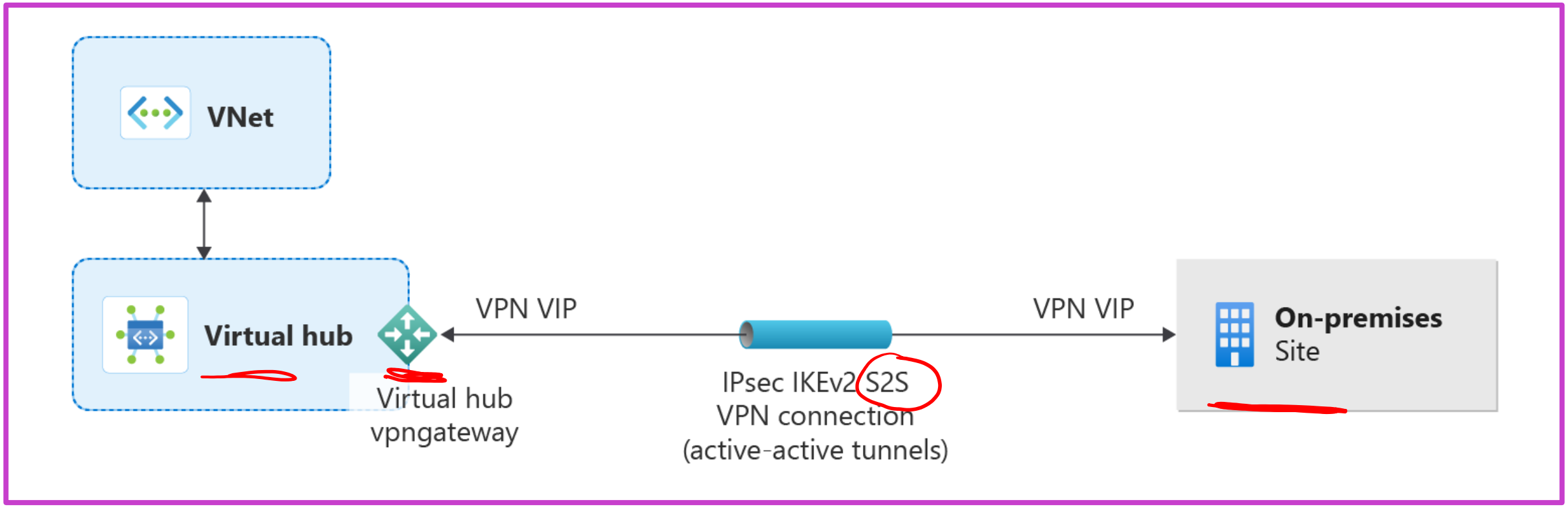
Plan and implement Virtual Network peering or VPN gateway



- Seamless connectivity: Azure virtual network peering connects networks across regions or tenants via Microsoft backbone.
- Scalability and security: Supports up to 1,000 peers with low latency, private traffic, and network security groups.
- Advanced configurations: Enables address resizing, service chaining, and gateway transit for complex topologies.

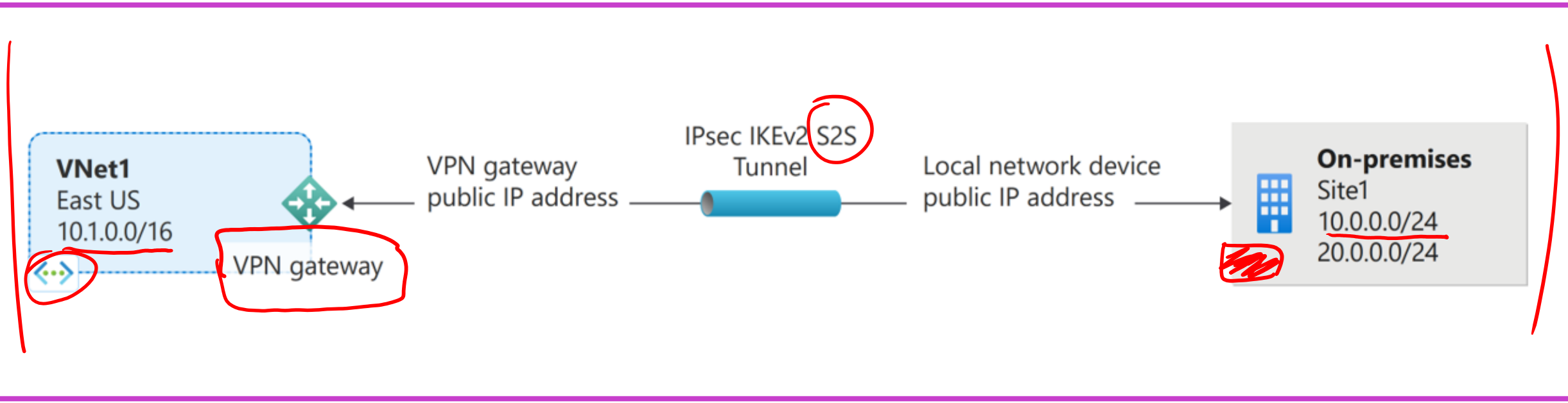
Plan and implement Virtual WAN, including secured virtual hub

A Virtual WAN uses an IPsec/IKE VPN to connect Azure resources, requiring an on-premises VPN device with a public IP.



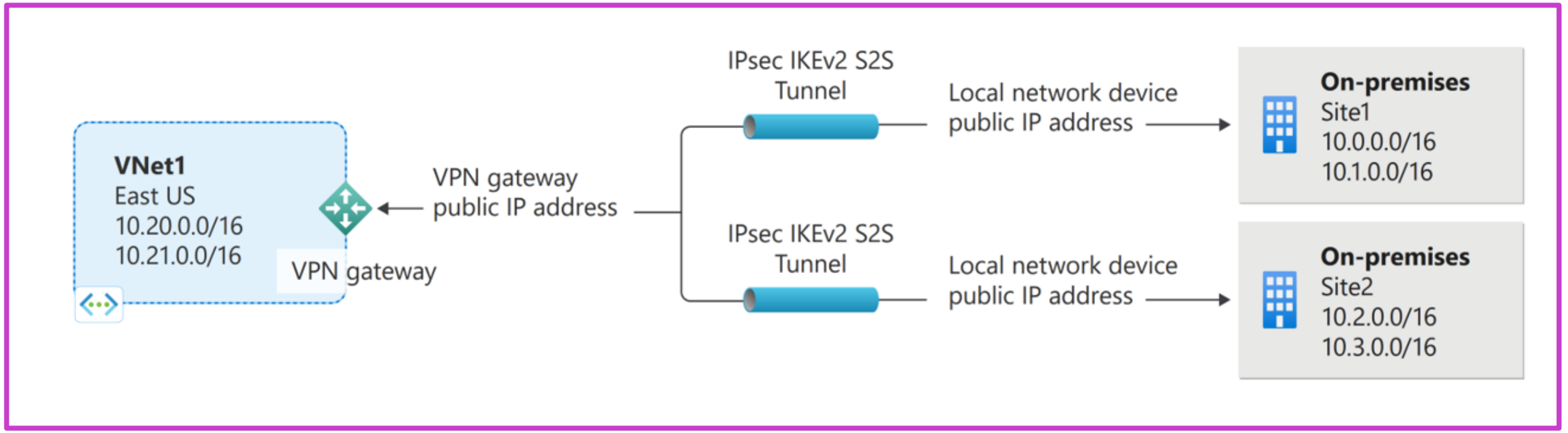
Secure VPN connectivity, including site-to-site and point-to-site

Site-to-site VPN



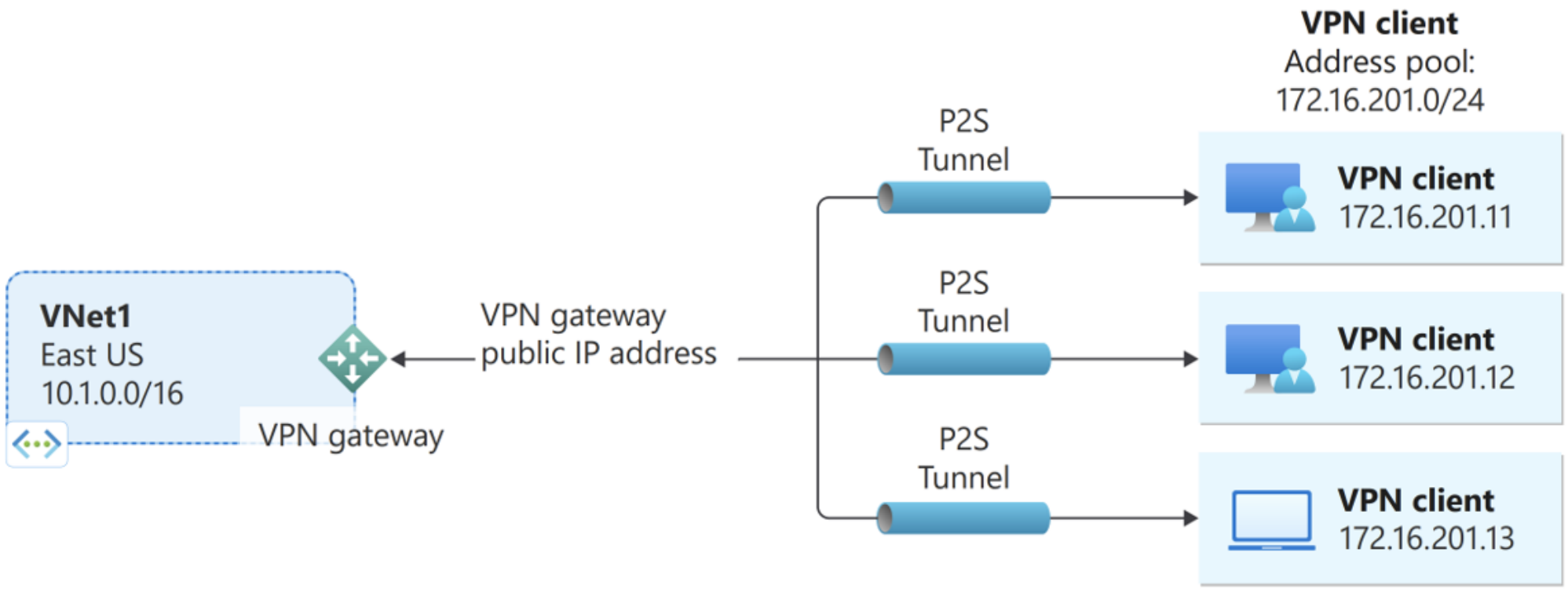
Secure VPN connectivity, including a site-to-site VPN with two IPsec IKEv2 tunnels

Site-to-site VPN (Two IPsec IKEv2 S2S Tunnels)



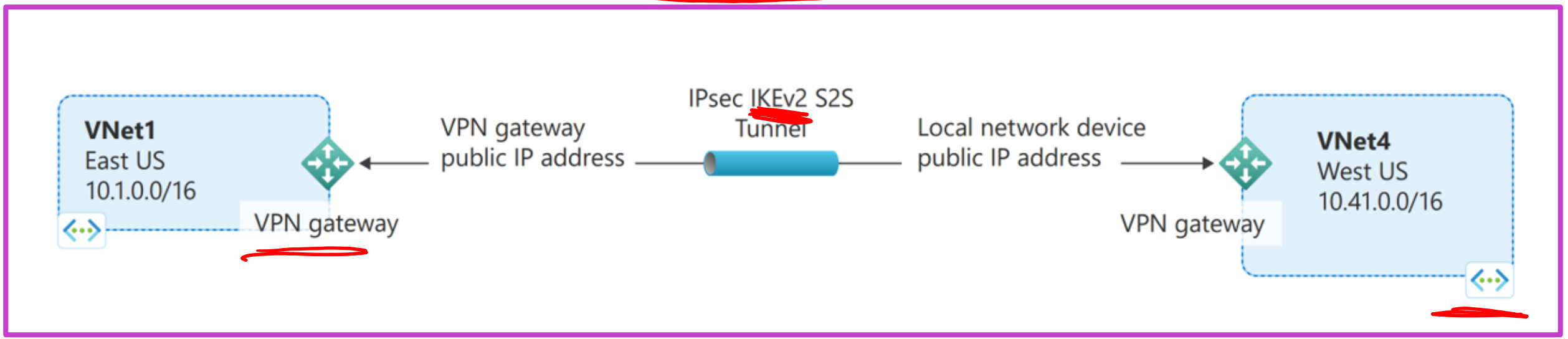
Point-to-site Virtual Private Network

Point-to-site (P2S) VPN gateway connection



VNet-to-VNet connections (Internet Protocol Secure/Internet Key Exchange Virtual Private Network Tunnel)

VNet-to-VNet connection



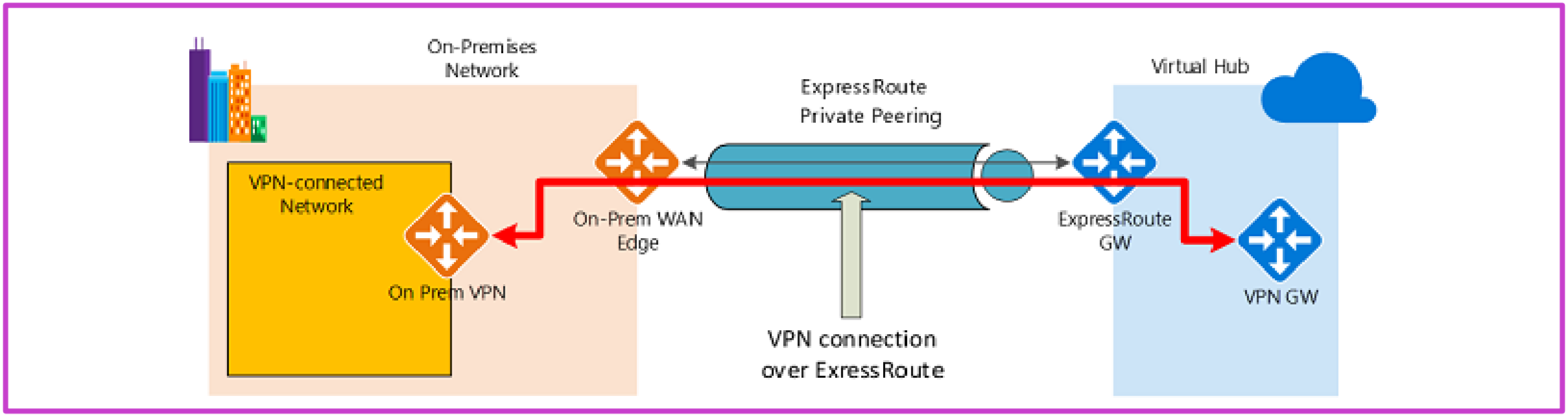
East US

Peering

No Encryption

West US

Implement encryption over ExpressRoute



Azure Virtual WAN Connection

- Azure Virtual WAN offers encrypted IPsec/Internet Key Exchange (IKE) VPN connections via ExpressRoute, avoiding public internet.

Traffic Paths to Azure

- Two routes exist from on-premises to Azure - one encrypted IPsec-protected path and one direct ExpressRoute path. For encryption, the VPN route should be prioritized over ExpressRoute.

Azure to On-Premises Traffic

- Ensure encrypted IPsec path preference either by advertising more specific prefixes on the VPN Border Gateway Protocol (BGP) session or using disjoint prefixes for VPN and ExpressRoute.

Configure firewall settings on Azure resources

To configure firewall settings, choose from the following options:

Azure native controls: Azure Firewall and the web application firewall in Application Gateway offer basic security. It is simple to set up and configure.

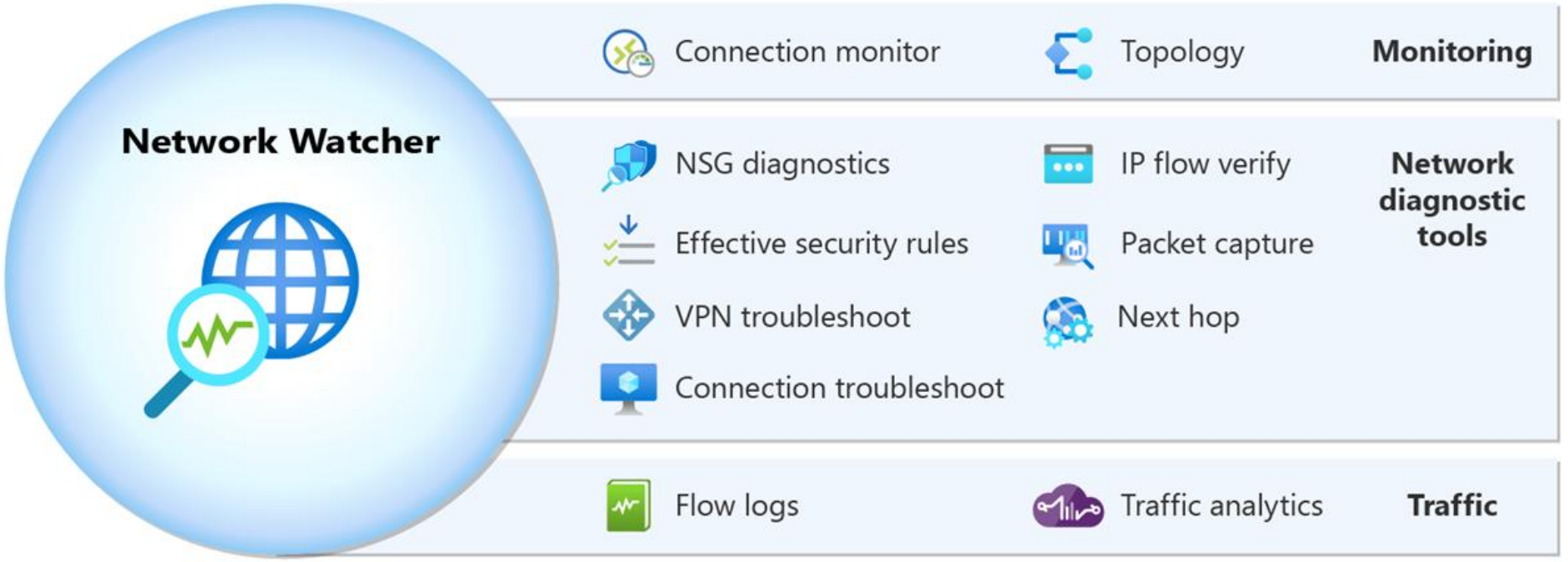
Third-party offerings: This option includes next-generation firewall (NGFW) and other third-party offerings, and its configuration might be more complex.

The location of ExpressRoute connection can affect how the firewall works. You have these options to terminate ExpressRoute in existing (on-premises) networks:

Terminate outside the firewall (the perimeter network paradigm)

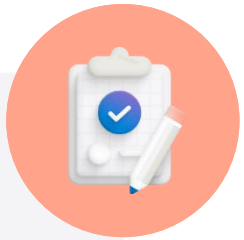
Terminate inside the firewall (the network extension paradigm) [default recommendation]

Monitor network security by using Network Watcher



- Comprehensive Monitoring: Azure Network Watcher provides tools to monitor, diagnose, and log Azure IaaS resources.
- Network Diagnostics: Includes IP flow verification, routing checks, security rule analysis, and VPN troubleshooting.
- Traffic Analysis: Enables flow logs, traffic analytics, and visualizations for network traffic insights and management.

Additional study – Planning and Implementing Security for Virtual Networks

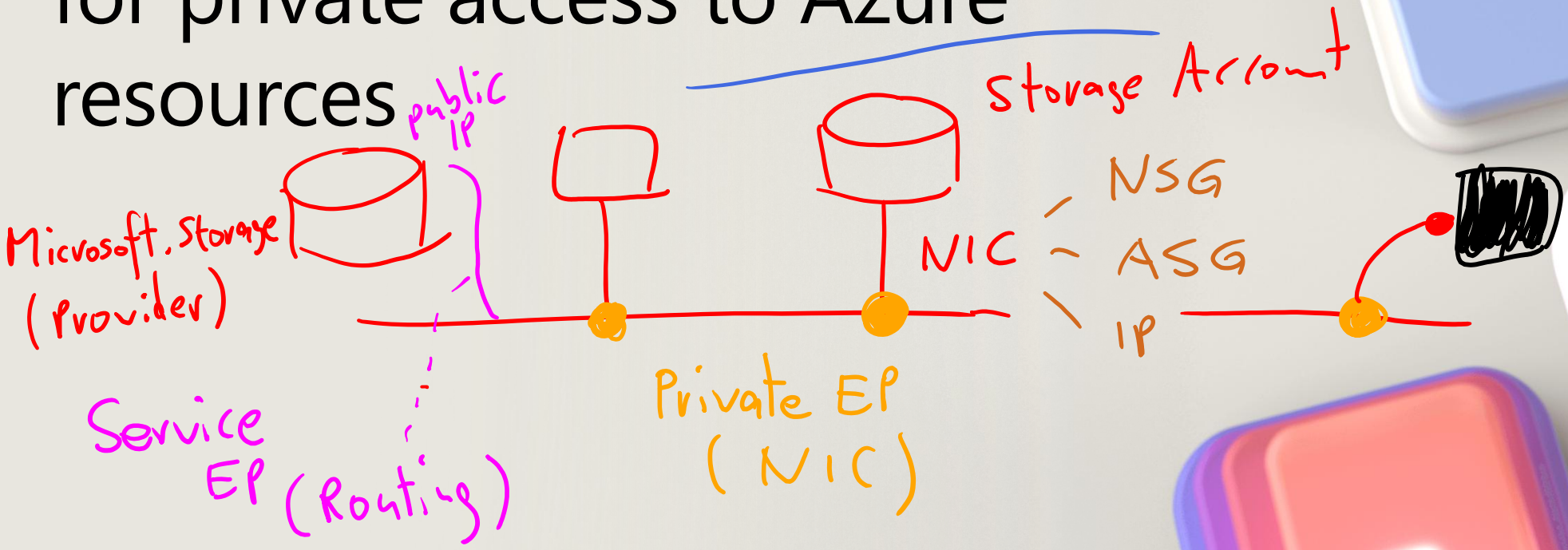


Microsoft Learn Modules (docs.microsoft.com/Learn)

Module Review Questions

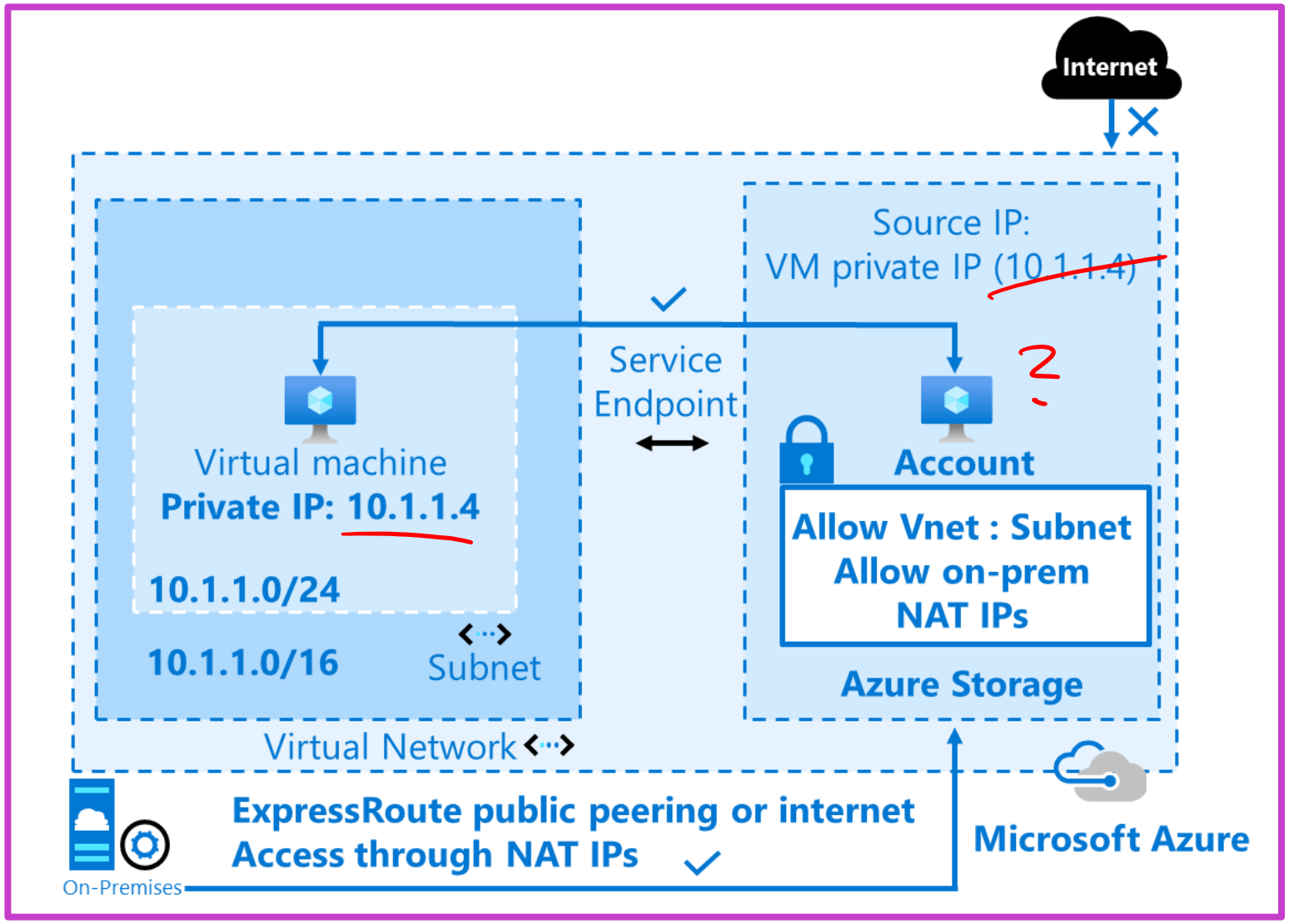
- Implement NSGs and ASGs: Control network traffic with Network Security Groups (NSGs) and Application Security Groups (ASGs).
- Manage Virtual Networks with Azure Virtual Network Manager: Centrally manage and secure virtual networks across regions.
- Plan and Implement Routing and Connectivity:
  Configure user-defined routes (UDRs), Virtual Network peering, and VPN gateways.
- Secure Virtual WAN and VPN Connectivity:
  Deploy Virtual WAN with secured virtual hubs and secure VPN (point-to-site and site-to-site) connections.
- Enhance Network Security and Monitoring:
  Encrypt traffic over ExpressRoute, configure firewall settings, and monitor with Network Watcher.

Plan and implement security for private access to Azure resources

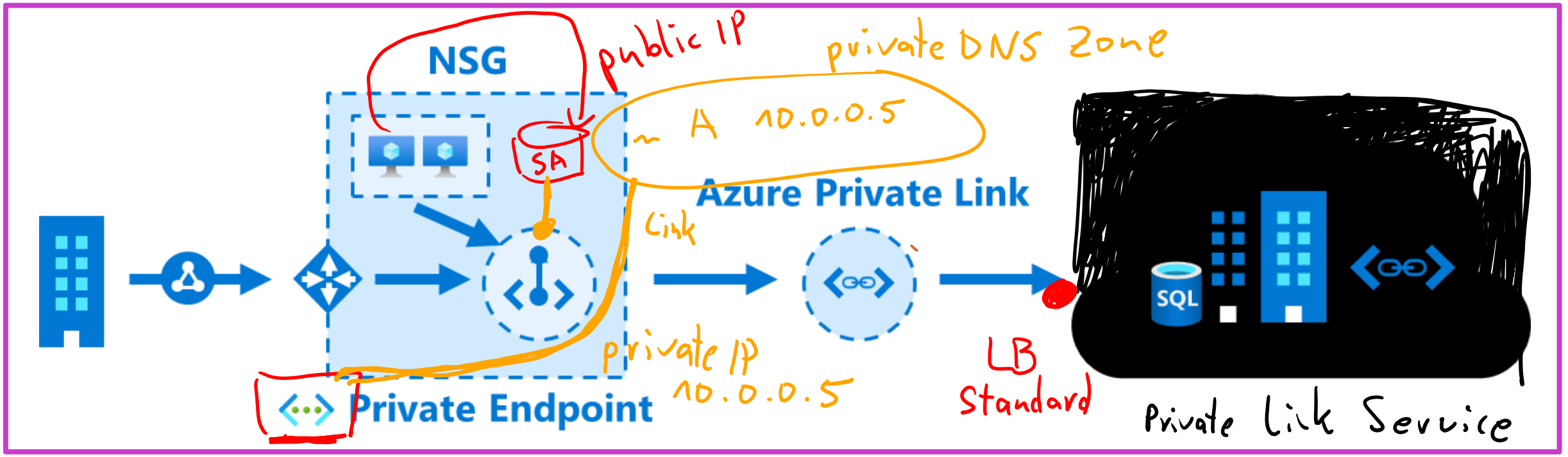


Plan and implement virtual network Service Endpoints

- Endpoints limit network access to specific subnets and IP addresses
- Improved security for your Azure service resources
- Optimal routing for Azure service traffic from your virtual network
- Endpoints use the Microsoft Azure backbone network
- Simple to set up with less management overhead



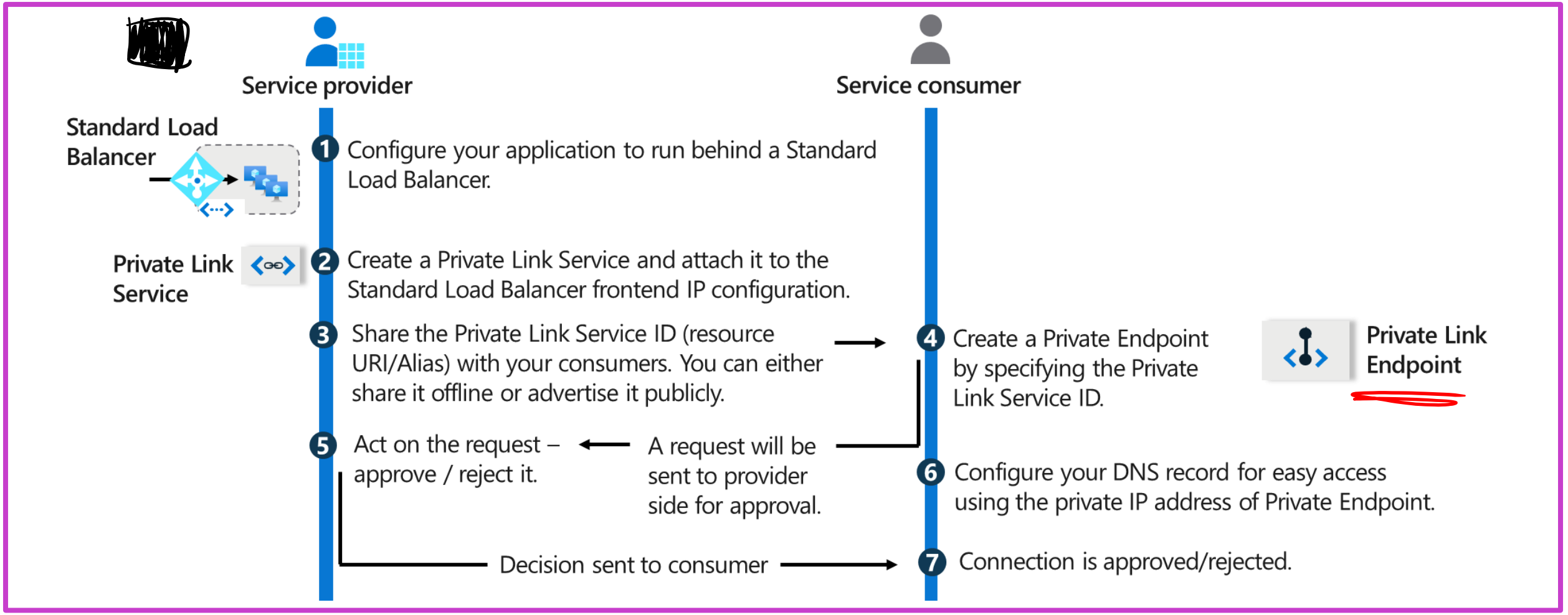
Plan and implement Private Endpoints



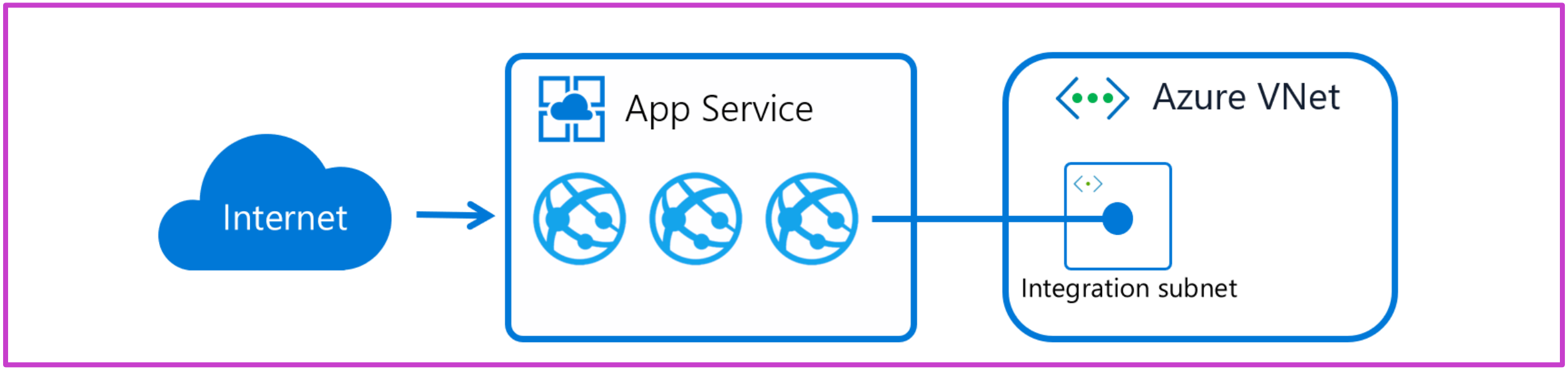
- Private connectivity to services on Azure
- Integration with on-premises and peered networks
- Traffic remains on the Microsoft network, with no public internet access
- During a security incident within your network, only the mapped resource would be accessible

Plan and implement Private Link services

Remember the following key aspects while planning and implementing Private Link services:



Plan and implement network integration for Azure App Service and Azure Functions



- Azure Virtual Network Integration: Enables outbound app traffic to access virtual network resources securely.
- Supports scalability: Works with multiple pricing tiers, regional connections, and peered virtual networks.
- Networking features: Leverages NSGs, route tables, NAT gateways, and private endpoints for routing and security.

Plan and implement network security configurations for an App Service Environment (ASE)

Remember these key considerations while you plan and implement network security configurations for an ASE:

Implement Virtual Network Integration

Optimize Network Security Groups (NSGs)

Enhance Security with Azure Private Link

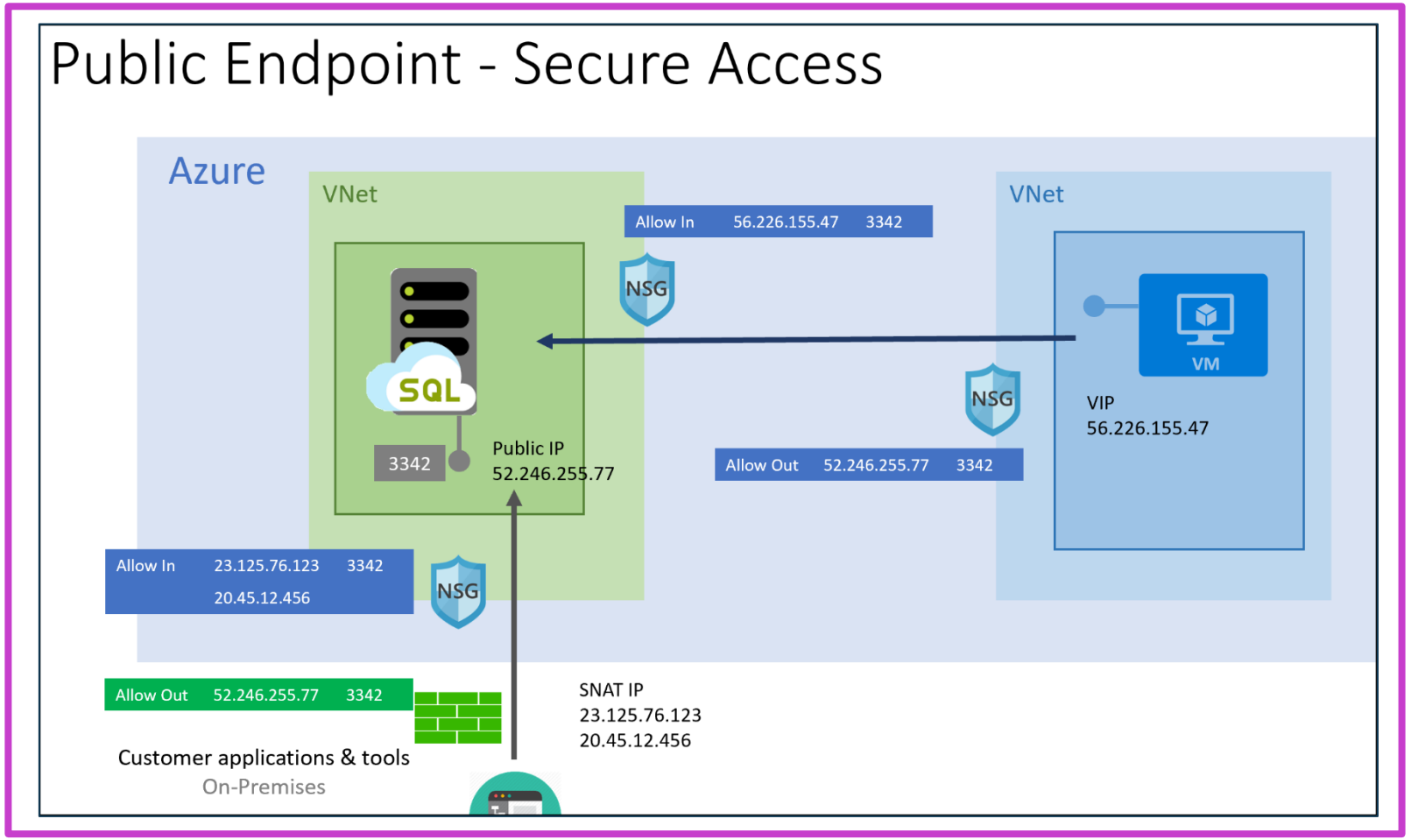
Limit Public Network Exposure

Integrate DDoS Protection

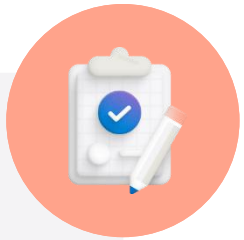
Implement and Fine-Tune the Web Application Firewall (WAF)

Plan and implement network security configurations for an Azure SQL Managed Instance

- Public Endpoint Scenarios: Enables Azure SQL Managed Instance connectivity for multi-tenant PaaS, high throughput, or policy constraints.
- Secure Connections: Encrypts data, uses Azure backbone, and recommends ExpressRoute for on-premises connections.
- Network Security: Leverage NSGs, trusted IPs, and private peering to restrict public endpoint access.



Additional study –Planning and Implementing Security for Private Access to Azure Resources



Microsoft Learn Modules (docs.microsoft.com/Learn)

Module Review Questions

- Implement Virtual Network Service Endpoints:
  Secure Azure services by extending virtual networks using Service Endpoints.
- Implement Private Endpoints and Private Link Services:
  Provide private, secure access to Azure services with Private Endpoints and Private Link.
- Integrate Networking for Azure App Service and Azure Functions:
  Connect Azure App Services and Functions to virtual networks for secure communication.
- Secure App Service Environments (ASE):
  Configure network security for isolated and dedicated hosting environments.
- Secure Azure SQL Managed Instances:
  Implement private network configurations for Azure SQL Managed Instances.

Plan and implement security for public access to Azure resources

Plan and implement Transport Layer Security (TLS) to applications, including Azure App Service and API Management

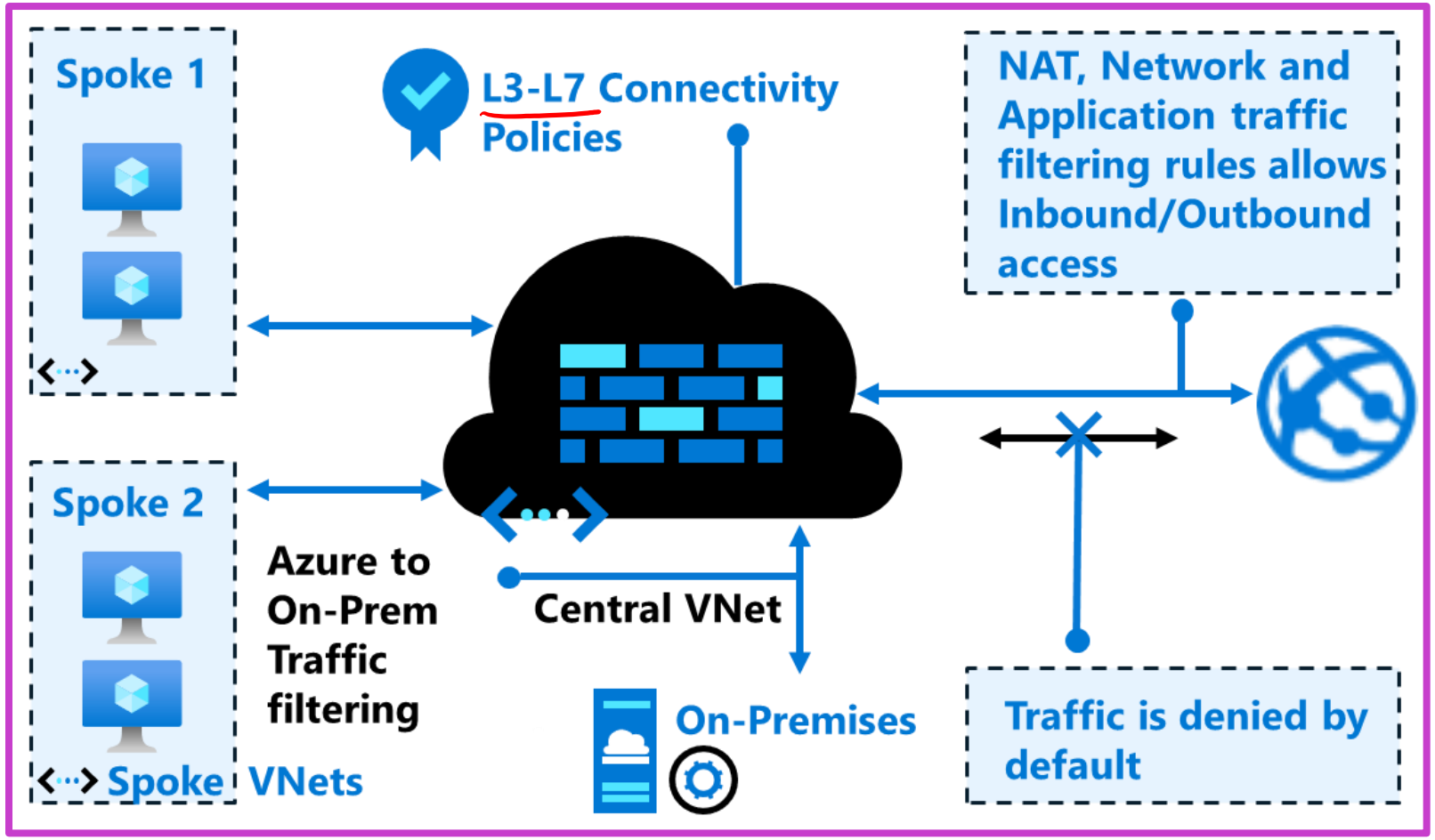
By implementing TLS encryption, you can protect your applications with:

Azure VWAN → AZ-700

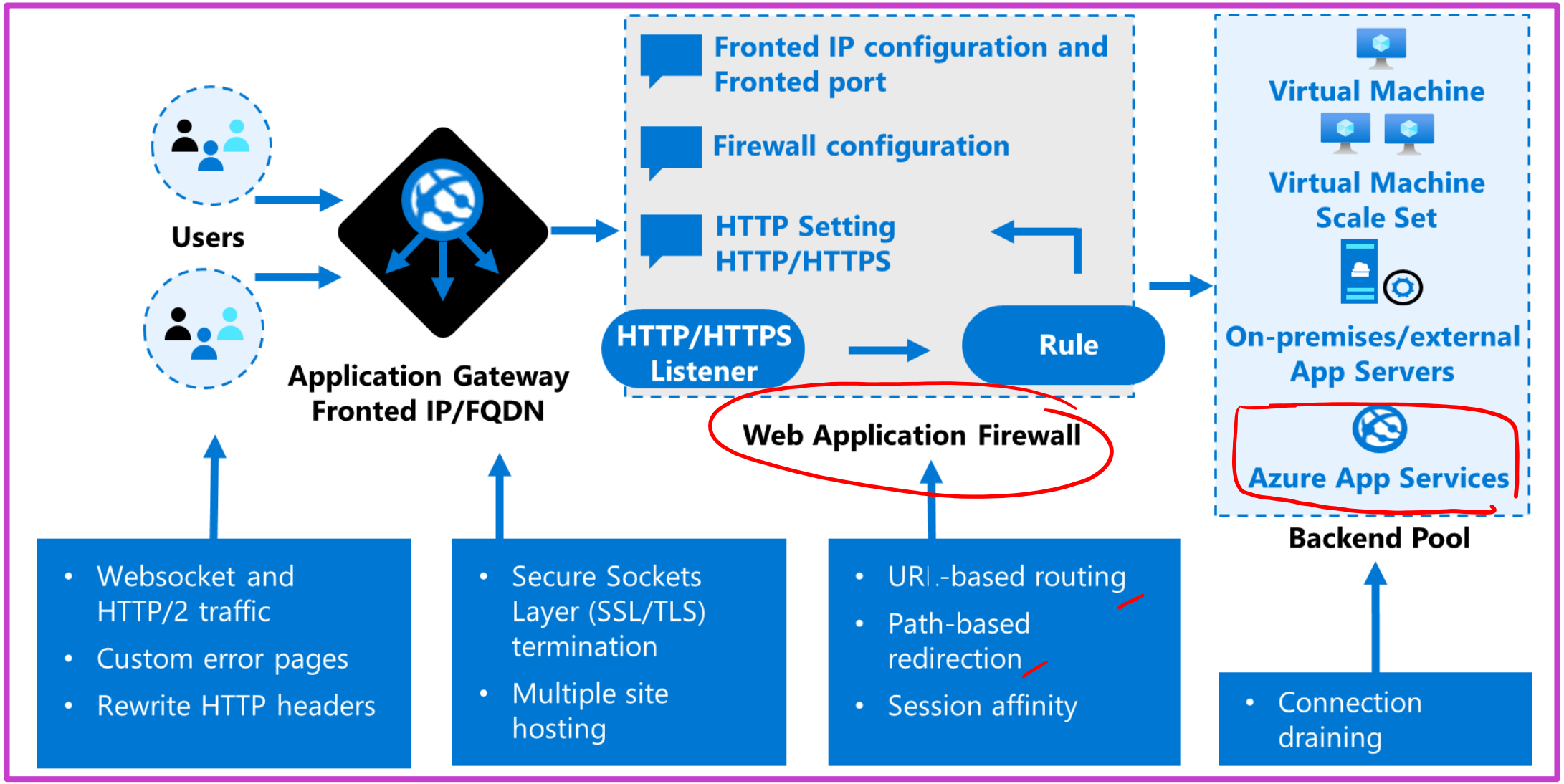
WAF

Plan, implement, and manage an Azure Firewall, including Azure Firewall Manager and firewall policies

- Application FQDN filtering rules
- Network traffic filtering rules
- FQDN tags
- Outbound SNAT
- Inbound DNAT support
- L3-L7 connectivity policies
- Separate firewall subnet
- Static public IP address
- Forced tunnelling – Push all internet Traffic for specific next hop (example – on-premises device).

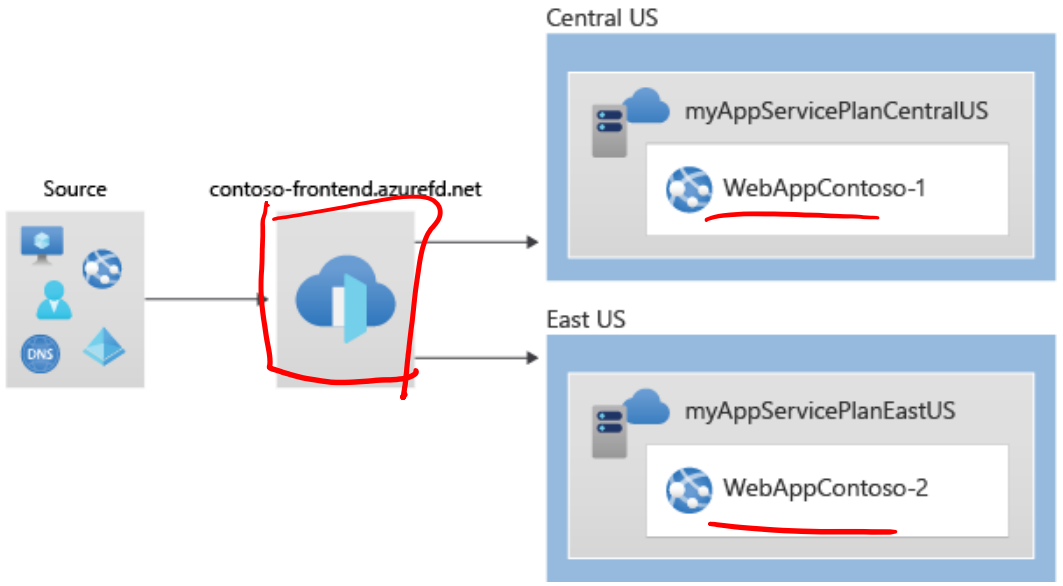


Plan and implement an Azure Application Gateway



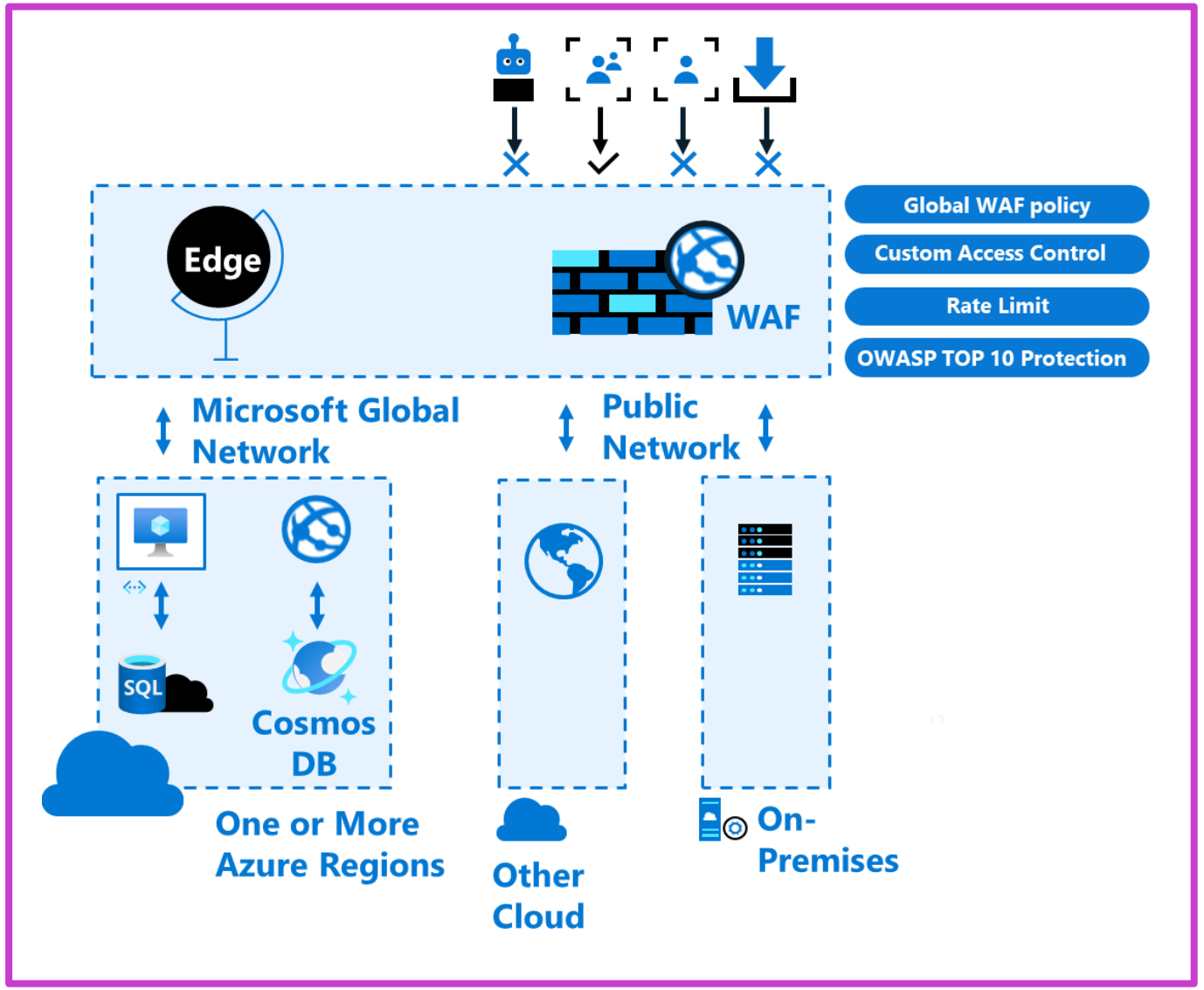
Plan and implement an Azure Front Door, including Content Delivery Network (CDN)

- Layer 7 global routing
- Accelerate application performance with anycast and split TCP
- URL-based routing and session affinity
- Multiple-site hosting
- Custom domains and certificate management
- Application layer security - WAF
- URL redirection and URL rewrite
- Protocol support - IPv6 and HTTP/2 traffic

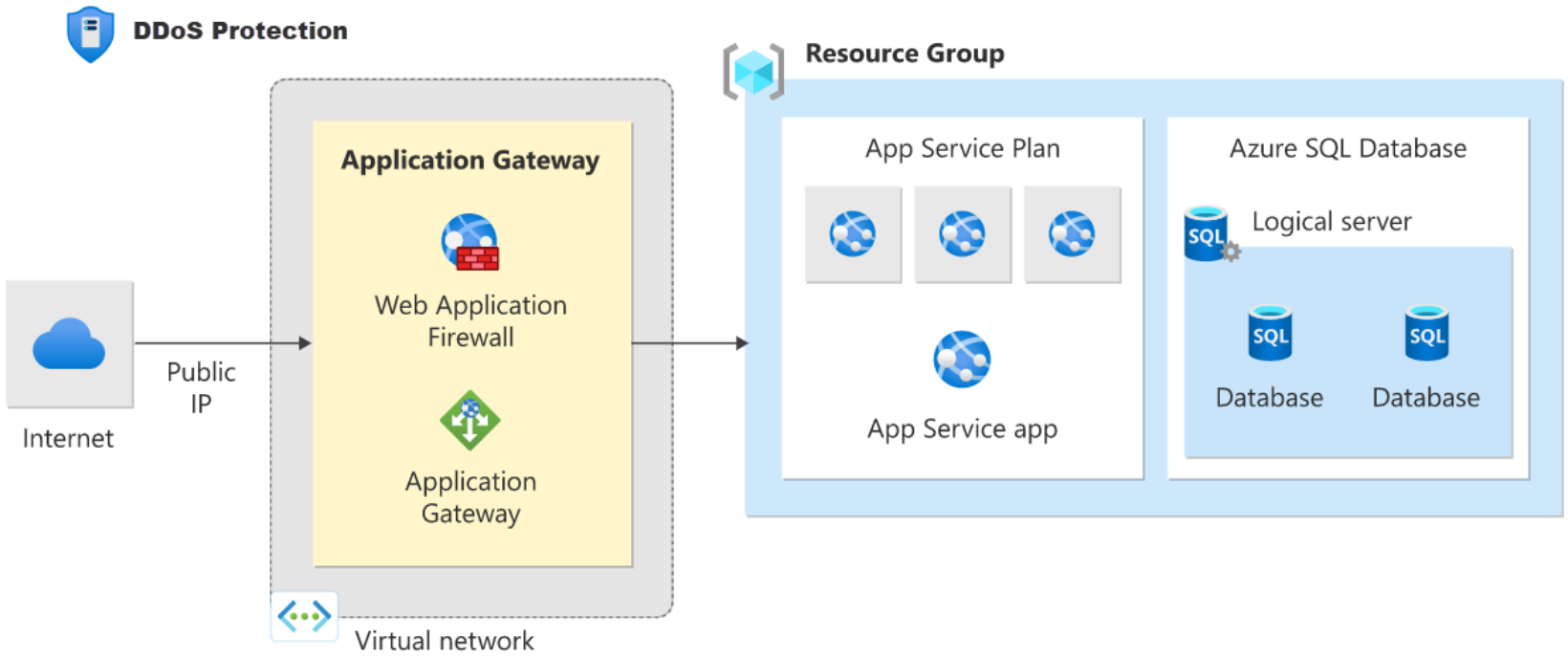


Plan and implement a Web Application Firewall (WAF)

- Protects against cross-site scripting and SQL injection
- OWASP Core Rule sets 3.1, 3.0, 2.29
- Custom access control
- Supports Azure Front Door, Azure Application Gateway, and CDN (preview)

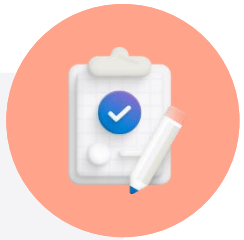


Recommend when to use Azure DDoS Protection



- Comprehensive Protection: Azure DDoS Protection defends against Layer 3-4 attacks with adaptive, always-on monitoring.
- Scalable Solutions: Offers Network and IP Protection tiers with analytics, alerts, and rapid response support.
- Multi-Layered Security: Integrates with WAF for complete network and application layer defense.

Additional study –Planning and Implementing Security for Public Access to Azure Resources



Module Review Questions

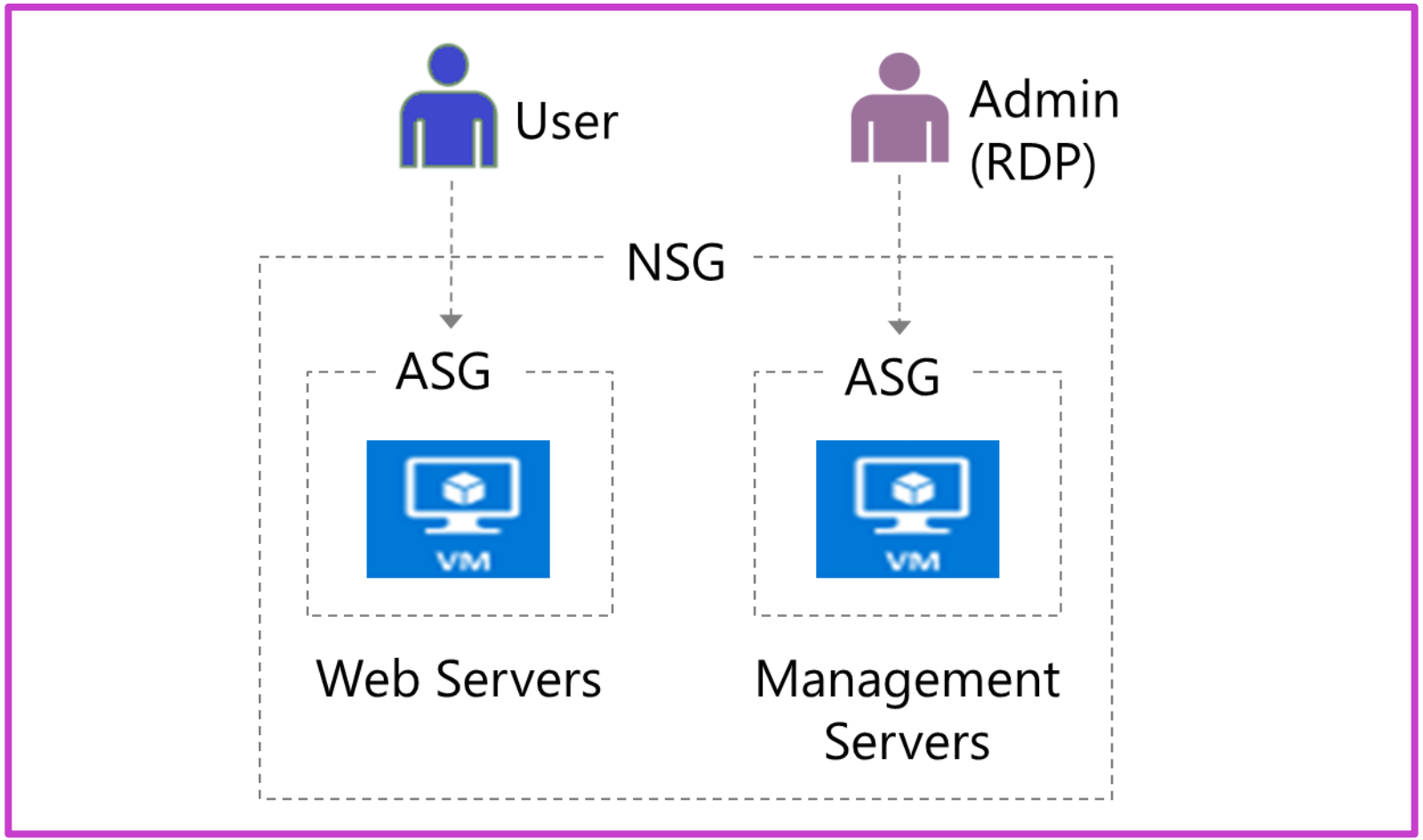
Microsoft Learn Modules (docs.microsoft.com/Learn)

- Implement Transport Layer Security (TLS): Secure applications with TLS encryption for Azure App Service and API Management.
- Deploy and Manage Azure Firewall: Protect networks with Azure Firewall, Firewall Manager, and firewall policies.
- Implement Azure Application Gateway: Enable secure, scalable web traffic management with Azure Application Gateway.
- Deploy Azure Front Door and CDN: Optimize and secure global web traffic with Azure Front Door and Content Delivery Network
- Implement Web Application Firewall (WAF) and Azure DDoS Protection: Protect web applications with WAF and mitigate attacks using Azure DDoS Protection Standard.

Module Labs

Lab 02 – Network Security and Application Security Groups

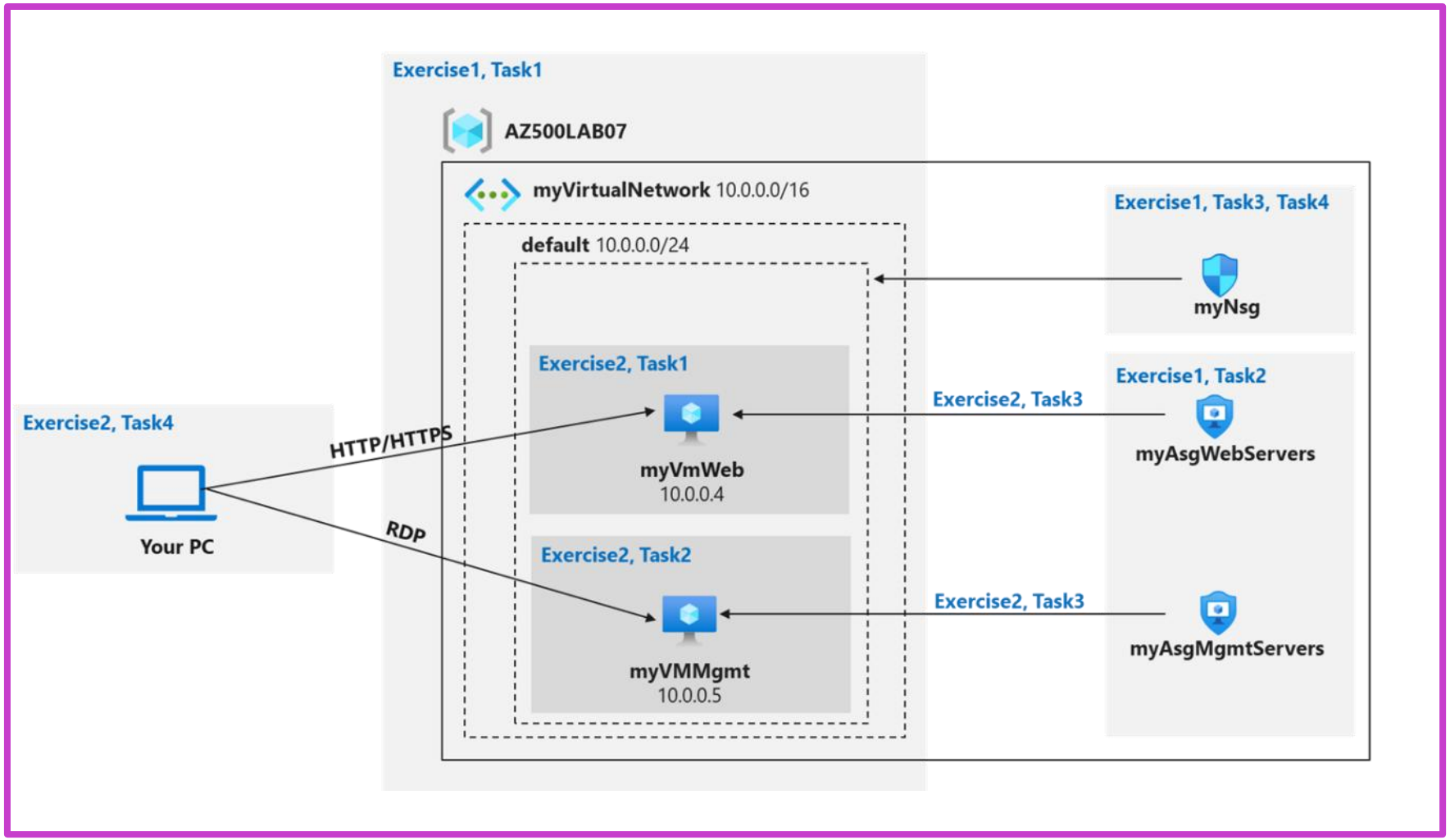
- **Create application security groups**
- **Wrap the ASGs with a Network Security Group (NSG)**
- **Use NSG rules to route traffic:**
  - Admins can RDP to the management servers but not the web servers
  - Users can access the web servers and see the default IIS page



Lab 02 – Network Security Groups and Application Security Groups

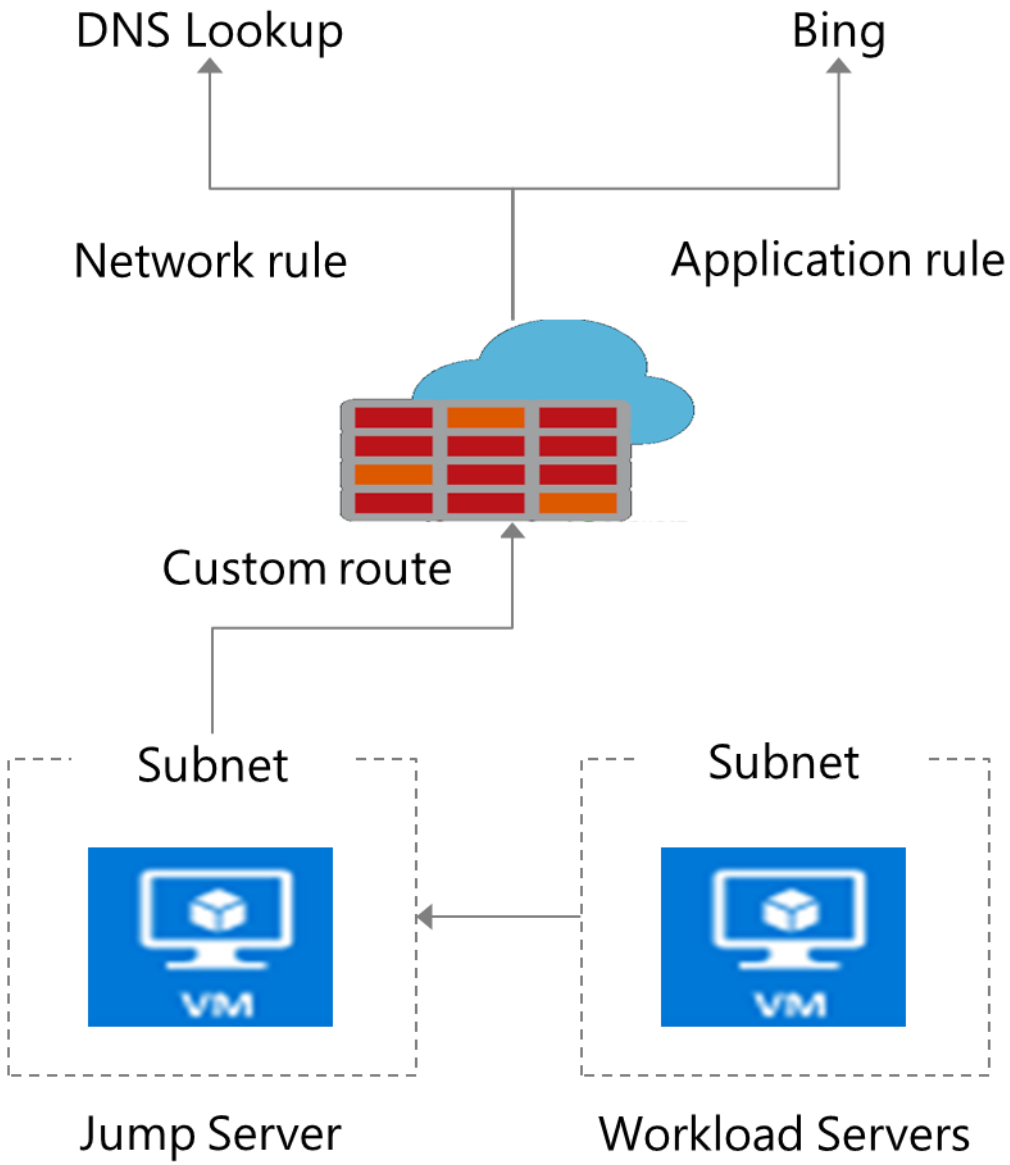
This exercise teaches students how to implement your organization's virtual networking infrastructure and test to ensure it is working correctly.

[Launch this Exercise in GitHub]



Lab 03 - Azure Firewall

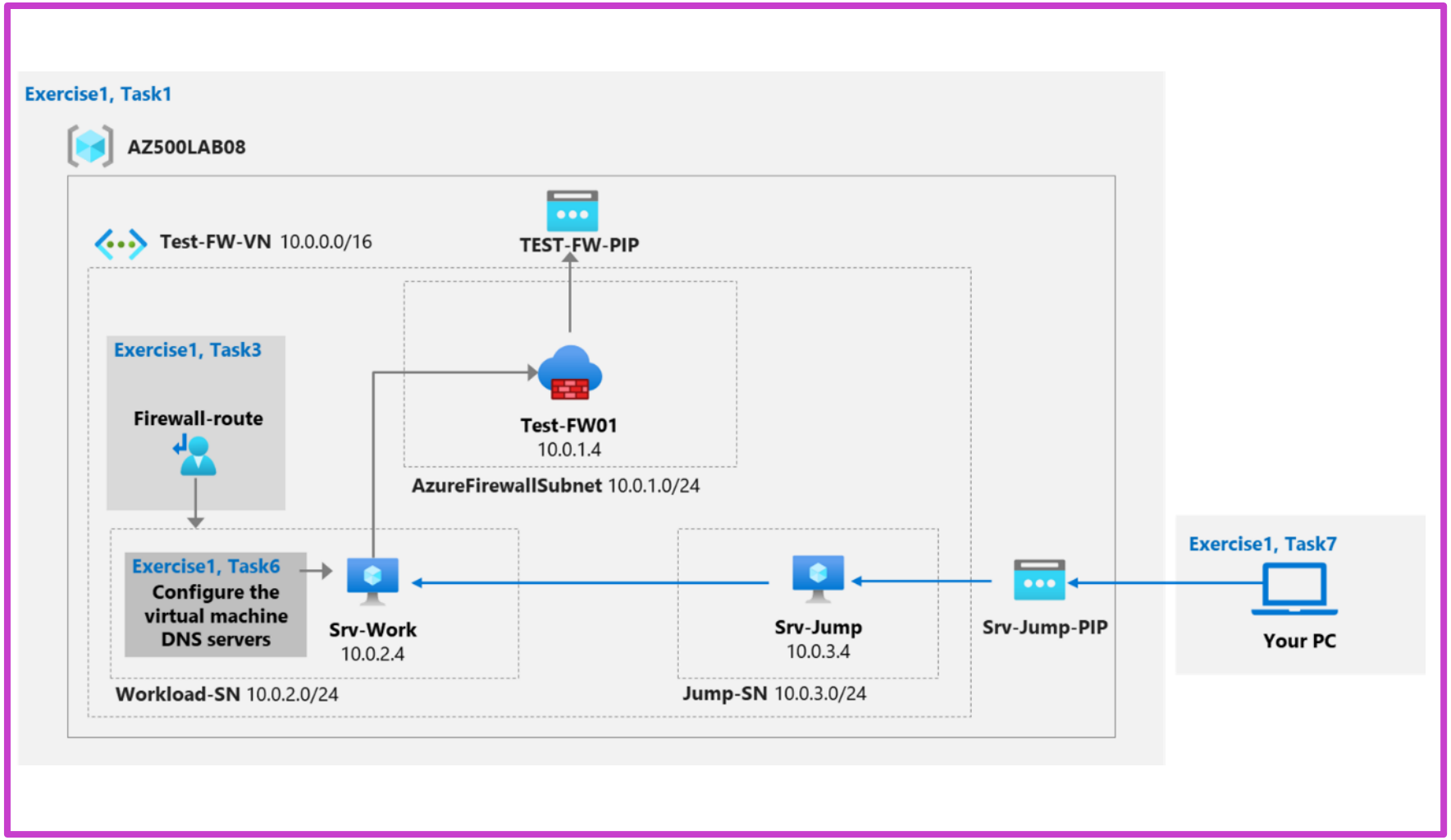
- Create a Workload subnet and Jump subnet each with a virtual machine
- Create a custom route to ensure outbound traffic from the workload subnet goes to the firewall
- Create firewall application rules to allow traffic to Bing
- Create firewall network rules to allow traffic to DNS lookup servers



Lab 03 – Azure Firewall

This exercise teaches students how to install Azure Firewall to control inbound and outbound network access—an essential part of a network security plan—and to create and test the following infrastructure components.

[Launch this Exercise in GitHub]



Knowledge check

1 **What is the primary purpose of Azure Network Security Groups (NSGs)?**

- ☐ Managing user access to Azure resources
- ☐ Safeguarding data within virtual machines
- ☑ Filtering inbound and outbound traffic to and from Azure resources

2 **Which security technology is commonly used to establish secure communication between a user's device and a corporate network?**

- ☐ Intrusion Detection System (IDS)
- ☐ Virtual Local Area Network (VLAN)
- ☑ Virtual Private Network (VPN)

3 **What is the purpose of an Intrusion Detection System (IDS) in host security?**

- ☐ Protecting data at rest in storage accounts
- ☑ Monitoring and detecting unauthorized activities on a host
- ☐ Preventing network-based attacks

Learning Path Recap

In this learning path, we:

Learned to secure virtual networks using NSGs, ASGs, UDRs, VNET peering, VPNs, Virtual WAN, ExpressRoute encryption, and Network Watcher monitoring.

Addressed private Azure resource access with Service Endpoints, Private Endpoints, Private Link services, and integrations for App Service, Azure SQL, and ASE.

Delved into public Azure access security through TLS, Azure Firewall, Application Gateway, Front Door, WAF, and Azure DDoS Protection recommendations.

End of presentation