how to use this document

- create a login to notebooklm.google.com (I prefer notebooklm over other interfaces, but it's up to you)
- upload this as a source
- use the notebook guide and produce the five prompts given

summary Azure Resource Manager

- resources are azure managed entities, like VMs, storage accounts, VNets
- understand resource hierarchy

summary azure portal and cloud shell

- login via Entra ID identity
- CRUD azure resoruces
- manage azure via cloud shell
- manage billing
- log support tickets

summary Azure CLI and Powershell

- azcli and powershell can:
  - manage azure resources locally (including in azure cloudshell)
  - create scripts for automation
  - no need to log in to the Azure portal

summary ARM templates

- ARM templates are Declarative JSON (IaC)
- quickly deploy repeatable and modular envs
  - you can call other ARM templates from ARM templates

summary Subscriptions

- subscriptions:
  - billing unit that aggregates all costs of underlying resources
  - contain resource groups and associated resources
- scoping level for governance and security
- can be associated with a single organization Entra ID tenant at a time

summary using management groups

- mgmt groups provide hierarchy of management
- root management group access is not given by default
- root management group can't be moved or seletec
- Azure RBAC is supported for mgmt groups
- Global Administrators must be elevated to USer Access Administrator of root group.

    - temporarily assign this role only

summary Understanding Azure Policy

- Azure Policy applies governance
    - create manage and assign policies.
    - Can be used to enforce (you can deny creation of resources outside of compliance) or audit compliance on resources.
- Policy components:
    - policy definition
    - policy assignment
- Many policies can be combined:
    - Initiative definition: can scope many definitions

summary tagging resources

- tags (name/value pairs) can be used to:
    - manage resources
        - shutting down all VMs via a tag, or enforce policy, or billing
- tags are not inherited, but can be via Azure Policy

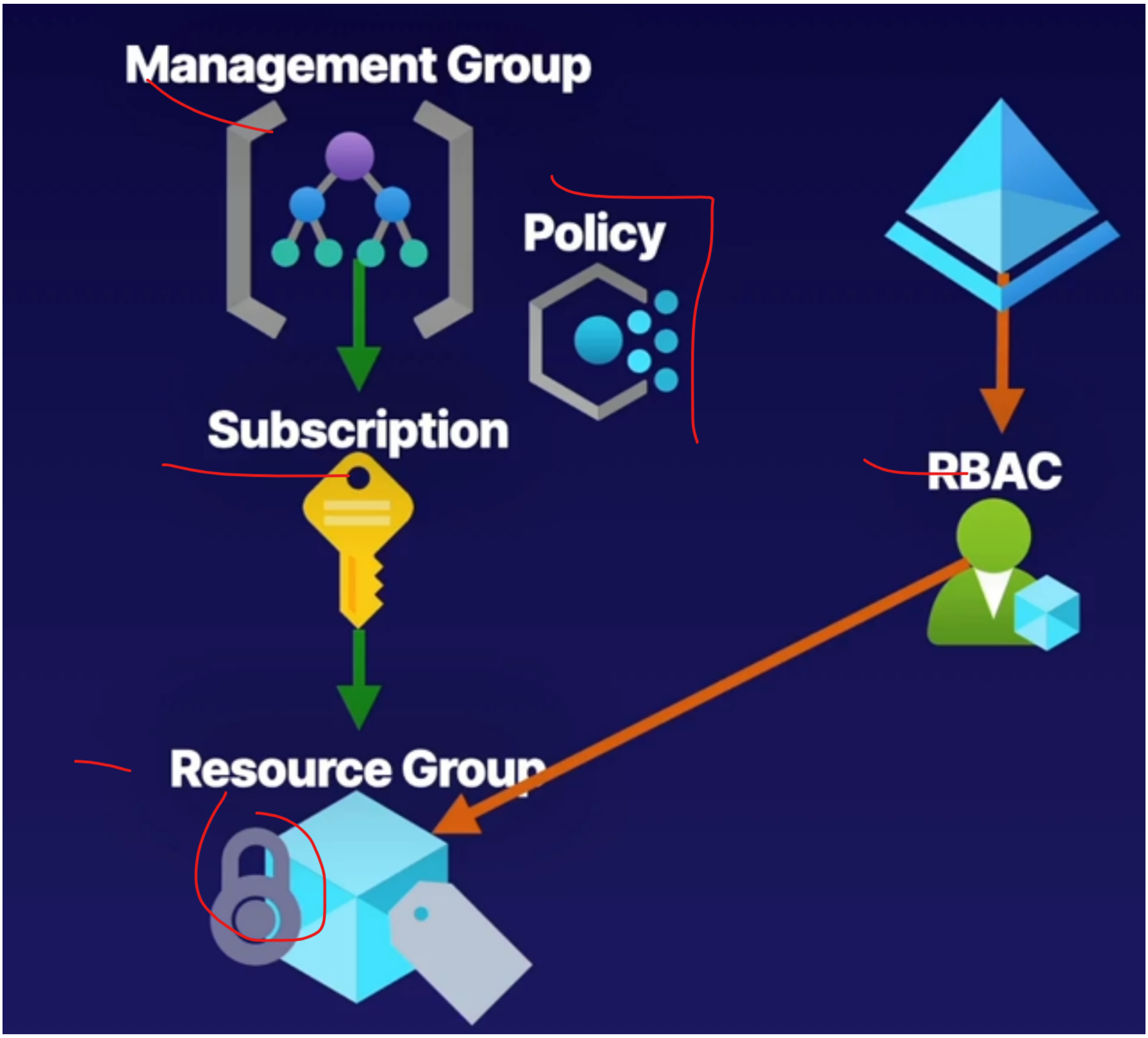
summary Logging and moving resources

- resource lock types:
    - `ReadOnly`: allows authed users to resource, but can not delete or update resource (ie: you can't power off a VM... you can't affect state at all!)
    - `CanNotDelete`: allows authed users to read and modify a resource, but can't delete. (ie: you can't delete a VM)
- there is inheritance for locks

summary managing azure costs

- pricing calc: how much will resources cost us to run at given spec
- TCO calc: analyze on-prem workloads and obtain costs
- Microsoft Cost Management: analyze costs, create budget

summary building a cloud governance strategy with azure tool



- management groups/subscription/resource group hierarchy
- policies are used to control
- (RBAC) role assignment to resource groups
- locks

summary Identity in Azure

- Azure AD / Entra ID
  - IAM basics
  - define Entra ID
  - Entra ID tenant
  - Entra ID architecture
  - compare Entra ID with legacy AG
  - Create and switch between tenants
- Entra ID Users
  - define users, types of users, methods of creating users, architecture
  - create and delete users
  - perform bulk user updates

    - invite guest accounts
- Entra ID groups
    - define groups, group and membership types, RBAC
    - create dynamic groups
    - assign access to resources
- Entra ID join:
    - define Entra ID Join, device settings and conditional access
    - join Windows 10 to Entra ID
- Administrative units:
    - Define MFA and self-service password reset (SSPR)
    - enable MFA
    - enable SSPR

summary conceptualizing Entra ID

- Entra ID
    - Tenant is the organization instance
- purposes:
    - IAM: global cloud-baed identity service for Azure that provides an identity repo.
    - Create identity resources: create users and groups.
    - Manage identity security: enable conditional access policies, control resource access and provide policy-based controls across all Azure resource instances and management functions.

summary managing tenants

- Entra ID tenant is within your region
- inside the tenant all identity resources exist

summary creating and managing users

- Entra ID tenant users and groups exist
- types of users: admins, member, guests
- Role assignment: determines perms and access
- Object ownership: apps, devices, groups and resources that are owned

summary creating and managing groups

- group types:
    - security groups: are used to manage access to shared resources for a group of users
    - M365 gorups: used to give members access to shared mailbox, calendar, files, etc
- Membership types:
    - assigned: static group membership
    - dynamic user: logic based given user properties
    - dynamic device: created that automate group membership via device attributes.

summary Creating administrative units

- purpose of administrative units: an Entra ID resource for providing a container for Entra ID objects.

- allow you to control the scope of your administrative users.
- Use case: administrative units based on geographical locations, business departments, or subsidiary organizations of a parent organization.

summary configure self-service password reset (SSPR)

- SSPR:
  - unauthed users use SSPR
  - decreases admin overhead
  - securre password reset for users and admins

summary Entra ID Device management

- device identity: gives devices identities so that the devices can access resources in Entra ID
  - simplified procedure for adding and managing devices
  - improve user experienc on devices
  - SSO for any registrered or joined

summary understanding roles in Azure

- Azure (RBAC) roles:
  - managing access to Azure `resources`
  - scope can be at multiple levels
  - supports custom roles
  - has a few role types
  - scope at management groups, subscriptions, resource groups, and resources
- Entra ID roles
  - manage access to Entra ID resources within Entra ID tenant
  - scope is at tenant level
  - supports custom roles
  - has a few role types
  - Administrative Units can help with scoping

summary Assigning access to resources

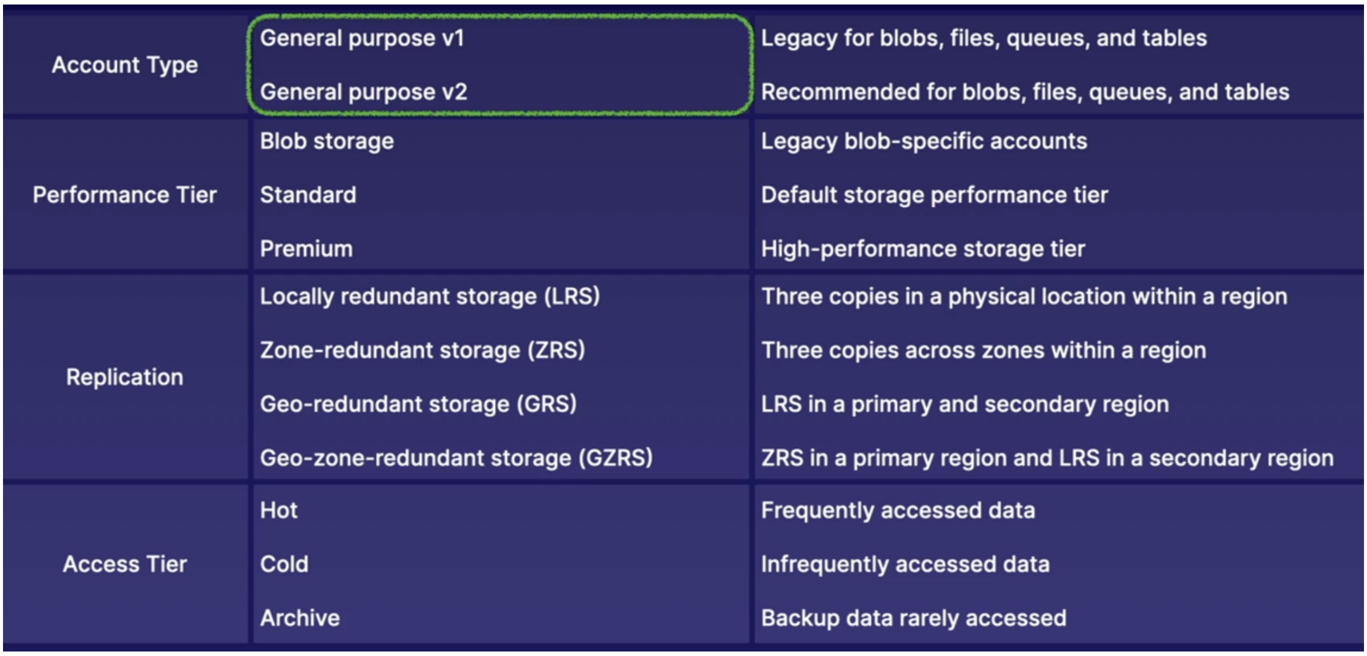
- Azure RBAC == authorization system to provide access to Azure resources
- implicit deny -> explicit allow -> explicit deny
- roles are cumulative/additive, Azure heirarchy inheritance applies

summary Creating custom roles

- custom roles
  - provide identities with access to azure resources or Entra ID objects
  - roles are collection of permissions
  - scoping hiearchy for role assignments
  - custom role definitions are JSON and should be based on built-in roles
  - create a custom role when there are no built-in role that meets your requirements

- to create a custom role, you must have `User Access Administrator` or `Owner` role for the account

summary Understanding Storage Accounts



Account Type	General purpose v1	Legacy for blobs, files, queues, and tables
	General purpose v2	Recommended for blobs, files, queues, and tables
Performance Tier	Blob storage	Legacy blob-specific accounts
	Standard	Default storage performance tier
	Premium	High-performance storage tier
Replication	Locally redundant storage (LRS)	Three copies in a physical location within a region
	Zone-redundant storage (ZRS)	Three copies across zones within a region
	Geo-redundant storage (GRS)	LRS in a primary and secondary region
	Geo-zone-redundant storage (GZRS)	ZRS in a primary region and LRS in a secondary region
Access Tier	Hot	Frequently accessed data
	Cold	Infrequently accessed data
	Archive	Backup data rarely accessed

- `General purpose v2` is generally suggested

summary conceptualizing azure blob storage

- blob service is object storage
- blob containers store blobs
- blob containers provide a flat-file structure

summary configuring blob object replication

- enabling blob container repl requires
  - Versioning: on both source and dest storage accounts, must be enabled
  - change feed: on source storage account, must be enabled.
- repl policies: a single storage account can be a soruce for up to two dst accounts. EAch policy supports only a single pairing using a policy ID.
- cross subscription and Entra ID tenant blob object repl is supported.

summary configuring blob lifecycle management

- storage accounts requirement: support General Purpose v2 and blob storage accounts
- types and subtypes: support block and append blobs, and support subtypes: base blobs, snapshots, and version
- filtering: filter blobs in the rule using prefix or blob index matches
- scoping: scope at the storage account level or limit blobs by filters
- if/then logic applies in lifecycle rules based on mod and access times.

summary configuring azure files

- managed file share service: utilizes storage account redudancy and security
- OS clients: Windows, linux and macOS
- protocol support: SMB, REST, NFS
- File shares can have quotes, default is 5TB

summary configuring azure File Sync

- Azure File Sync:
    - extends on-prem file share: increases storage capacity through cloud tiering
    - Windows only: windows 2012 R2 or later file servers only
    - Requires File Sync Agent: download Azure File Sync agent onto local file server

summary storage network access

- private network access, each sub-service has an endpoint
- endpoints have a:
    - public endpoint
    - restricted access
    - private endpoint

summary securing storage accounts

- storage accounts are encrypted default encryption with keys managed by microsoft
- you can secure the management and data layer
    - using access keys
    - using SAS
    - using Entra ID authentication (RBAC)

summary Using Azure Jobs

- move large amounts of data between on-prem and Azure Storage in case there isn't enough bandwidth, etc
- Import jobs: send large amounts of data to the Azure cloud when network bandwidth won't support data migration
- Export jobs: receive large amounts of data on-prem from azure cloud when entwork bandwidth won't support data migration (for BLOBs)
- WAImportExport CLI tool: use to prepare disks for data and to estimate number of disks needed.
- Windows support only
- Azure Blob and Files

summary Storage utilties (storage explorer vs. AzCopy)

- storage explorer
    - manage storage accounts
    - use Entra ID or SAS to auth
    - gui provided
    - uses AzCopy under the hood
- azcopy

  - manage storage accounts
  - use Entra ID or SAS to auth
  - CLI tool == scripting capabilities

summary Conceptualizing Virtual Networks

- purpose of a network: a network allows a client to have an isolated network where resoruces cna communicate with one another and with outside networks
- isolated network: VNets are isolated networks on the Azure cloud (SDN)
- private network access: provides private connectivity between resources like VMs or App Services
- network integration: allows connectivity between VNets, on-prem networks and remote user devices

summary creating virtual networks

- default connectivity: by default, intra-network traffic and outbound internet traffic is allowed
- addres restrictions: use of private addr using RFC1918. The smallest vnet subnet size is /29, largest /8
- reserved IPs: x.x.x.[0-3] and x.x.x.255
- DNS and DHCP are provided: but DNS can be customized
- network integration: VNets are built for integration with one another, hybrid connectivity using VPNs and ExpressRoute
- VNet protocol support: TCP, UDP, ICMP

summary deploying network resources

- network interface cards have:
  - private ip and public ip
- private IPs: static or dynamic assigned addr that allow private connectivity between resources
- public IPs: static or dynamic assigned addr that allow public connectivity **from** the internet to a resource
  - basic SKU: static or dynamic assigned public IP that is **accessible by default** and requires an NSG to restrict traffic. Does not support availabiity zone deployment
  - Standard SKU: statically assignable public IP that is **not accessible by default** and rquires an NSH to allow traffic. Supports AZ deployment

summary routing VNets

- system routes: default route that are built-in to virtual networks that cannot be modified
- custom routes: user-defined routes or BGP routes that override system routes.
- order of precedence:
  - custom routes (highest)
  - BGP
  - system routes (lowest)

summary Network Security Groups

- network security groups control traffic
- NSGs are stateful
- NSG are used for

    - filter traffic: determining what trafic will be allowed or denied inbound and outbound
    - association: must be associated to suybnet or NIC
    - rules: evaling default rules that cannot be deleted and user-defined rules that can be created
    - priority: specifying priority to roder the precedence of rules. the lower the number, the higher the priority
        - user defined rules can use priority nubmers of 100-4096
    - there must be effective access flow... remember NSGs are bound to subnet (inter-subnet including internet) and/or NIC (east-west)

summary Using Azure DNS

- features:
    - RBAC (this wasn't covered 😃)
    - activity logs (this wasn't covered 😃)
    - resource locking (this wasn't covered 😃)
    - private DNS zone
    - alias records

summary using azure firewall

- create a new subnet called `AzureFirewallSubnet`, and create a /26
- must create a route
- options for rules:
    - Nat rules
    - NEtwork rules
    - Application rules

summary using service endpoints

- using service endpoints, you can enable private connectivity to your serivces
    - decreases attack surface
    - enables use of NSG rules
    - enhanced routing

summary Using Private Endpoints

- a private endpoint provides
    - a private IP for your connected services
    - connectivity to Azure services
    - connectivity to customer/partner services
    - direct service (Sub-resoruce) mapping

summary configuring azure VNet peering

- types of peerings
    - virtual network peerings
    - global virtual network peering
- benefits:

- low latency, high bandwidth connections (MSFT backbone)
- cross-network comms
- data transfer between/across subscriptions, Entra ID tenants via Azure roles, azure regions
- transitivity: peering connections are non-transitive
- reciprocity: peering connections are not reciprocal

summary Implementing VPNs

- Config steps:
  - create VNets and Subnets
  - specify the DNS server
  - create GatewaySubnet
  - Create the VPN Gateway
  - Create a Local NEtwork Gateway
  - Configure the VPN device on prem
  - Create the VPN connection
- connections options
  - VNet-to-VNet
  - Site-to-Site
  - Point-to-Site

summary Configure ExressRoute

- Azure ExpressRoute
  - dedicated physical connection
    - partners offer PoPs in data centers
  - built-in redundancy
  - connectivity to MSFT
  - connectivity via private peering (Azure resources)
  - dynamic routing via BGP
  - 50Mbps-10Gbps

summary implementing Virtual WAN

- azure Virtual WAN
  - single operational interface where we manage fully manage networks
  - Connect networks using hub-spoke architecture
  - basic (S2S VPN connections only) and standard SKUs
  - connect S2S and P2S VPN gateways, global reach ExpressRoute, and VNets
  - secure with Azure Firewlal and Firewall Manager
  - Any-to-any connectivity
  - Connections propagated to managed routes
  - Hubs are Managed Virtual Networks

summary creating and managing VMs

- VMs provide OS instances, are compute resources
- allows migrate workloas

- compute resources are elastic

summary Managing VM disks

- Azure Disks are VHD
- OS disk, temporary disk, data disk
    - disks are stored as page blobs
- SSE == physical encryption on disks
- ADE == key based encryption for data

summary configuring VM scale sets

- HA: design highly avialable solutions using zonal redudant deployment
- Availability Sets: provide protection for redundant VMs by preventing outagesw related to faults and updates by logically groupign them into domains
- scale sets: autoscale solutions to meet demands of traffic and scale in to decrease costs when demand goes down

summary Automating VM deployments

- ARM template: deploy VM squickly and manage infrastructure using change control using IaC
- VHD template: create a golden image of VMs to easily deploy VMs with consistent software and configs
- Automation mgmt: manage VM deployments using custom data and manage VMs using extension scripts

summary Managing Virtual Machine Updates

- Automation Account: service for managign update configs for VMs
- Hybrid Runbook Worker: runbook for updates and configs that will be run
- Log Analytics workspace: storage for logging details about update mgmt process
- Log Analytics Agent: agent installed on OS instance for sending back data to workspace

summary Automating VM configs

- Automation acocunt: service for managing update configs for VMs
- Powershell DSC: powershell scripts that declare desired state of VMs
- Local Configuration Manager: sends current config state to pull server for eval

summary Using Azure Bastion

- bastion is used to access VMs
- private traffic: traffic from Bastion to target VM stays within VNets (peer Vnets included)
- Hardened bastion: NSGs are not needed because bastion is hardened internally
- Service Integration: bastion natively integraze with Azure Firewall
- Concurrent connections: max 25 RDP and 50 SSH simultaenously
- Audit logs: enable diagnostics for auditing Bastion connections
- Required roles: `Reader` role perms are required on the Bastion, VM, and NIC in order to use Bastion

summary Introducing Azure Load Balancer

- load balancing: balance traffic between external or internal solutions
- health probing: health check ports for nodes in backend pool
- DNAT: port forward inbound traffic to nodes in the backend pool
- SNET: port forward outbound traffic from nodes in the backend pool
- Availability zones: determine AZ selection for deployment

summary Using Application Gateway

- load balancing: balance traffic between backend pools using HTTP/HTTPS
- SSL termination: terminate TLS/SSL at the app gateway
- url routing: url path-based routing between multiple backend pools (multiple web sites running on a single public IP)
- security: WAF security for the LB solution
- autoscaling: scale up/down the backend pools for the app gateway

summary creating an app service plan

- app service plans: a plan that defines compute resources and available features for a web app
- app service plan compute resources: dependant: pricing tier, size of VM instances, number of VM instances and region
- app service plan compute types: shared, dedicated, and isolated, each provides a different level of compute isolation, netowkr isolation, and features like scaling.
- app serviec plans and web apps: provides PaaS to config and host apps rather than infra. Manage a few config details to run a web app

summary creating web apps

- application runtime: host and app iusing a specific runtime that is select as part of the provisioning process
- public accessibility: Web apps are publicly accessible by default, and can be accessed usign the domain provided to you by Azure
- publishing tools: publish your app code to web apps using various publishing tools, including Azure DevOps, GitHub,zip file, SCM, etc
- database support: connect your DB to your web app using a connection string

summary configuring web apps

- scaling: limited by pricing tier and compute type
- deployment: used for staging applications for a swap
- network: Web App is public by default and can be deployed into or integrated with a VNet
- Backup: blob backups of app configs, file contents and DB connection strings

summary describing containers in Azure

- development: create and build a container so it can be shipped
- registry: manage a container registry of container images in a single place (Azure Container Registry)
- Azure Container Instances (ACI): docker container hosting platform

summary Using Azure Monitor

- Metrics:
  - Metrics are gathere on a per-resource basis
  - to use metrics:
    - view metrics in Metrics Explorer
    - Query in Log Analytics
    - Alert and take action
    - export and archive
- Logs:
  - logs are not gathered by default iby the Azure platform
  - to use logs:
    - query in Log Analytics
    - archive
    - strema to third party
- Diagnostic Settings:
  - Define how and where metrics and logs will be stored on a per-resource basis
    - OS level data
    - app level data

summary setting up alerting and actions

- use data to trigger alerts
  - alert rules
  - scoped to resources
  - consider conditions
  - then can take actions

summary configure Azure Monitor logs

- azure Monitor Logs aggregate to a Log Analytics Workspace
- within Log Analytics workspace: visualize, alert, gain insights
- data sources:
  - Internal data: azure resources, Entra ID tenant, and subscriptions
  - External data: on prem resources in hybrid env
- Log Analytics Agent: an extension installed on resources to allow for telemtry to be gathered into the workspace

summary Understanding Monitor Insights

- Azure Monitor services:
  - VM Insights: VMs and VMSS-specific services
  - NEtworks
  - Containers
  - App Insights

summary Configuring Application Insights

- Application Insights is a full stack monitoring solution that can gather a lot of data client and server side and stream in near-real time to an aggregated destination

- runtime instrumentation: codeless approach with Application Insights, no package implementation
- Built-time instrumentation: coded approach with Application Insights, package implemented via SDK
- Instrumentation key: key for implementing instrumentation in applciations (this key is stored in Application Insights resources)

summary using Network Watcher

- network watcher can be implemented per region
- Monitoring Tools:
  - topology: view a diagram of the resources in VNet
  - connection Monitor: monitor conenctivity between Azure resources (and on-prem networks)
  - Network Performance Monitor: monitor network perf and connectivity between VNets, datacenter, and/or ExpressRoute from centralized location
- Diagnostic tools:
  - IP Flow Verify: test if traffic is allowed or denied inbound or outbound from VMs
  - Next hop: determine how traffic hops from VM to dst
  - effective security rules: determine effective security rules on a NIC
  - packet capture: capture packets to and/or from a VM for analysis
  - Connection tshoot: determine connectivity between src and dst VMs
  - VPN diags: diag and tshoot VNet gateway issues

summary Understanding Disaster Recovery

- Disaster recovery methods
  - backup: a copy of business critical data
  - cold site: a copy of critical infra that needs preparation before DR is complete
  - hot site: a copy of crit infra and data that is ready to be swapped in as the prod workload

summary Configuring Azure Backup

- workloads: azure VMs, on prem workloads, SQL server workloads, SAP HANA workloads
- Recovery services fault: storage mgmt for all backup data.
- Azure Backup: cloud-managed backup service for configing backup frequency and retention

summary Azure Site Recovery

- create DR solutions to repl to a primary location to a secondary locations
  - Replicate Items: workload that will be repled site-to-site by Azure Site Recovery
  - Replication Policy: defines the frequency of snapshots and retention period of recovery points. CAn be app-consistent or crash-consistent
  - Recovery plan: automate and run test failover events with protected itemss and pre- and/or post-scripts

summary backup reports

- backup reports capture backup related operations to understand cloud storage usage
- Log Analytics Workspace and the settings in the Recovery Services Vault
- backup reports contain:

  - backup policies
  - backup jobs
  - backup items
  - summary of estate