Technology Overview

30 July 2021 15:33

1. Computing services

a. Azure Virtual machine - windows / linux, most common type of compute
   i. Choose your own OS, memory, CPU, Storage
   ii. However you share hardware w other customers
b. Azure Container instances - **Docker/Platform as a service**
   i. Run containerized app w/o provisioning servers or VMs
c. Azure kubernetes service (AKS) - **Kubernetes as service**
   i. Basically provide a way of managing a cluster of containers
   ii. Easy deploy, manage and scale containerized apps
   iii. Use open source lib
d. Azure functions / Serverless computing
   i. **Serverless** compute, you only focus on the most import bit of the codes, Function will deal w the rest (API,respond to database changes etc.)
   ii. pay only for compute time
e. Azure Virtual Desktop
   i. desktop and app virtualization service that runs on the cloud
f. Azure app service
   i. PaaS offerings to build, deploy, and scale enterprise-grade web, mobile, and API apps
g. Azure service fabric - **Tire 1 Enterprise containers as a service**
   i. Distributed platform for containerised apps, microservices and distributed apps (放在不同计算机通过网络完成同一个任务)
   ii. Can run in Azure or on-prem
   iii. Deploy and manage microservices
h. Azure Batch
   i. Plan, schedule and execute large scale workload (100+ jobs in parallel)
   ii. Use spot VM (underutilised low priority VM) for lower cost

2. Storage services

sqlshack.com/different-azure-storage-types-file-blob-queue-table/

a. Azure blob storage - **object serverless storage**
   i. Store very large files, and large amount of unstructured files
   ii. Pay for what you store, unlimited, no filesystem protocol or resizing volumes
b. Azure disk storage
   i. Virtual volume attach to your VM, choose SSD / HDD, encryption by defult
   ii. Just like the physical disk in your local machine, except that this is virtual
c. Azure file storage
   i. File share platform, both cloud or on-prem e.g. SMB
d. Azure queue storage
   i. Storage for queueing and delivering messages between apps
e. *Azure table storage - **wide column NoSQL database**
   i. NoSQL database for unstructured data, more like a database than storage
   ii. Replacement = Azure Cosmos DB table API
f. Azure data box / Azure databox heavy
   i. Rugged briefcase computer and storage design to move terabytes or petabytes of data
g. Azure achieve storage
   i. Long term cold storage when you want to hold files for years and cheap i.e. The disk not actively spinning
h. Azure data lake storage
   i. Centralized repository for all unstructured an structure data at any scale e.g. When work w big data from multiple source

3. Azure database and analytics services

a. Azure Cosmos DB
   i. Fully managed **NoSQL databased** , super large 99.99% availability
b. Azure SQL Database
   i. Fully managed Microsoft **(MS) SQL** database with auto-scale
c. Azure SQL Managed Instance
d. Azure Database for MySQL, PostgreSQL, MariaDB
   i. Fully managed scalable, high availability and security

big data and analytics

Big data = massive volumes of structured/unstructured data, too large to move and process using traditional database and software techniques

a. Azure Synapse Analytics
   i. Fully managed **Enterprise data warehouse** with big data analytic component
   ii. Intended to run **SQL quires** against large databases for things such as reporting
   iii. integral security at every level of scale no extra cost
b. Azure HDInsight
   i. Fully managed **open-source analytics software** for enterprises, such as Hadoop, Spark, Kafka
   ii. Can run open-source frameworks e.g. Apache Spark, Apache Hadoop etc., and ML
c. Azure Databricks
   i. An APACHE Spark-based analytics platform, basically a **3rd party Databricks** cloud services supported within Azure
d. Azure Data Lake Analytics
   i. on-demand analytics job service that simplified big data need to write quires
   ii. A **data lake** is a **storage repo** that host vast amount of **raw data** in its native form until it's needed, you only pay for your job when it's running,

4. Application integration service

a. Azure notification hub - oub/sub, send notification to any platform from any backend
b. Azure API apps - API gateway, quick build / consume APIs in cloud
c. Azure service bus - hybrid, messaging as service (MaaS)
d. Azure stream analytics - Serverless real-time analytics, from cloud to edge
e. Azure logic apps
    i. schedule, automate and orchestrate tasks, business process & workflows, have pre-defined logic blocks
    ii. Integration w enterprise SaaS and Enterprise apps
f. Azure API management
    i. Hybrid, multi-cloud management platform for APIs
    ii. Can put this in- front of existing APIs and add additional functionalities

5. Developer and mobile tools

a. Azure SignalR service
    i. **Real-time messaging,** add real-time data and functionality to web and mobile applications
b. Azure app service
    i. **PaaS** that enables developers to build, run, **scale enterprise-grade web, mobile, and API apps**
    ii. .NET, Node.js, Java, Python, PHP
c. Visual studio
    i. **Code editor,** integrated development environment (IDE) for application development
d. Xamarin
    i. **Mobile-app framework**, use .NET

6. Azure DevOps service

Azure DevOps - SaaS platform, provides end-to-end DevOps toolchain for developing and deploying software

a. Azure Boards
    i. **Kanban** board, using agile tools to plan, track progress ect.
b. Azure pipelines
    i. Build, test, deploy **CI/CD** works with any languages or platforms and cloud. Automated deployment, connect to GitHub
c. Azure Repos
    i. just like **Github repos**, pull request and advance file management
d. Azure Test Plans
    i. test and ship using **manual and exploratory testing tools**
e. Azure Artifacts
    i. Add artifacts to CI/CD pipelines
f. Azure DevTest labs
    i. Dev-test environment

7. Azure resource manager (ARM)

Infrastructure as code (IaC) - manage your IT infrastructure using configuration files, i.e. write a code script to configurate and manage your infrastructure (server, OS, storage ect.) rather than manually

a. Azure resource manager (ARM)
    i. Create Azure resource using JASON template

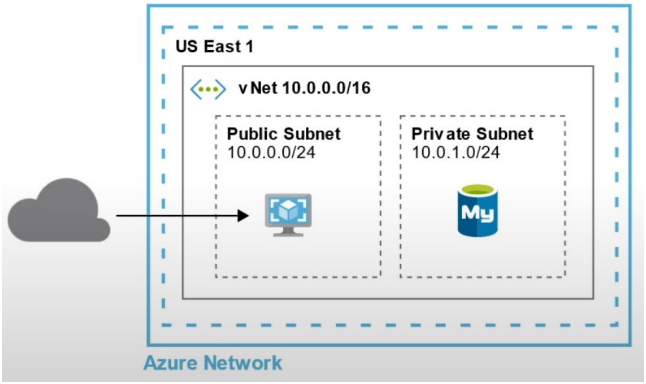
8. Azure QuickStart templates

Azure QuickStart = a library of pre-made **ARM templates** provided by **community** to quickly lunch new projects

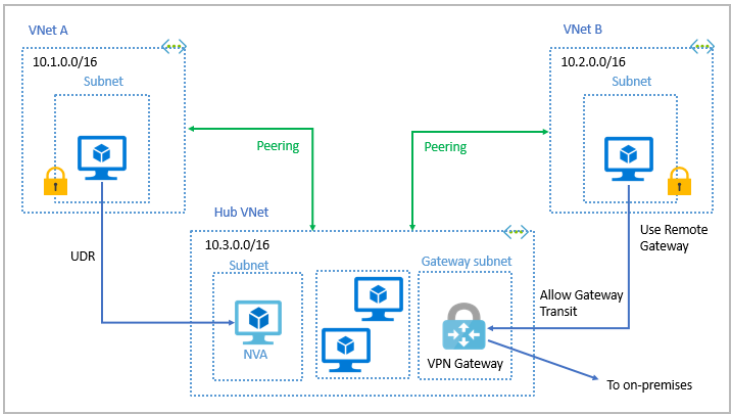
- e.g. template to deploy web app on Linux w Azure Database

9. Azure Virtual Network (VNet) and Subnets

a. VNet - enables private networks, allow Azure resources (e.g. VM) to securely communicate with each other, the internet, and on-premises networks. You need to choose a **range of IP using CIDER range**
    i. e.g. CIDER range of 10.0.0.0/16 = 65536 IP address , if change 16 to 24, less IP addresses you get
b. Subnet - when you break up your IP range for VNet into smaller networks. The Subnet CIDER range needs to be smaller than the VNet represent their portion, e.g. 10.0.0.0/24 = 256 IP address
    i. Public subnet - reach the internet (e.g. web app)
    ii. Private subnet - do not reach internet (e.g. database)
    iii.



Isolation and segmentation	VNet to Subnets
Internet communications	To enable connections - define a public IP address or a public load balancer To manage VM - connect via the **Azure CLI, Remote Desktop Protocol, or Secure Shell**

Communicate between Azure resources	**Virtual networks** - connect not only VMs but other Azure resources Service endpoints - connect to other Azure resource types资源类型 (e.g. Azure SQL databases and storage accounts) - can link multiple Azure resources to VM to improve security and provide optimal routing between resources
Communicate with on-premises resources (local to cloud)	**Point-to-site VPN -** from a computer outside your organization, back into your corporate network = client side initiates an encrypted VPN connection to connect that computer to the Azure VNet **Site-to-site VPN -** links your local VPN device / gateway to the Azure VPN gateway in a VNet. The devices in Azure looks like being on the local network, but actually connection is encrypted, connection is through the internet **Azure ExpressRoute** - when need greater bandwidth 宽带 and higher level security, doesn't travel over the internet
Route network traffic	路由（routing）就是通过互联的网络把信息从源地址传输到目的地址的活动 By default, Azure routes traffic between subnets on any connected VN, on-premises networks, and the internet **Route tables** - allows you to define rules about how traffic should be directed. Can customised control how packets 数据包 are routed between subnets. **Border Gateway Protocol Border Gateway Protocol (BGP)** works with Azure VPN gateways or ExpressRoute to propagate on-premises BGP routes to Azure virtual networks.
Filter network traffic	Filter筛选 traffic between subnets by using the following approaches: **Network security groups -** an Azure resource, can contain multiple inbound 入站 and outbound 出站 security rules. You can define these rules to allow or block traffic, based on factors such as source and destination IP address, port, and protocol. **Network virtual appliances** 网络虚拟设备 - a specialized VM that can be compared to a hardened network appliance 强化网络设备. A network virtual appliance carries out a particular network function, such as running a firewall or performing **wide area network (WAN)** 广域网 optimization.
Connect virtual networks	Can link VNets together by using **virtual network peering,** these VNets can be in separate regions, so you can create a global interconnected network through Azure. UDR is **user-defined Routing** 用户定义的路由. UDR is a significant update to Azure's Virtual Networks as this allows network admins to control the routing tables between subnets within a VNet, as well as between VNets, thereby allowing for greater control over network traffic flow 

10. Cloud native networking services

a. Azure DNS
   i. Domain Name System (DNS) translates human readable domain names (for example, www.amazon.com) to machine readable IP addresses (for example, 192.0.2.44)
   ii. Azure DNS hosts your domains in Azure. So you can manage your DNS records w the same credentials, APIs, tools, and billing as your other Azure service

b. Azure VNet

c. Azure load balancer
   i. OSI level 4 - only transport level

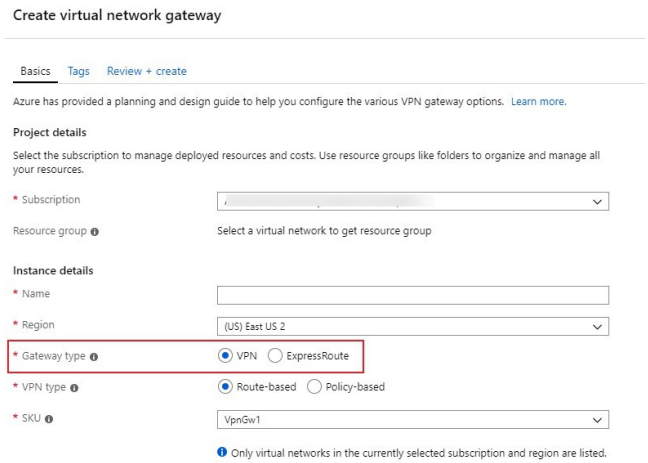
d. Azure Application Gateway
   i. OSI level 7 (HTTP) load balancer, web traffic load balancer that enables you to manage traffic to your web applications

e. Network security groups
   i. Protect your subnet using virtual firewall

11. Enterprise / hybrid networking services

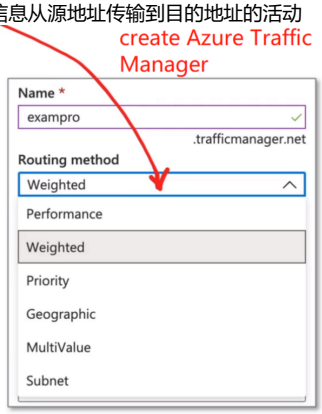
a. Azure front door
   i. Scalable and secure entry point for fast delivery of your global web applications

b. Virtual Network Gateway - Can be policy-based (specify IP) or route-based
   i. VPN gateway
      i. Connect on-prem to VNet via **site to site**
      ii. Connect device outside your organization to VNet via **point to site**
      iii. Connect VNet to VNet via **network to network**
   ii. Azure Express Route
      i. A **SUPER FAST** connection between your on-prem to Azure cloud from 50 Mbps to 10 Gbps
      ii. Secure - doesn't travel over the internet

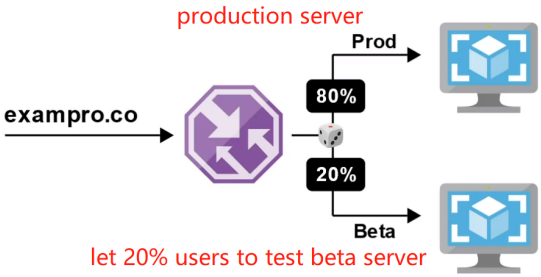


12. Azure traffic manager

ATM operates as the DNS layer, quickly direct incoming DNS request based on **routing method** of your device
路由（routing）就是通过互联的网络把信息从源地址传输到目的地址的活动



- You can route traffic to severs that are geographically nearby to reduce latency
- Failover to backup systems if primary systems become unhealthy
- Route to random VM to simulate A/B testing

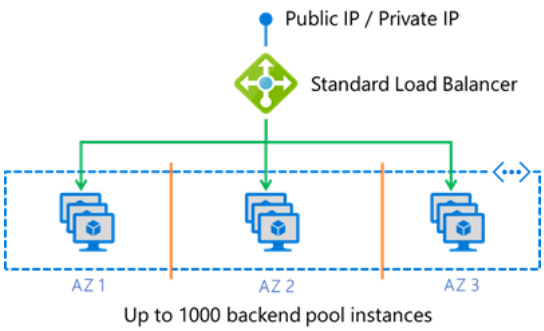


13. Azure DNS

Allows you to host your domain names on Azure
You can create DNZ zones and manage your DNS records

14. Azure load balancer

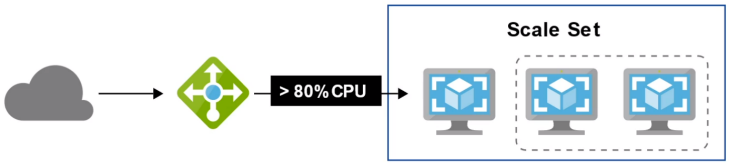
a. Used for evenly distributing **incoming network traffic** across a group of backend resources or servers
b. Operates on **OSI Layer 4 (transport)** - doesn't understand HTTP requests
c. Public load balancer
  i. incoming traffic from the internet to public-facing server (i.e. Server w public IP address)
d. Internal (private) load balancer
  i. Incoming internal traffic to private-facing server (Private IP)



15. Scale sets

a. Can group identical VMs together and **automatically increase / decrease the amount of servers** based on
   i. Change in CPU, memory, disk, network performance
   ii. On a predefined schedule - Elasticity

E.g. load balancer determines internet traffic that the current load of the existing server is > 80% of the CPU utilisation, then the scale set will **automatically** add more servers.



16. IoT services

IoT = a network of internet connected objects (usually hardware) able to collect and exchange data

- Smart switches
- Smart bulbs
- Smart fridges
- Voice command speaker e.g. Alexa

a. IoT central
   i. Connect your IoT devices to cloud
b. IoT hub
   i. Secure communication between your IoT apps and devices it manage
c. IoT edge
   i. Built on IoT hub, allows data processing and analysis nearest the IoT devices
   ii. Edge computing = offload compute from cloud to local computing hardware e.g. IoT device / home computers / phones
d. Windows 10 IoT core services
   i. Cloud services subscription to commercialize a device on **Windows 10 IoT core**
   ii. long-term OS support to manage device updates /access device health

17. AL/ML services

AL = machines perform jobs mimics human behaviour
ML = machines get better at a task without explicit programming
DL = artificial neural network inspired by human brain to perform complex tasks

a. Azure Machine learning service

i. A service that simplifies running AL/ML related workloads, allows you to build flexible pipelines to automate workflow
ii. Azure machine learning studio (classic)
   i. An older service that manages AL/ML workloads, no pipeline, workload not easily transferable from classic to other new services

b. AI services

i. Personalizer - An AI service Improve user experiences with real-time learning
ii. Translator - real-time multi-language text translation
iii. Anomaly detector - detect anomalies in data
iv. Azure Bot service - build intelligent, enterprise-grade bots with ownership and control of your data
v. Form recogniser - automate extraction of text, key/ values pairs and tables from your documents
vi. Computer vision - Extract rich information from images and videos
vii. Language understanding - build natural language understandings into apps / bots and IoT devices
viii. QnA Maker - conversational question-and-answer bot from your existing content
ix. Text Analytics - extract info such as sentiment, key, phrases, named entities and language fromtxt
x. Content moderator - moderate text and images to provide safer, more positive user experience
xi. Face - detect / identify people and emotions in images
xii. Ink Recogniser - recognise digital ink content e.g. Handwriting, shapes etc.

18. Serverless services

- infrastructure management tasks like capacity provisioning and patching are handled by the cloud service provider (CSP), you can focus on only writing code that serves your customers, so it becomes **HA, scalable and cost-effective**
- Serverless computing generally encompasses 3 things:
  a. Event-driven scale
     i. Good fit for workloads that respond to **incoming events & triggers**, e.g.
        i. timers e.g. if a function needs to run every day at 10:00 AM UTC
        ii. queues e.g. with order processing)
        iii. HTTP e.g. API and webhook scenarios
     ii. The platform **automatically** schedules the function to run and scales the number of compute instances based on the rate of incoming events.
  b. Abstraction of servers
     i. The VM that's running your code isn't explicitly allocated to you. Your code is executed on VM, then it's moved off -**HA**
  c. Micro-billing
     i. Pay only for the time their code runs - billing into microseconds

Azure implementations of serverless compute:

Azure Functions

- You **write code** to complete each step (don't need to worry about underlying infrastructure) - can execute code in almost any modern language
- Either stateless or stateful
  - **Stateless (the default),** behave as if r**estarted every time** responding to an event
  - **Stateful** (called Durable Functions), Has a context to track prior activity.

Azure Logic Apps

- **Use a GUI** to define the actions and how they relate to one another, can execute logic blocks triggered by Azure services without writing any code
- **Stateful**

Blob storage

- Serverless object storage, just upload file, don't need to worry about underlying file-systems, resizing

Event grid

- Use Pub/Sub messaging systems to allow you to react to events and trigger other Azure cloud service such as Azure Function