

# Class notes 8/21-8/31

## What is Cloud?

- virtual servers
- computer resources over the internet
- virtual storage space
- computer spread out on the internet
- enables store data, computational power
- hardware agnostic

## Popular Cloud providers

- google cloud
- AWS
- microsoft azure
- oracle cloud

## Growth in Cloud...

“ according to Gartner, the worldwide infrastructure services market grew by 29.7 % to hit a total of 120.3 billion during 2022, up from 92.8 billion the previous year. “

## Higher earning potential for cloud engineers...

—>Average annual US salary of 101,526 according to ZipRecruiter

—> according to Glassdoor, Azure cert. could boost your earning potential .

Below are US salaries for other Azure-certified cloud-based roles...

1. Azure DevOps engineer: \$126,096
2. Azure cloud engineer: \$130,233
3. Azure data engineer: \$122,746

## **What is expected of a AZ-900 professional?**

→ can describe Azure architectural components and azure architectural components and services

- compute
- networking
- services

→ can describe features and tools to...

- secure
- govern
- administer Azure

Taking the Azure Cert is the starting point in a journey towards a career in Azure

## **Describe Cloud concepts (25-30%) - module 1**

- cloud computing
- benefits of cloud computing
- cloud service types

### **describe cloud computing**

- define cloud computing

- describe shared responsibility model
- define cloud models {public, private, hybrid}
- identify appropriate use cases for each cloud model
- describe the consumption based model
- compare cloud pricing models
- describe serverless

## What is cloud computing ?

is the delivery of the computing services over the internet

what are computing services?

→ IT infrastructures → virtual machines (VMs), storage, databases, and networking

Cloud services expand traditional IT services → internet of things (IoT), machine learning (ML), and artificial intelligence (AI)

\*\*\*Cloud computing uses internet to deliver these services, it doesn't have to be constrained by physical infrastructure the same way that a traditional datacenter is.

\*\*meaning if you need to increase your IT infrastructure rapidly you don't have to wait to build a new data center—you can rapidly expand your IT footprint

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## Describe the shared responsibility model...

→ Typical DataCenter or an IT lab has to take care of the following...

1. physical security, power, cooling, network connectivity, physical hardware
2. software on servers like OS, database systems, security software like firewall, antivirus softwares etc.
3. enterprise apps that use OS and infrastructure to provide services to customers

## **Shared responsibility (SaaS)**

### **SOFTWARE AS A SERVICE**

Customer always has the responsibility for.

1. information and data stored in the cloud
2. devices that are allowed to connect to your cloud (cell phones, computers, etc.)
3. the accounts and identities of the people, services, and devices

Ex: Netflix on AWS

the streaming software built by Netflix has to be maintained by Netflix

## **Shares responsibility cont. (LaaS)**

### **LOGGING AS A SERVICE**

Cloud provider always has the responsibility for..

1. the physical datacenter
2. physical network
3. physical host

Ex: Netflix on AWS, discuss responsibilities

## **Shared responsibilities cont. (PaaS)**

### **PLATFORM AS A SERVICE**

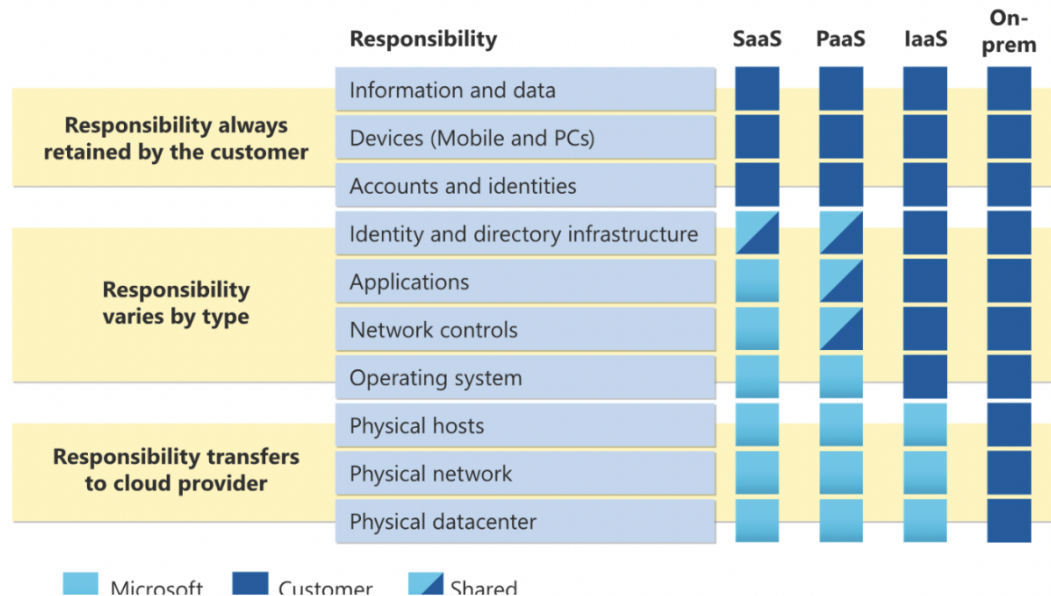
service model defines the responsibility of the following

1. operating system
2. network controls
3. applications

#### 4. identity and directory infrastructure

ex: netflix on aws

it uses Amazon Simple Email Service (Amazon SES) to send emails to customers



## Cloud Models

- Private
- Public
- Hybrid
- Multi-cloud (becoming more popular)

Private →

is a cloud (delivering IT services over the internet) that is used by a single entity. Private cloud provides much greater control for the company and its IT department

Public →

public cloud is built, controlled, and maintained by the third party cloud provider. with a public cloud anyone that wants to purchase cloud services can access and use

resources. the general public availability is a key difference between public and private cloud services

Hybrid →

is a computing environment that uses both public and private clouds in an inter-connected environment

\*\*\*hybrid cloud environment can be used to allow a private cloud to surge for increase, temp demand by deploying public cloud resources. Hybrid cloud can be used to provide an extra layer of security.

ex:

users can flexibility choose which services to keep in the public cloud and which to deploy on their private cloud infrastructure

→ Multi-Cloud Providers

maybe you use different features from different cloud providers. or maybe you started you cloud journey with one provider and are in the process of migrating to different provider. Regardless in a multi-cloud environment you deal with two (or more) public cloud providers and manage resources and securities in both environments

## Candidates for hybrid cloud

1. organizations that already have a massive investment in infrastructure...

it will like to use mobility and opportunities for collaboration

ex: education sector, universities etc.

2. organizations that are facing increasingly stringent requirements regarding privacy and enforcement to protect confidential data.

ex: healthcare sector, patient information is highly sensitive

3. organizations that have to keep sensitive data on-premise to satisfy compliance requirements. However, would like to expand their infrastructure and have scalability and connectivity

## Mini quiz

Please categorize between public, private and hybrid

1. Applications can be quickly provisioned and deallocated  
(public, private and hybrid)
2. Organizations pay only for what they use  
(public, hybrid)
3. Organizations determine where to run their applications  
(hybrid)
4. organizations control security, compliance or legal requirements  
(private, private !)
5. organizations have complete control over resources and security  
(private, private )
6. data is not co-located with other organizations data  
(private, private)
7. hardware must be purchased for startup and maintenance  
(private)
8. organizations are responsible for hardware maintenance and updates  
(private)
9. provides the most flexibility  
(hybrid)
10. organizations don't have complete control over resources and security  
(public)

## **Serverless computing**

enables developers to build applications faster by eliminating the need for them to manage infrastructure.

with server-less applications, the cloud service provider automatically

→ provisions

→ scales

→ manages infrastructure required to run the code

## **What is Azure Arc?**

is a set of technologies that help manage your cloud environment.

Azure Arc can help manage your cloud environment

- whether its a public cloud solely on Azure
- a private cloud in your datacenter
- hybrid config
- multi-cloud environment running on multiple cloud providers at once.

## **Azure VMware Solutions**

if you're already established with VMware in a private cloud environment but want to migrate to a public or hybrid cloud

→ Azure VMware solutions lets you run your VMware workloads in azure with seamless integration and scalability

## **Describe the consumption based model**

Two types of expenses to consider:

1. capital expenditure (CapEx)
2. operational expenditure (OpEx)

cloud computing operates on a consumption-based model.

## **Advantages of OpEx**

1. no upfront costs
2. no need to purchase and manage costly infrastructure that users might not use to its fullest potential.
3. the ability to pay for more resources when they're needed.
4. the ability to stop paying for resources that are no longer needed.



## **Traditional Datacenter**

discuss the limitations of traditional datacenter in terms of...

1. budgets
2. operational challenges
3. constraints on the growth of business
4. misuse/ inefficient use of the hardware and software resources

## **Cloud vs traditional Data center**

In traditional Datacenter:

you try to estimate your future resource needs. if you overestimate you spend more on your datacenter than you need to and potentially waste money. if you underestimate your datacenter will quickly reach capacity and your applications and services may suffer from decreased performance. Fixing an under-provisioned datacenter can take a long time. you may need to order, receive, and install more hardware. You'll also need to add more power, cooling, and networking for the extra hardware

vs.

Cloud Base model:

you don't need to worry about getting the resources just right. if you find that you need more virtual machines you add more. if the demand drops and you don't need as many VMs you can remove them as needed. either way you just pay for the VMs that you're actually using, not the 'extra capacity' that the cloud provider has on hand.

## **Cloud Computing**

is the delivery of computing services over the internet by using a pay-as-you go pricing model. you typically pay only for the cloud services you use.

This helps:

1. plan and manage your operating costs

2. run your infrastructure more efficiently
3. scale as your business needs change

Cloud computing is a way to rent compute power and storage from someone else's datacenter. you can treat cloud resources like you would your own datacenter. however, unlike your own datacenter when you're done using cloud resources you give them back. you're only billed for what you use.

instead of maintaining CPUs and storage in your datacenter, you rent them for the time you need them. The cloud provider takes care of maintaining the underlying infrastructure for you. the cloud enables you to quickly solve your toughest business challenges and bring cutting edge solutions to the user.

## **Benefits of using cloud services**

1. high availability and scalability in the cloud
2. reliability and predictability in the cloud
3. benefits of security and governance in the cloud
4. benefits and manageability in the cloud

## **High availability and Scalability**

when building or deploying a cloud application, two of the biggest considerations are uptime(or availability) and the ability to handle demand (scalability)

1. high availability focuses on ensuring maximum availability regardless of disruptions or events that may occur.
2. when you're architecting your solution you'll need to account for service availability guarantees. azure is a highly available cloud environment with uptime guarantees depending on the service. these guarantees are part of the service level agreements (SLAs)

## **Service level Agreements (SLA)**

this is an agreement between the customer and a cloud vendor on the server uptime and penalties for breaching the uptime agreements

typically customers would want 99% uptime per week. this means that they allow a down time of 1.68 hours per week.

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## Scalability

Vertical Scaling:

with vertical scaling if you were developing an app and you needed more processing power, you could vertically scale up to add more CPUs or RAM to the VM. conversely if you realized you had over specified the needs you could vertically scale down by lowering the CPU or RAM specifications

Horizontal scaling:

if you suddenly experience a steep jump in demand your deployed resources could be scaled out (either automatically or manually).

Ex:

you can add additional VMs or containers, scaling out. in the same manner, if there was a significant drop in demand, deployed resources could be scaled in either automatically or manually, scaling in!

## Reliability and predictability in the cloud

Reliability :

is the ability of a system to recover from failures and continue to function. it is also the pillars of Microsoft Azure Well - Architecture Framework

with a decentralized design, the cloud enables you to have the resources deployed in the regions around the world. With this global scale even if one region has a catastrophic event other regions are still up and running. Also known DISASTER RECOVER PLAN!

Predictability:

predictability in the cloud lets you move forward with confidence:

you can forecast

1. performance

## 2. cost

both performance and cost predictability are heavily influenced by the Microsoft Azure Well-Architected Framework

## Performance

performance predictability focuses on predicting the resources needed to deliver a positive experience for your customers.

→ support performance predictability

1. autoscaling → deploy additional resources to meet the demand, scale back when the demand drops
2. load-balancing → if traffic is heavily focused in one area, this can help redirect some of the overload to less stressed areas
3. high availability

if you suddenly need more resources you can do the above

## Cost

predicting and forecasting the cost of cloud spend

with cloud you can

1. track your resource use in real-time,
2. monitor resources to ensure you're using them in the most efficient way
3. apply data analytics to find patterns and trends that help better plan resource deployments

By operating in the cloud and using cloud analytics and information you can predict future cost and adjust your resources as needed.

tools you can use is:

1. total cost of ownership (TCO)
2. pricing calculator → gives you an estimate of cloud spend

## Security

you can find a solution that matches your security needs

if you want maximum security (IaaS) → provides you with physical resources but lets you manage the operating system and installed software including patches and maintenance

if you want patches and maintenance taken care of (PaaS) or (SaaS) deployments may be the best cloud strategies for you

cloud is intended as an over-the-internet delivery of IT resources, cloud providers are typically well suited to handle things like

1. distributed denial of a service (DDoS) attacks

this makes your network more robust and secure

## **Governance**

making sure deployed resources meet the corporate standards and government regulatory requirements

Ex:

1. general data protection regulation (GDPR) compliance
2. payment card industry (PCI) compliance
3. regulatory compliance in health care (very personal information )

cloud based auditing helps flag any resources that are out of compliance with your corporate standards and provides mitigation strategies.

depending on your operating model software patches and updates also automatically be applied which helps with both governance and security

## **Benefits manageability in the cloud**

two type of manageability

1. management of the cloud
2. management in the cloud

## **Management OF the cloud**

1. automatically scale resource deployment based on need

2. deploy resources based on preconfigured template, removing the need for manual configuration
3. monitor the health of resources and automatically replace failing resources
4. receive automatic alerts based on configured metrics, so you're aware of performance in real time

## **Management IN the cloud**

Tools:

1. through the web portal
2. using the command line interface
3. using APIs
4. using Powershell

## **Infrastructure as a Service (IaaS)**

is the most flexible category of cloud services, as it provides you the maximum amount of control for your cloud resources

the cloud provider is responsible for

1. maintaining the hardware
2. network connectivity (to the internet)
3. physical security

the user is responsible for everything else

1. operating system installation
2. configuration
3. maintenance
4. network configuration
5. database and storage configuration etc...

essentially you're renting the hardware in the cloud datacenter, but what you do with the hardware is up to you

ex:

1. lift-and-shift migration: you're standing up cloud resources similar to your on-prem datacenter. then simply move the things running on-prem to running on the IaaS infrastructure
2. testing and deployment: you have established configs for deployment and test environments that you need to rapidly replicate. you can stand up or shut down the different environments rapidly with the IaaS structure, while maintaining complete control

## Platform as a Service (PaaS)

is a middle ground between renting space in a datacenter (IaaS) and paying for a complete and deployed solution (SaaS).

PaaS environment, the cloud provider maintains

1. the physical infrastructure
2. physical security
3. connection to the internet
4. operating systems
5. middleware
6. development tools
7. business intelligence services that make up the cloud services

In PaaS

you don't have to worry about licensing or patching for the operating systems and databases

is well suited to provide complete development environment without the headache of maintaining all the development infrastructure

ex:

1. development framework: provides a framework that developers can build upon to develop and customize cloud-based applications. **similar to the way you create an excel macro PaaS lets developers create applications using built in software**

**components. this cloud feature allows for scalability, high availability, and multi-tenant capability reducing the amount of coding developers must do**

2. analytics and business intelligence: tools provided as a service with PaaS allow the organization to analyze and mine their own data, finding insights and patterns and predicting outcomes to improve forecasting, product design decisions, investment returns and other business decisions

## **Software as a Service (SaaS)**

is the most complete cloud service model from a product perspective. with SaaS you're essentially renting or using fully developed application.

1. emailing
2. messaging applications
3. financial software (finance and expense tracking)
4. business productivity applications
5. connectivity software

while SaaS may be the least flexible it's also the easiest to get up and running. it requires the least amount of technical knowledge or expertise to fully employ.

## **What is Azure?**

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Provides more than 100 services that enable you to do everything from running your existing application's on VMs to explore new software paradigms such as intelligent bots and mixed reality

Azure provides AI and machine learning (ML) services that can naturally communicate with your users through vision, hearing, speech.

it also provides storage solutions that dynamically grow to accommodate amounts of data



Core Architectural components of Azure may be broken down into two main groupings.

1. physical infrastructure
2. management infrastructure

## **Physical Infrastructure**

datacenters:

8/31 Azure Fundamentals Class notes

summary: last night's class

1. Azure regions, region pairs and sovereign regions
2. availability zones
3. azure datacenter
4. azure resources
5. management groups

## **Azure Compute and Networking Services**

we will learn three compute options

1. virtual machines- vm scale sets, vm availability sets, Azure Virtual desktop (options)
2. container instances (kinda like dockers)
3. azure functions (serverless containers)

## **Learning objectives**

1. compare compute types

2. describe vm options - vm, vm scale sets, vm availability sets, Azure Virtual desktop
3. describe application options
4. describe resources required for virtual machines
5. describe hosting options - azure web apps
6. describe virtual networking- azure virtual networks, azure virtual subnets, peering, azure dns, VPN gateway, and ExpressRoute
7. define public and private endpoints

## **Describe Virtual Machines**

provide infrastructure as a service (IaaS). Just like a physical gives total control

### **Easily scale VMs in Azure**

individual vms can be run for testing, development or minor tasks

vms could be grouped together to provide high availability or decrease in response to demand

can also be set to scale based on a defined schedule (awesome thing to have!)

VMs can auto deploy a load balancer to make sure

### **VM availability sets**

are designed to ensure that VMs stagger updates and have varied power and network connectivity, preventing you from losing all your VMs with a single network or power failure

VMs grouping in two ways:

1. update domain

## 2. fault domain

### **Update Domain**

groups VM that can be rebooted at the same time. It allows to to apply updates while knowing that only one update domain grouping will be offline at a time.

ex:

if you have two update with VMs in then you can update the machines at different times and still be able to work on any of the machines you already have

### **Fault Domain**

groups your VMs by common power source and network switch. By default and availability set will split VMs across up to three fault domains. this helps protect against a physical power or network failure!

### **Describe Azure Virtual Desktop**

is a desktop and application virtualization service that runs on the cloud. it enables you to use a cloud-hosted version of windows from any location. Azure Virtual Desktop works across devices and operating systems. works with apps that you can use to access remote desktops or most modern browsers

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### **Enhance Security**

Azure virtual desktop provides centralized security management for users desktops with Azure active directory(Azure AD)

you can enable multi-factor authentication (MFA)

data and apps are separated from the local hardware. actual desktop and apps are running in the cloud, meaning the risk of Confidential data being left on a personal

device is reduced. user sessions are isolated in both single and multi-session environments

multi-session environment- multiple users are working on the same instance

## **windows 10/11 support**

Azure VD lets you use windows 10/11 enterprise multi-session. the only windows client based operating system that enables multiple concurrent users on a machine.

## **Azure Containers**

are virtualization environments. much like running multiple VM on a single physical or virtual host. unlike VM you don't manage the operating system for a container.

with container you can quickly restart if there is a crash or hardware interruption. one of the most popular container engines is Docker which is supported by azure.

portability

cluster orchestration (k8s)- have different environments

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## **Container Instances**

\*\*\*revisit

## **Choosing your solution**

create solutions by using micro-service architecture. this architecture allows you to break solutions into smaller independent pieces.

ex

you might split a website into container hosting your front end, backend and third is for storage. this split allows you to separate portions of your app into logical sections that can be maintained, scaled and updated independently.

imagine your websites backend has reached capacity but your front-end and storage aren't being stressed. with containers you can scale the back end separately to improve performance. you can also change the storage service or modify the front end without impacting other components

## **Azure Functions**

event driven, server-less compute option that doesn't require maintaining VM or containers. If you build an app using VMs or containers those resources have to be running in order for your app to function. with azure functions an event wakes the function, alleviating the need to keep resources provisioned when there are no events

infrastructure as a service → platform as a service → software as a service

### **Benefits**

ideal when youre only concerned abt the code running your service and not about the underlying platform or infrastructure. Functions are commonly used when you need to perform work in response to an event (often via REST request)

## **Azure Functions**

functions scale automatically based on demand

runs your code when it triggered and auto dellocates resources when the function is finished- youre only charged for the CPU time used when you function runs

functions can either be stateless or stateful

stateless- no memory/restart every time/ fast food

stateful- data is saved/ track prior activity/ fine-dining restaurant

## Serverless computing (tool)

functions are key component in serverless computing. they're general compute platform for running any type of code. A developer can easily st

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## Application hosting options

Azure app service

you build and host web apps, background jobs, mobile back-end, and RESTful APIs in the programming language of your choice without managing infrastructure.

it offers automatic scaling and high availability.

supports windows and linux

enables automated deployment in Github, azure DevOps or any git repo to support a continuous deployment model (CI/CD)

robust hosting option where you can host apps on azure, lets you focus on building apps, azure focus

App services-support features

deployment and management are integrated into the platform

endpoints can be secured

sites can be scaled quickly to handle high traffic loads

built in load balancing and traffic manager provide high availability

all of these app styles are hosted in the same infrastructure and share these benefits. this flexibility makes app service the ideal choice to host web-oriented applications

## API apps

much like hosting websites you can built a REST-based API by using your choice of language and framework. you get full swagger support and the ability to package and publish your API AZURE marketplace. the produced apps can be consumed from any HTTP or HTTPS based clients .

(look up what swagger and figma)

## **WebJobs**

you can use webjobs feature (.exe, Java, PHP, Python, or node.js) or script (.cmd, .bat, powershell, or bash) in the same context as a web app, API app, or Mobile app. they can be sceduled or run by a trigger. Webjobs are often used to run background tasks as part of your application logic.

look up what a Background job vs. a scheduled job

## **Mobile apps (saaS)**

feature of app service to quickly build a back end for iOS and android

# **Install Java and install Eclipse:**

<https://adoptium.net/temurin/releases/>

when you develop any software using java you can put it on the cloud. running from the cloud

eclipse is an ide

java community or java enterprise (we all install this one)

java 20 community edition

java 17 - LTS

download jdk .pkg file

jre? unzip to folder?

<https://www.eclipse.org/downloads/>

quiz on tuesday - advise study the slide deck