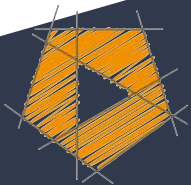


# AZ-900 Microsoft Azure Fundamentals

Scott Duffy, Instructor



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Exam version *May* 2022



v3 of course



# Microsoft Azure Fundamentals

“foundational level knowledge of cloud services and how those services are provided with Microsoft Azure”

# Microsoft Azure Fundamentals

- Candidates with non-technical backgrounds
- Candidates with a technical background who have a need to validate their foundational level knowledge around cloud services

# Microsoft Azure Fundamentals

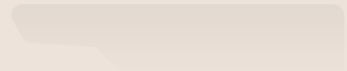
- Describe cloud concepts
- Describe Azure architecture and services
- Describe Azure management and governance

You'll be prepared to take  
and pass the AZ-900 exam



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Created by Adrien Coquet



But you don't have to, if  
you just want to learn  
cloud concepts



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# What is the Cloud?





**There is no cloud**  
it's just someone else's computer

# The ability to rent computing resources - on demand



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# What Does “Computing Resources” Mean?

Windows and Linux Servers

Unlimited File Storage

Databases

Queues

Content Delivery Network

Batch Processing Jobs



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# What Computing Resources?

Big Data - Hadoop

Media Services

Machine Learning

Chat Bots

Cognitive Services



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# 1000+

Azure Service options



# Exam AZ-900: Microsoft Azure Fundamentals

Candidates for this exam should have foundational knowledge of cloud services and how those services are provided with Microsoft Azure. The exam is intended for candidates who are just beginning to work with cloud-based solutions and services or are new to Azure.

Azure Fundamentals exam is an opportunity to prove knowledge of cloud concepts, Azure services, Azure workloads, security and privacy in Azure, as well as Azure pricing and support. Candidates should be familiar with the general technology concepts, including concepts of networking, storage, compute, application support, and application development.

Azure Fundamentals can be used to prepare for other Azure role-based or specialty certifications, but it is not a prerequisite for any of them.

You may be eligible for ACE college credit if you pass this certification exam. See [ACE college credit for certification exams](#) for details.

## Important

The English language version of this exam will be updated on May 5, 2022. Please download the skills measured document below to see what's changing.

Passing score: 700. [Learn more about exam scores.](#)

# Free Study Resources

Located at the end of the course:

- Free PDF Study Guide
- Download the slides and MP3 audio if you like to study offline
- 50 question practice test



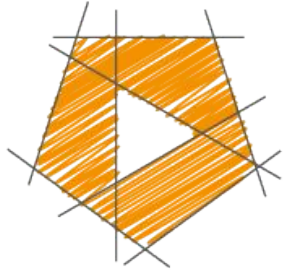
**Section 15: Thank You!** ^

3 / 6 | 16min

- ☒ 63. Thank you!  
2min
- ☐ 64. An Overview of Azure Certifications (June 2021)  
14min
- ☐ Practice Test 1: 50 Question Practice Test
- ☐ 65. Other Exam Resources  
1min
- ☒ 66. Course Resources - Study Guide, Slides, Audio  
1min
- ☒ 67. Bonus: 50+ Hours of Hands-On Azure Practice for AZ-900  
1min

Resources ▾

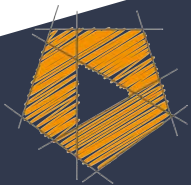




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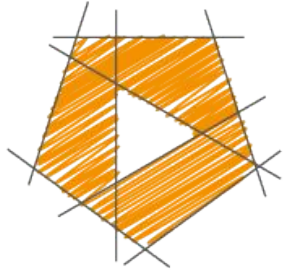
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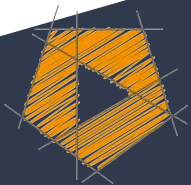
Let's have a look at  
“The Cloud”



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# Describe Cloud Concepts (25-30%)



## **Describe cloud concepts (25–30%)**

### **Describe cloud computing**

- define cloud computing
- describe the shared responsibility model
- define cloud models, including public, private, and hybrid
- identify appropriate use cases for each cloud model
- describe the consumption-based model
- compare cloud pricing models

### **Describe the benefits of using cloud services**

- describe the benefits of high availability and scalability in the cloud
- describe the benefits of reliability and predictability in the cloud
- describe the benefits of security and governance in the cloud
- describe the benefits of manageability in the cloud

### **Describe cloud service types**

- describe infrastructure as a service (IaaS)
- describe platform as a service (PaaS)
- describe software as a service (SaaS)
- identify appropriate use cases for each cloud service (IaaS, PaaS, SaaS)

# Define Cloud Computing





# Shared Responsibility Model



When you run  
services in your own  
office...

you are responsible  
for:

Building security

Physical network security

Physical computer security

Operating system patches

Network and Firewall settings

Application settings

Authentication platform

User accounts

Devices

Data

When you run  
services in the cloud  
using a VM...

you are responsible  
for.

~~Building security~~

~~Physical network security~~

~~Physical computer security~~

Operating system patches

Network and Firewall settings

Application settings

Authentication platform

User accounts

Devices

Data

When you run  
services in the cloud  
on an App Service...

you are responsible  
for.

~~Building security~~

~~Physical network security~~

~~Physical computer security~~

~~Operating system patches~~

Network and Firewall settings (shared)

Application settings (shared)

Authentication platform (shared)

User accounts

Devices

Data

When you use  
software as a service...  
  
you are responsible  
for.

~~Building security~~

~~Physical network security~~

~~Physical computer security~~

~~Operating system patches~~

~~Network and Firewall settings~~

~~Application settings~~

Authentication platform (shared)

User accounts

Devices

Data

# Shared responsibility model

Responsibility	SaaS	PaaS	IaaS	On-prem	
Information and data	Customer	Customer	Customer	Customer	RESPONSIBILITY ALWAYS RETAINED BY CUSTOMER
Devices (Mobile and PCs)	Customer	Customer	Customer	Customer	
Accounts and identities	Customer	Customer	Customer	Customer	
Identity and directory infrastructure	Microsoft	Microsoft	Customer	Customer	RESPONSIBILITY VARIES BY SERVICE TYPE
Applications	Microsoft	Microsoft	Customer	Customer	
Network controls	Microsoft	Microsoft	Customer	Customer	
Operating system	Microsoft	Microsoft	Customer	Customer	
Physical hosts	Microsoft	Microsoft	Microsoft	Customer	RESPONSIBILITY TRANSFERS TO CLOUD PROVIDER
Physical network	Microsoft	Microsoft	Microsoft	Customer	
Physical datacenter	Microsoft	Microsoft	Microsoft	Customer	

 Microsoft  Customer

# Public cloud



“The public cloud is defined as computing services offered by third-party providers over the public Internet, making them available to anyone who wants to use or purchase them.”



Azure owns the hardware, on  
their network and  
infrastructure

# Private cloud



“The private cloud is defined as computing services offered either over the Internet or a private internal network and only to select users instead of the general public.”

So Azure does have a private cloud offering that's called Azure stack,  
and you can purchase the stack software, install it on your own  
hardware, and you can be running a version of Azure privately

Looks and acts like a cloud, except customer owns or leases or has exclusive access to the hardware

# Hybrid cloud



“A hybrid cloud... is a computing environment that combines a private cloud with a public cloud.”

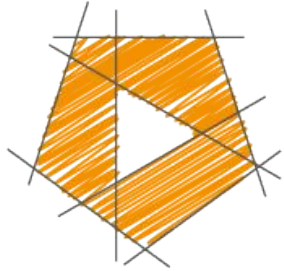
Combination of public and private clouds; scale private infrastructure to the cloud

# Compare and Contrast





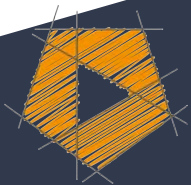
Public vs private vs hybrid



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# Cloud Pricing Models



Cloud pricing can be  
complicated

Usually any service is  
priced by 2 or 3 metrics  
combined

Example: Cosmos DB

Operations +  
Consumed Storage +  
Optional Dedicated Gateway +  
Backup Storage

## Example: Cosmos DB

Operations - 400 RU/s = \$23.36 +  
Consumed Storage - 100 GB = \$25.00 +  
Optional Dedicated Gateway = \$277.40 +  
Backup Storage - 7 backups = \$60.00



# 1. Free services

Some services are always free or have a free tier or free below a certain limit:

- Virtual network
- Private IP address
- Azure Migrate
- Inbound Internet traffic
- 5GB of outbound Internet traffic
- Azure Policy
- Azure AD
- 1 million executions Azure Functions
- Azure App Service

## 2. Pay for Time

Certain services charge by time.

- Virtual machine
- App services
- Databases
- Load balancers
- Managed storage
- Public IP address

A very common and logical way to pay for something

Some services charge by the minute or by the hour

Varies (greatly) based on the specific service you choose, performance, options, etc.

### 3. Pay per GB

In addition to time, you may also have to pay per GB used.

- Database storage
- Backups
- Unmanaged disks
- Network traffic (between regions)
- Network traffic (more than 5GB/month egress from Azure)

## 4. Pay for Operations

Each operation can also cost, a fraction of a penny.

- Unmanaged storage (reads, writes, deletes)
- Databases (queries)
- Messaging

Usually charged in bulk - per 10,000 requests, per million requests, etc - for practical reasons of cost

## 5. Pay per execution

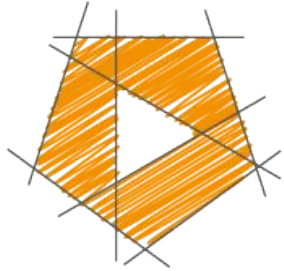
Some serverless offers just charge you for each time the program runs

- Azure Functions (consumption model)
- Serverless Databases
- Messaging Services
- Logic Apps (consumption model)

## 6. Other metrics

Active Directory Premium services charge per assigned user

Pricing changes between  
regions

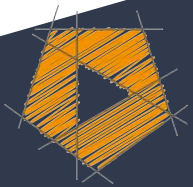


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# Benefits of Cloud Computing



# Benefits

Cost savings - both real and accounting

Availability & Scalability

Reliability & Predictability

Security & Governance

Manageability

Global reach

Range of ready on-demand services

Range of tools

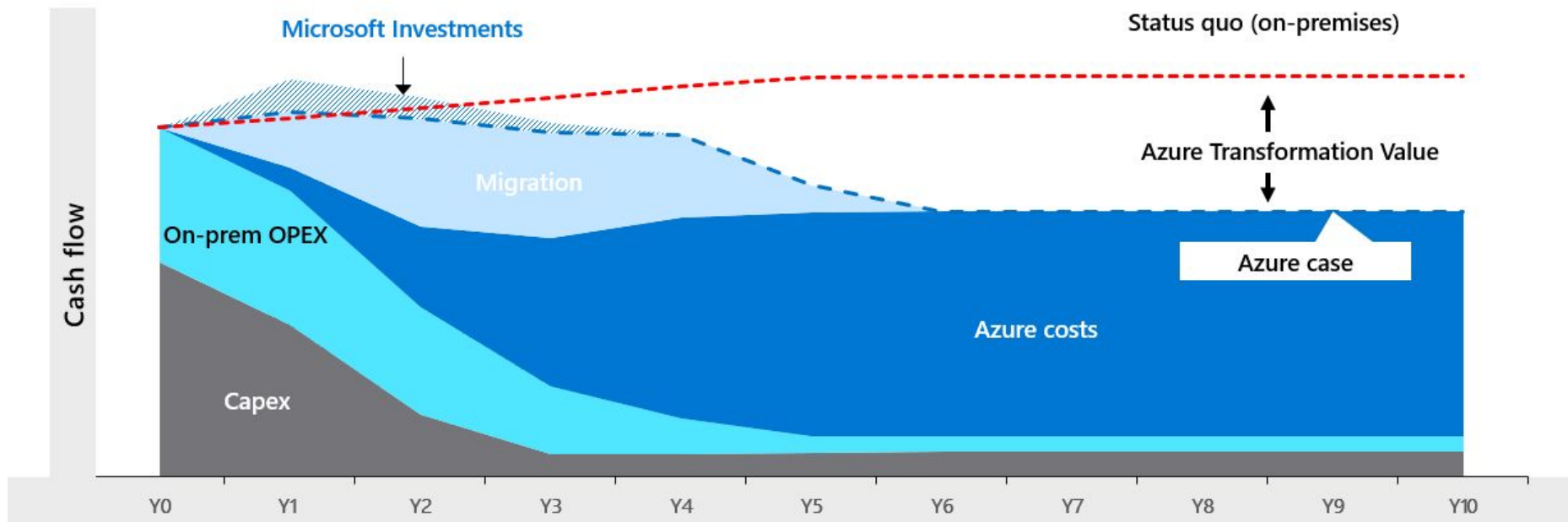


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# Cost Savings





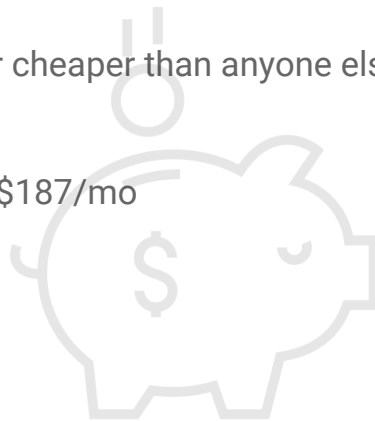
# Cost Savings – Real

Economies of scale

Total cost of ownership (TCO) - electricity, Internet, cooling, employees

Microsoft can run a server cheaper than anyone else with few exceptions

4 vCPU server - as low as \$187/mo

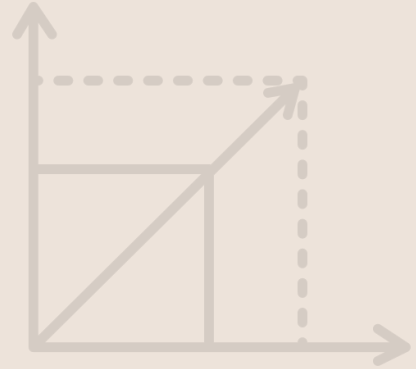


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You can take actions to  
reduce your cost -  
i.e. autoscaling



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Created by Alla Zaluska



To be continued...



# High Availability



Expressed as a percentage, it's the ability of a system to respond to users

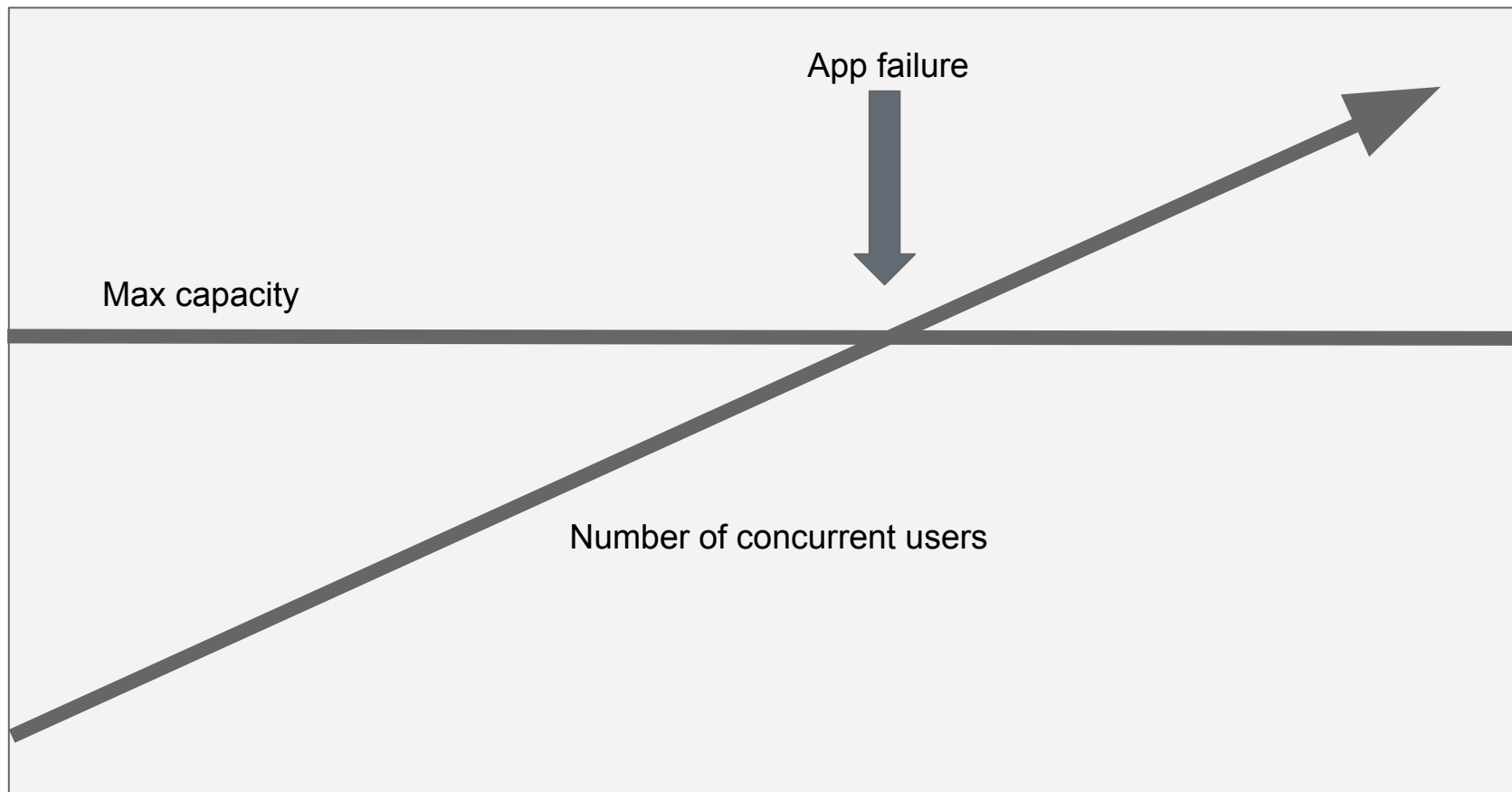
# 99.99%

Four nines, 4 minutes per month

# Scalability



The ability of a system to handle  
growth of users or work

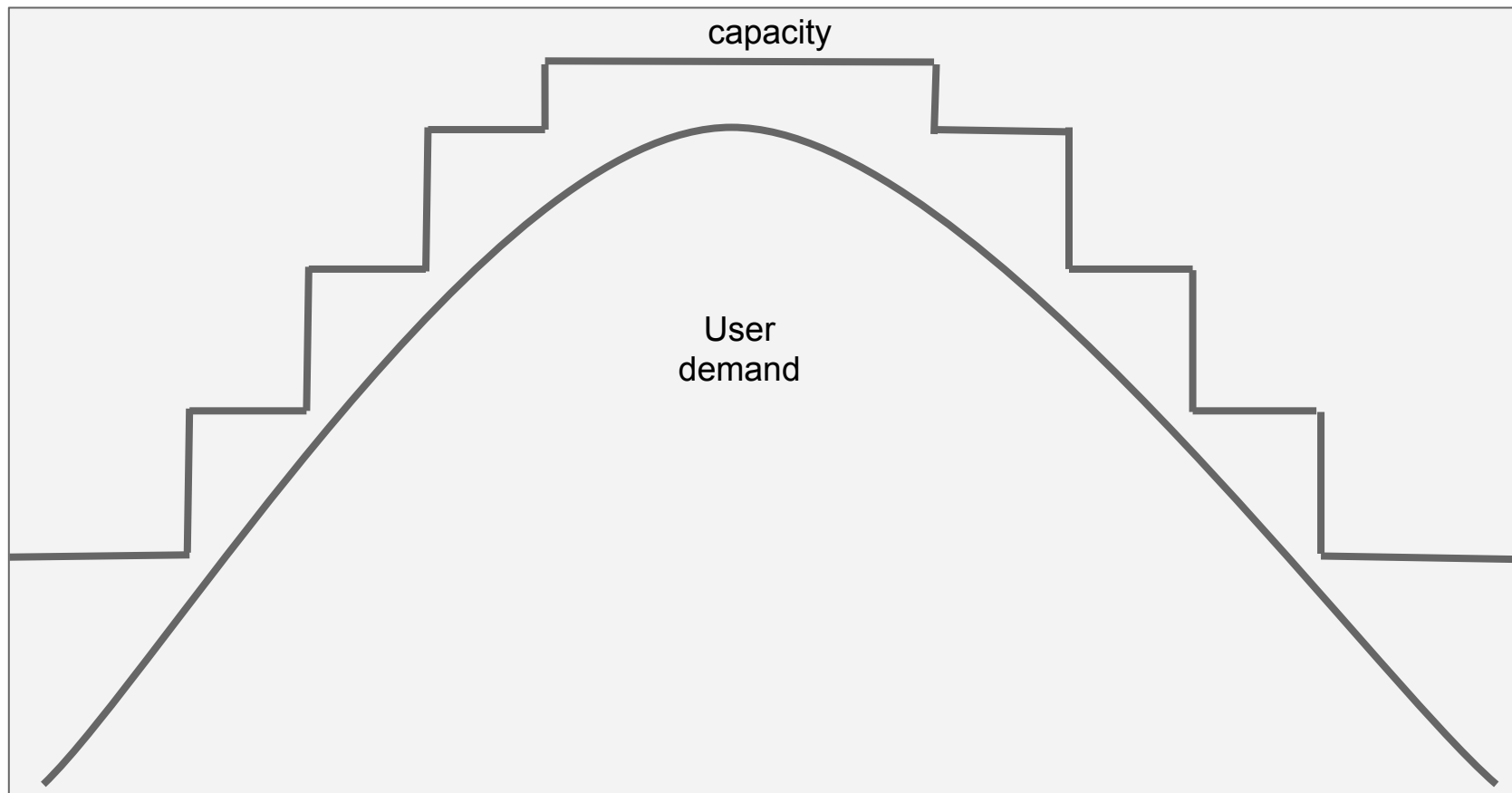


# Elasticity





The ability of a system to  
automatically grow and shrink  
based on application demand



To be continued...



# Reliability & Predictability



Since you're giving up  
control of the platform,  
you need the cloud to be  
reliable

Microsoft publishes  
“Service Level  
Agreements” (SLAs) for  
their services

Financial guarantee of  
their performance

Azure has established  
procedures for rollouts  
and regional recovery



# Availability Sets and Zones

Give you the tools for  
backup and site recovery

Simulate failures using  
Chaos Studio

# Global Reach



It's not possible for most businesses to run data centers in multiple countries



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Created by Creative Stall





To be continued...



# Security & Governance





Security is a full-time job

Use of AI/ML in products  
like Azure Firewall

Identity is the number 1  
attack vector; identity  
protection is key

Basic DDoS protection free

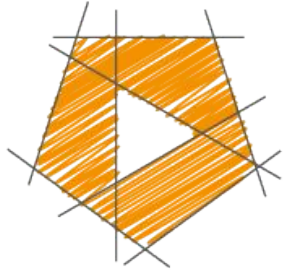
Data governance

# Azure Policy and Blueprints

Monitoring is important

Automation to act on  
events being monitored  
without human  
intervention required



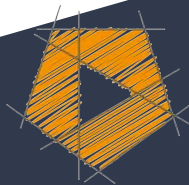


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Section 4

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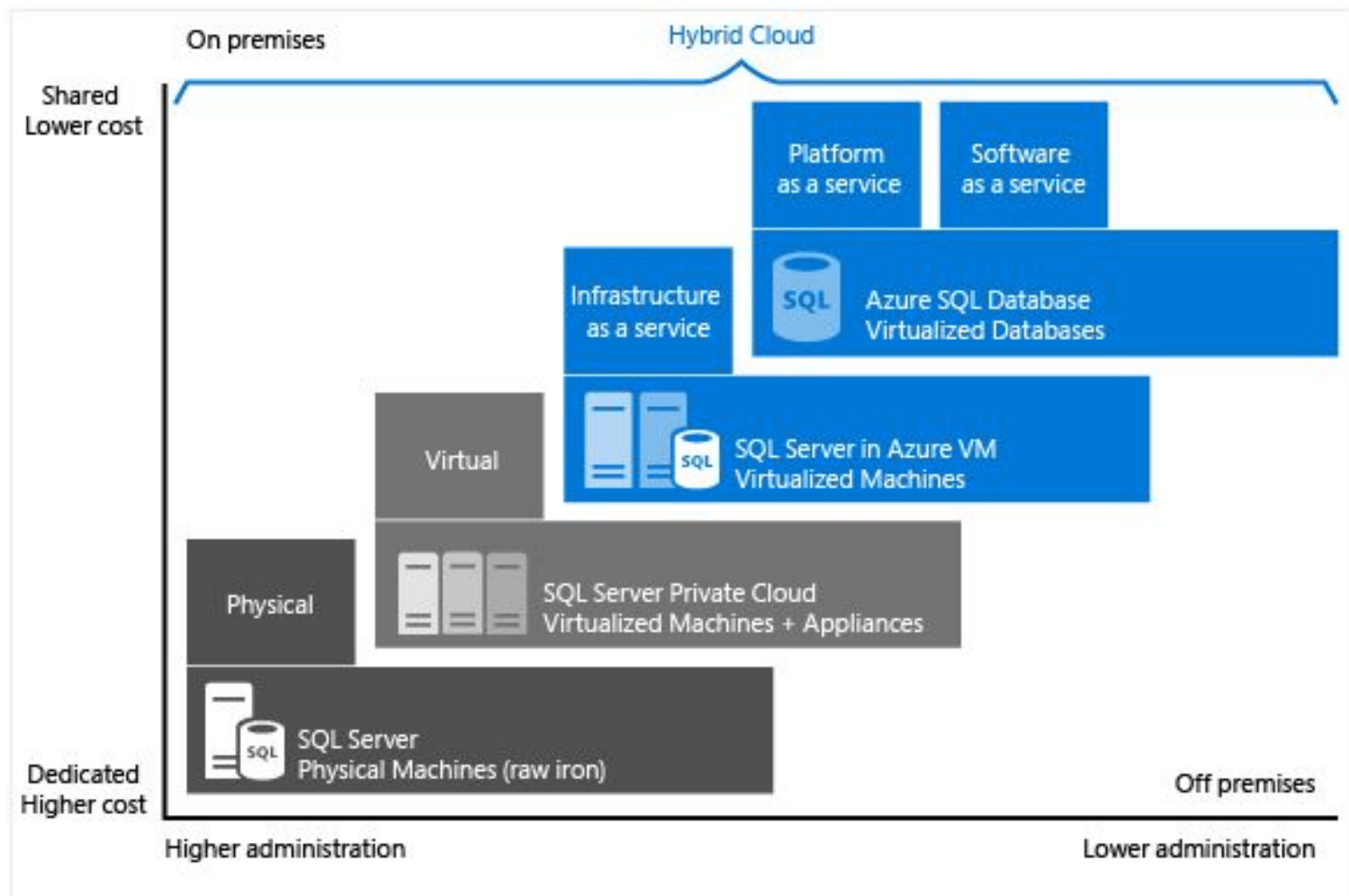
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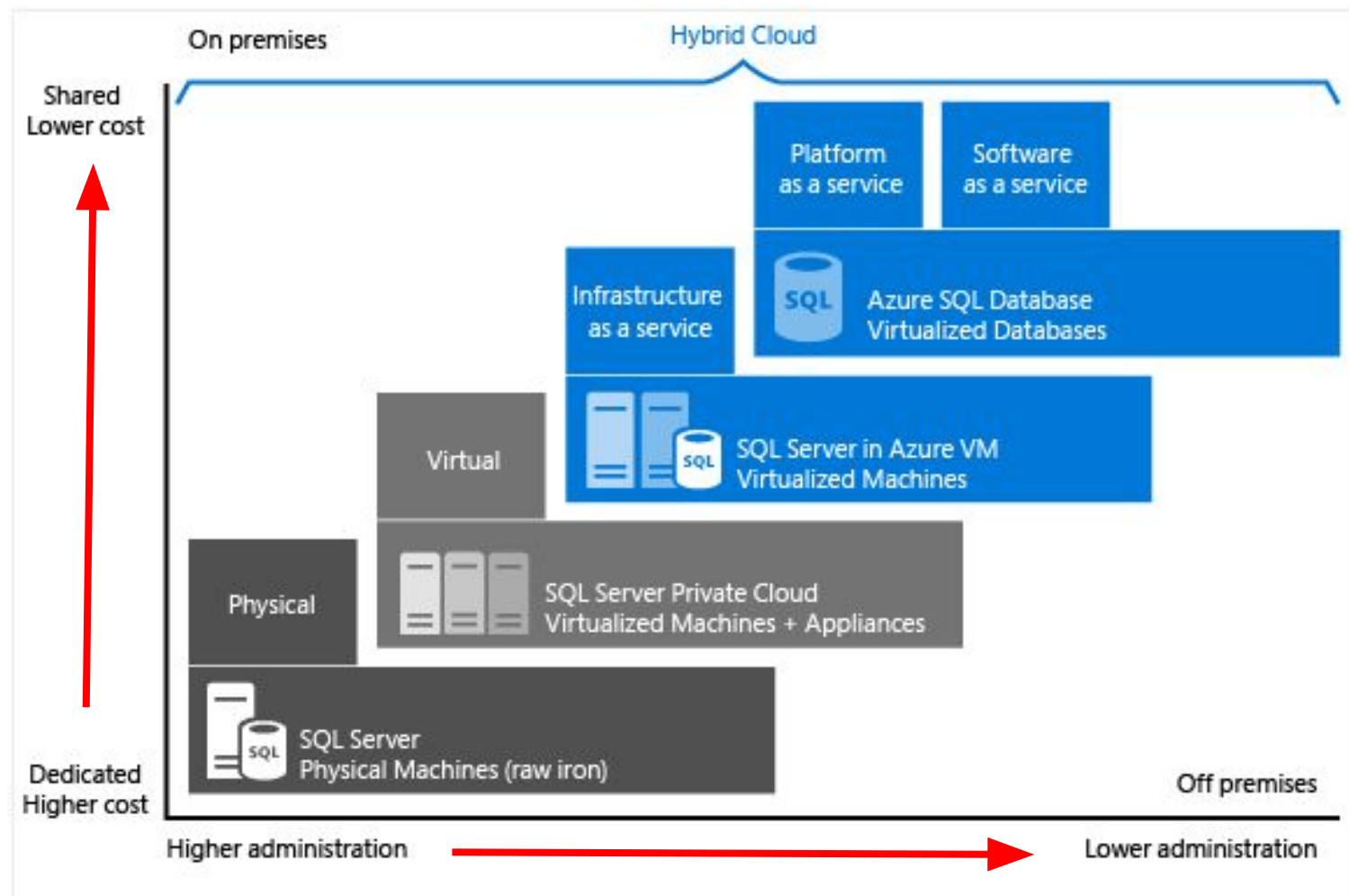
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# Cloud Models

Infrastructure as a Service

Platform as a Service

Software as a Service

Serverless

# Infrastructure-as-a-Service (IaaS)



“Infrastructure as a service (IaaS) is a type of cloud computing service that offers essential compute, storage, and networking resources on demand, on a pay-as-you-go basis.”



Virtual machines, networking, load balancers, firewalls

# Platform-as-a-Service (PaaS)

PaaS is a complete development  
and deployment environment.

Now this is sometimes called cloud native, and you're going to have to modify your applications a little bit to run in the platform as a service model because you don't have access to the machine.

“Platform as a service  
(PaaS) is a complete  
development and  
deployment environment  
in the cloud”

PaaS model with past scaling is your responsibility, right?

With SaaS and with serverless scaling is not your responsibility.

“Like IaaS, PaaS includes infrastructure—servers, storage, and networking—but also middleware, development tools, business intelligence (BI) services, database management systems, and more. PaaS is designed to support the complete web application lifecycle: building, testing, deploying, managing, and updating.”

Upload code packages and have them run, without access to the hardware

# Software-as-a-Service (SaaS)



“Software as a service (SaaS) allows users to connect to and use cloud-based apps over the Internet. Common examples are email, calendaring, and office tools (such as Microsoft Office 365).”

Access to configuration only



# Serverless



There are still servers...  
you just don't ever have to  
deal with them



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from Noun Project  
Created by Jae Deasigner

Even less access to the  
server than PaaS

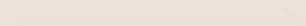
Even with PaaS, you have  
to choose an App Service  
Plan

# With PaaS, scaling is your responsibility



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Serverless means not  
worrying about choosing  
the right plan

Serverless means not  
worrying about scaling

Serverless means you  
might pay \$0 if you don't  
use the service



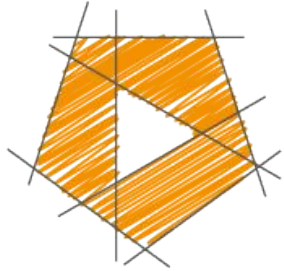
# Azure Serverless Offers

Compute - Azure Functions

Compute - Serverless Kubernetes (Virtual Nodes w/ ACI)

Database - Azure SQL Database Serverless

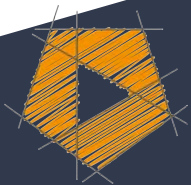
Database - Cosmos DB Serverless



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Describe Azure architecture and services (35–40%)



## **Describe Azure architecture and services (35–40%)**

### **Describe the core architectural components of Azure**

- describe Azure regional, regional pairs, and sovereign regions
- describe availability zones
- describe Azure datacenters
- describe Azure resources and resource groups
- describe subscriptions
- describe management groups
- describe the hierarchy of resource groups, subscriptions, and management groups

### **Describe Azure compute and networking services**

- compare compute types, including container instances, virtual machines (VMs), and functions
- describe VM options, including Azure Virtual Machines, Azure Virtual Machine Scale Sets, availability sets, and Azure Virtual Desktop
- describe resources required for virtual machines
- describe application hosting options, including the Web Apps feature of Azure App Service, containers, and virtual machines
- describe virtual networking, including the purpose of Azure Virtual Networks, Azure virtual subnets, peering, Azure DNS, Azure VPN Gateway, and Azure ExpressRoute
- define public and private endpoints

### **Describe Azure storage services**

- compare Azure storage services
- describe storage tiers
- describe redundancy options
- describe storage account options and storage types
- identify options for moving files, including AzCopy, Azure Storage Explorer, and Azure File Sync
- describe migration options, including Azure Migrate and Azure Data Box

### **Describe Azure identity, access, and security**

- describe directory services in Azure, including Azure Active Directory (Azure AD) and Azure Active Directory Domain Services (Azure AD DS)

# Core Azure architectural components



# Regions



# 60+

Regions - not all accessible by everyone





# Region Pairs



# What are Paired Regions?

Each region has one other region which is treated as its “pair”

Almost always in the same geography - data storage laws

The data connection between region pairs is the highest speed available

Software rollouts are deployed to one region of a pair and the other is not touched

If multiple regions go down, one region of each pair is treated as a priority

# Example Pairs

Canada

Canada Central - Canada East

Europe

North Europe - West Europe

USA

East US - West US

USA

East US 2 - Central US

USA

North Central US - South Central US

Brazil

Brazil South - South Central US

# Sovereign Regions



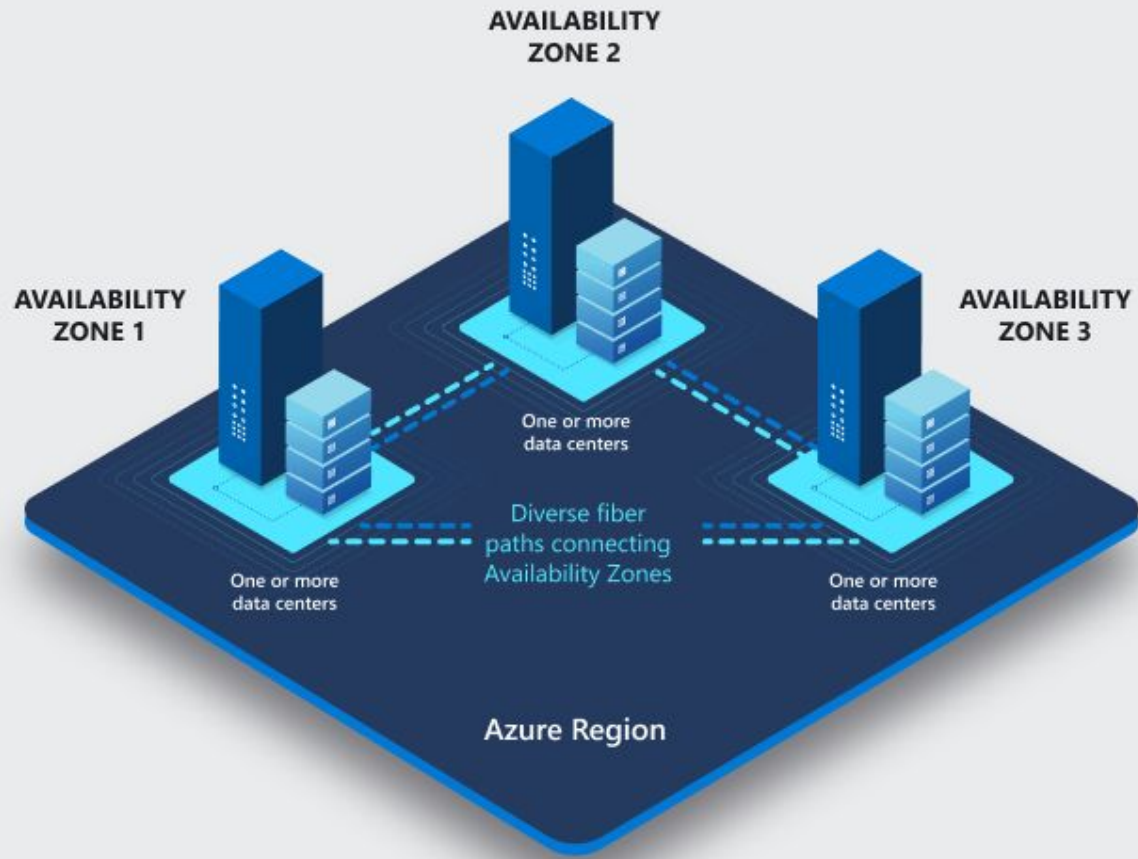
# Sovereign Regions

Azure Government (US)

China

# Availability Zones







# Regions with Availability Zones

## The Americas

Brazil South

Canada Central - Canada East

Central US - East US - East US 2

South Central US - West US 2 - West US 3

US Gov Virginia

## Europe

France Central

Germany West Central

North Europe

Norway West

UK South

West Europe

Sweden Central

# Regions with Availability Zones

## Africa

South Africa North

## Asia Pacific

Australia East

Central India

Japan East

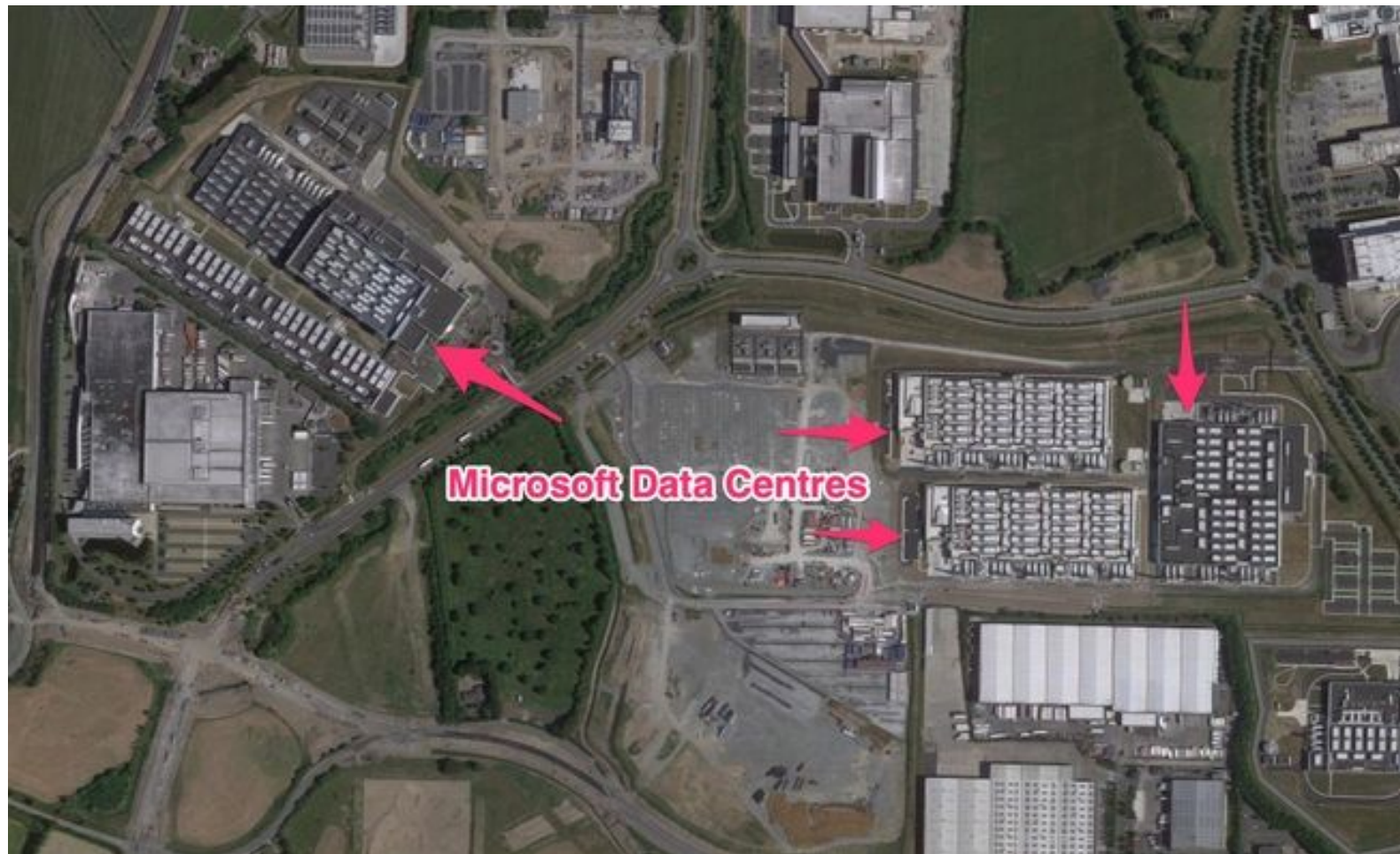
Korea Central

Southeast Asia - East Asia

China North 3

# Data Centers





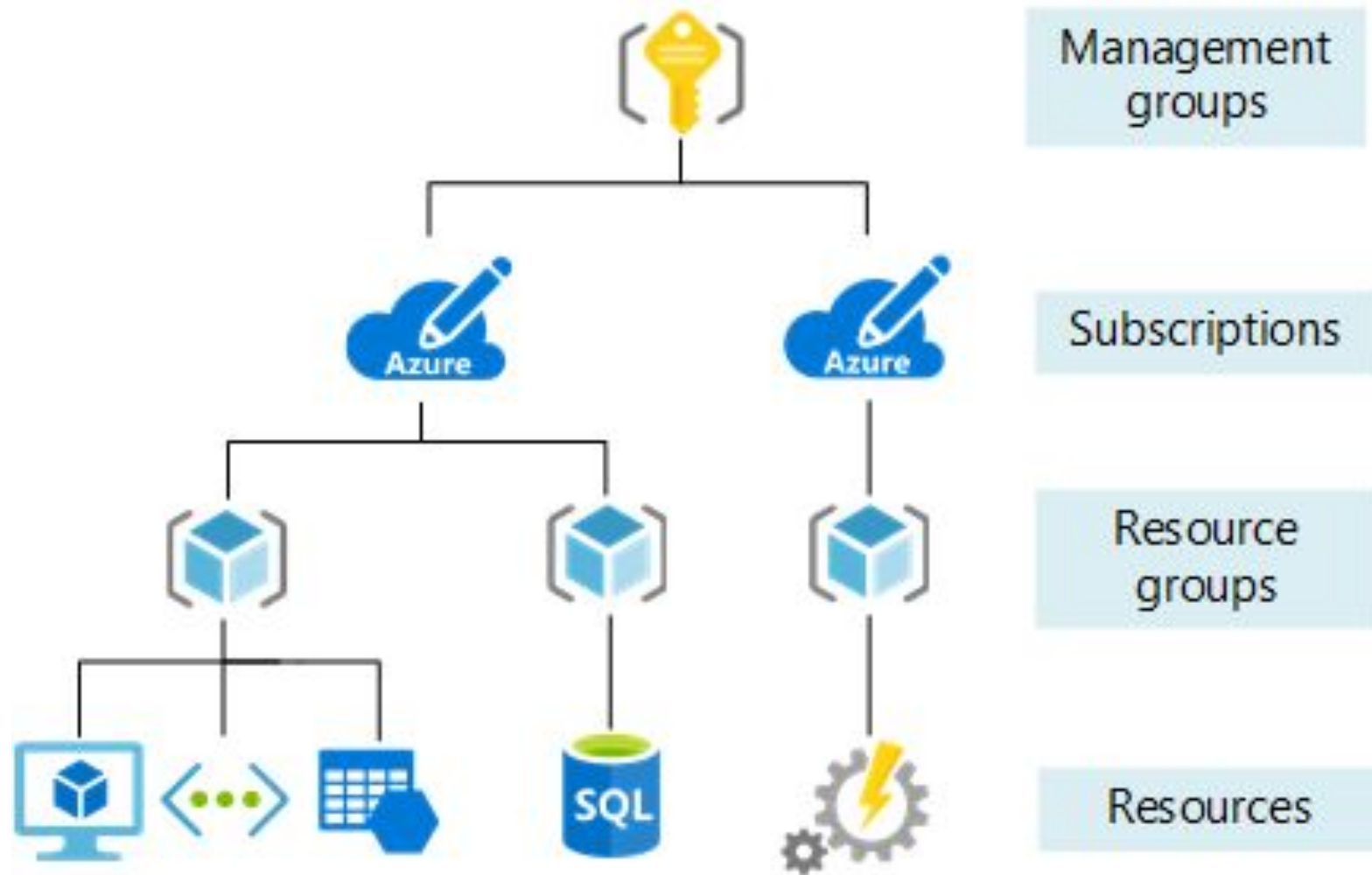
# Resource Groups

organize your resources into groups.

Now, typically you're going to keep resources that are related to each other in the same group.

So this is a logical grouping.

You can have a storage account and a database and a virtual machine  
You cannot make a resource part of multiple groups and all  
resources must belong to one group.



# Azure Subscription



Subscription is a billing  
unit



Users have access to one  
or more subscriptions,  
with different roles

All resources consumed by  
a subscription will be  
billed to the owner

Can be used to organize  
resources into completely  
distinct accounts



HR Azure  
subscription



Finance Azure  
subscription



Marketing Azure  
subscription

### Services Consumed



Azure  
Automation



Cloud Service



Virtual machine



SQL Data  
Warehouse



Traffic Manager



Service  
Fabric

### Services Consumed



Visual Studio  
Online



Cloud Service



Virtual machine



Web App



Traffic Manager



Site Recovery

### Services Consumed



Service Bus



Cloud Service



CodePlex



RemoteApp



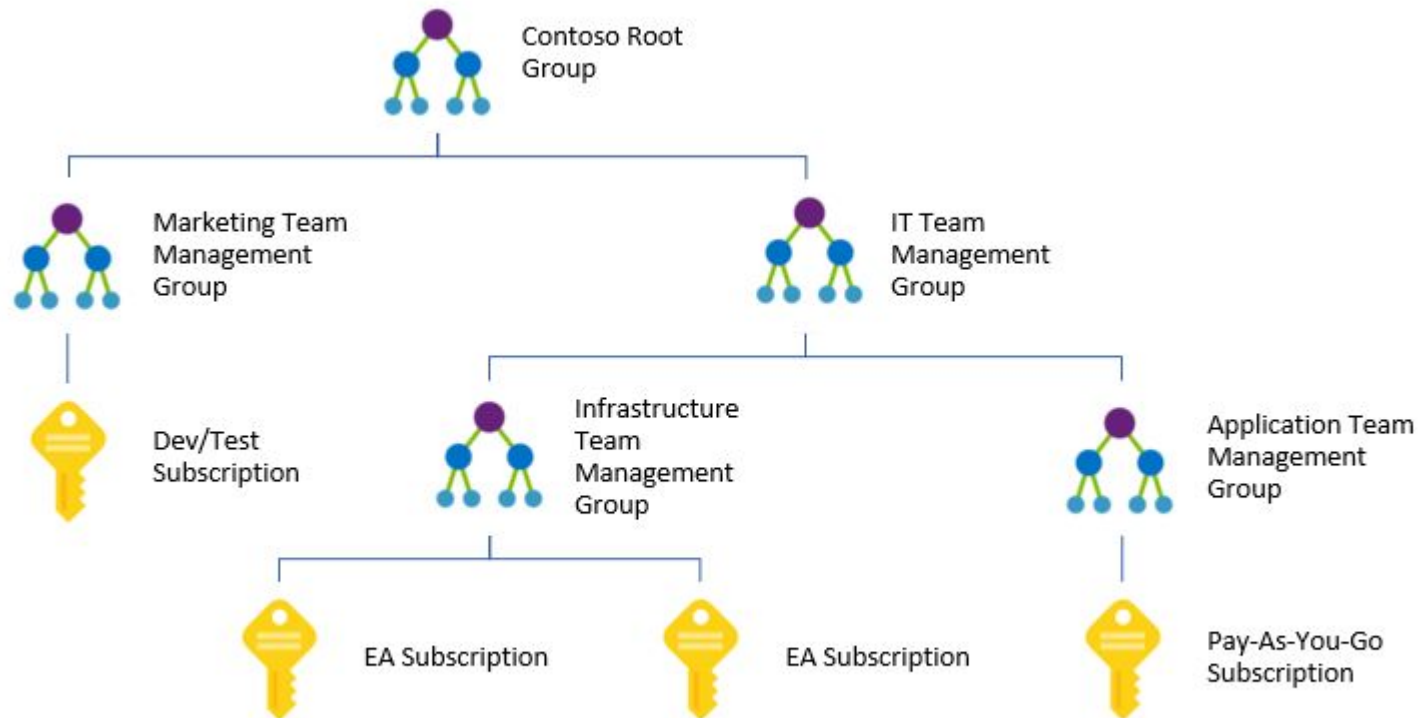
Traffic Manager

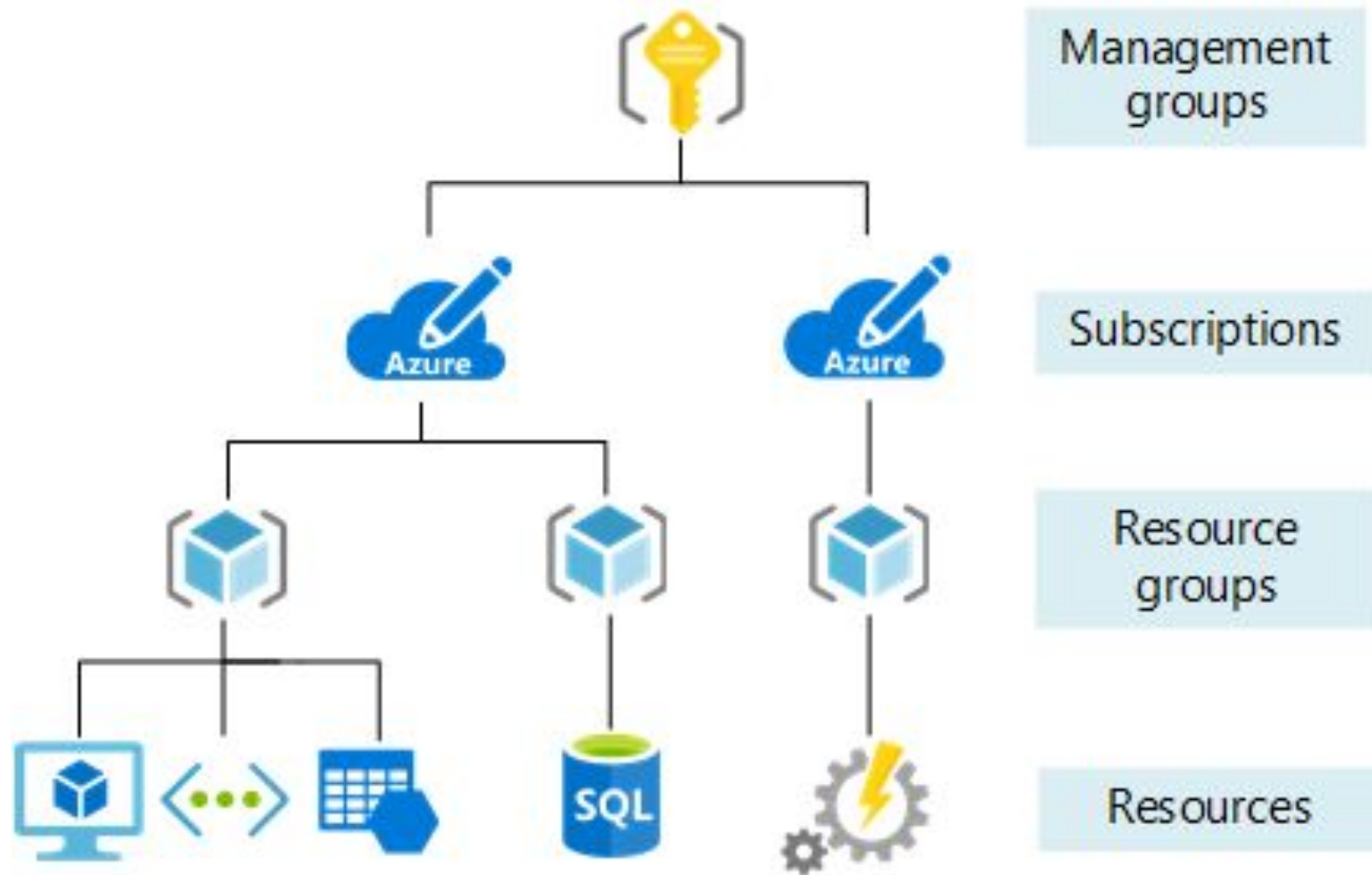


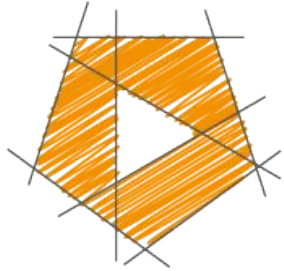
StorSimple

# Management groups







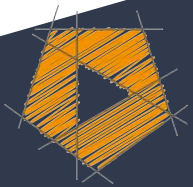


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# AZ-900 Microsoft Azure Fundamentals

Scott Duffy, Instructor



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## **Describe Azure architecture and services (35–40%)**

### **Describe the core architectural components of Azure**

- describe Azure regional, regional pairs, and sovereign regions
- describe availability zones
- describe Azure datacenters
- describe Azure resources and resource groups
- describe subscriptions
- describe management groups
- describe the hierarchy of resource groups, subscriptions, and management groups

### **Describe Azure compute and networking services**

- compare compute types, including container instances, virtual machines (VMs), and functions
- describe VM options, including Azure Virtual Machines, Azure Virtual Machine Scale Sets, availability sets, and Azure Virtual Desktop
- describe resources required for virtual machines
- describe application hosting options, including the Web Apps feature of Azure App Service, containers, and virtual machines
- describe virtual networking, including the purpose of Azure Virtual Networks, Azure virtual subnets, peering, Azure DNS, Azure VPN Gateway, and Azure ExpressRoute
- define public and private endpoints

### **Describe Azure storage services**

- compare Azure storage services
- describe storage tiers
- describe redundancy options
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- identify options for moving files, including AzCopy, Azure Storage Explorer, and Azure File Sync
- describe migration options, including Azure Migrate and Azure Data Box

### **Describe Azure identity, access, and security**

- describe directory services in Azure, including Azure Active Directory (Azure AD) and Azure Active Directory Domain Services (Azure AD DS)

# Azure Compute and Networking

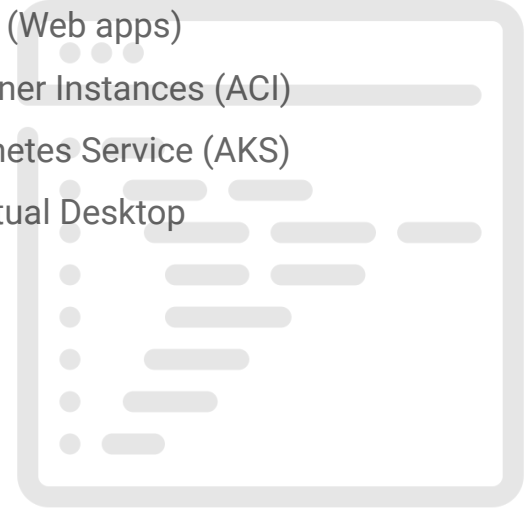


# Getting Deep into the Technical

- **Compute services**
- **Networking services**
- Storage services
- Database services

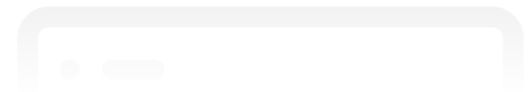
# Compute services covered

- Virtual Machines (VM)
- VM Scale Sets (VMSS)
- App services (Web apps)
- Azure Container Instances (ACI)
- Azure Kubernetes Service (AKS)
- Windows Virtual Desktop



Created by KonKapp  
from Noun Project

from Noun Project  
Created by KonKapp



Compute –  
“Executing code” in the  
cloud

# Virtual Machines

Infrastructure as a service - IaaS

Take an existing machine from your environment into the cloud - a copy

Windows or Linux operating systems - several of each

A “slice” of a physical machine shared with other customers

Full control over it, as if it was your machine

In AWS, a Virtual Machine is called Elastic Compute Cloud (EC2).





# Virtual Machine Types

Over 200 to choose from

Number of CPU cores, CPU speed, RAM size,  
temporary disk size, IOPS, etc

# VM Scale Sets

- Elasticity
- Two or more virtual machines running the exact same code
- With a “load balancer” in front to direct traffic randomly to one of the machines
- Able to add more machines as demand grows (autoscaling)
- Able to reduce machines as demand slows
- Can handle up to 100 VMs in a single scale set
- Can be configured to increase that to 1000 VMs in a single scale set
- If you need more, you can create more scalesets

# App Services

A new paradigm for running code in the cloud

Give your code and configuration to Azure, and they will run it

Promise of performance but no access to hardware

Platform as a Service (PaaS)

# Containers

Another paradigm for running code in the cloud

Containers contain everything the app needs to run in a “container image”

Fastest and easiest to deploy

**Azure Container Instance (ACI)** - single instance, quickest way to deploy a container

**Azure Kubernetes Service (AKS)** - runs on a cluster of servers, enterprise-grade

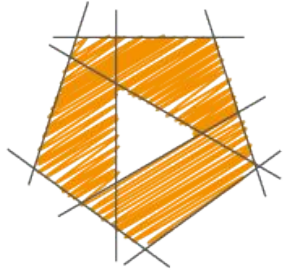
# Azure Virtual Desktop

Desktop version of Windows that runs in the cloud

Your software installed, your files - available from anywhere

Can even see your desktop on iOS and Android, or from any web browser

Runs on Azure

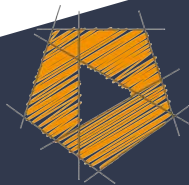


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# AZ-900 Microsoft Azure Fundamentals

## Section 6

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# Networking Services Covered

Virtual Networks

VPN Gateway

VNet Peering

ExpressRoute



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from Noun Project

from Noun Project  
Created by Barracuda



In AWS, a Virtual Network is called Virtual Private Cloud (VPC).



# Types of Networking Services

- Connectivity Services
- Protection Services
- Delivery Services
- Monitoring Services

# Connectivity

**Virtual Network** - emulating a physical network

Microsoft Global Network already exists, so a virtual network is just software configuration

**Subnet** - a subdivision of a virtual network, that you control, that has its own security rules

**Virtual Private Network (VPN)** - connecting two networks as if they were on the same network, uses a Network Gateway

**ExpressRoute** - high-speed private connection to Azure

**DNS Services** - domain name resolution

# Protection – Security Section of the Course

**DDos Protection** - Distributed Denial of Service attack protection

**Azure Firewall**

**Network Security Groups**

**Private Link**

# Delivery – Not on the Exam

**Load Balancer** - distribute traffic evenly between multiple backend servers

**Application Gateway** - a higher-level of load balancer with an optional firewall

**Content Delivery Network (CDN)** - stores common static files on the edge, closer to the users for (perceived) improved performance

**Azure Front Door Service** - a load balancer, CDN and firewall all-in-one

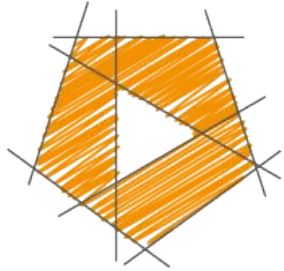
# Monitoring – Management Tools Section of the Course

Network Watcher

ExpressRoute Monitor

Azure Monitor

To connect 2 virtual network's , we use  
network peering. (global)

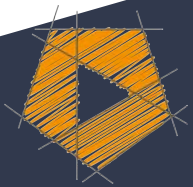


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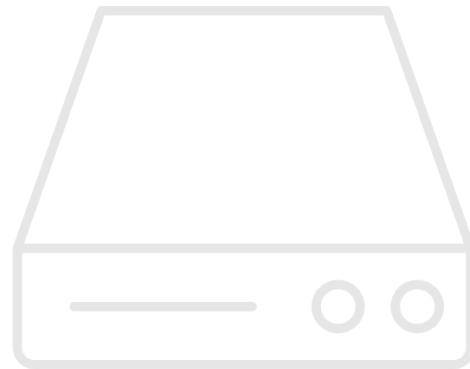
# Storage Services Covered

Container (Blob) Storage

Disk Storage

File Storage

Storage Tiers



Created by DinosoftLab  
from Noun Project

from Noun Project  
Created by DinosoftLab

Storage – one of the  
foundational technologies  
on which much is built

# Container (Blob) and File Storage

The **Azure Storage** account

**General Purpose v2 (gpv2)** is the most common type

Blobs, Tables \*, Queues \*, Files

**Azure Data Lake Storage Gen2**

Cheapest type of storage

Pay Per GB (~1.8 cents per GB)

BLOB is a “backronym” for  
Binary Large OBject.

A collection of binary data. That binary data could be in the form of a file (stored in a storage account) or data stored in a database.

In AWS, a Storage Account is called Simple Storage Service (S3).



# Many, Many Options

Access tiers - Hot, Cool, Archive

Performance tiers - Standard or Premium

Location

Redundancy / Replication

Failover options

# Disk Storage

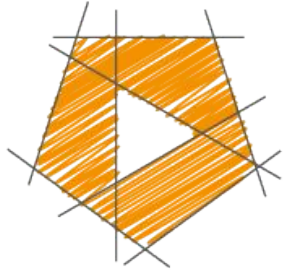
Azure Virtual Machine Disks

## **Managed Disks**

Reserve capacity in advance

Optimized to virtual hard disks



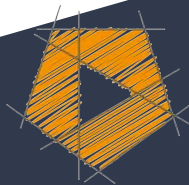


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### **Describe Azure identity, access, and security**

- describe directory services in Azure, including Azure Active Directory (Azure AD) and Azure Active Directory Domain Services (Azure AD DS)
- describe authentication methods in Azure, including single sign-on (SSO), multifactor authentication, and passwordless
- describe external identities and guest access in Azure
- describe Azure AD Conditional Access
- describe Azure role-based access control (RBAC)
- describe the concept of Zero Trust
- describe the purpose of the defense in depth model
- describe the purpose of Microsoft Defender for Cloud

# What is “Identity”?



In computing, “identity”  
is a representation of a  
person, application or  
device



Created by Humble\_Bee  
from Noun Project

from Noun Project  
Created by Humble\_Bee

# Examples of Identity

John Henry Doe

[johndoe@example.com](mailto:johndoe@example.com)

Monthly Payroll Application

The laser printer at 6th Floor West

Usually requires a  
password, a secret key or a  
certificate to prove

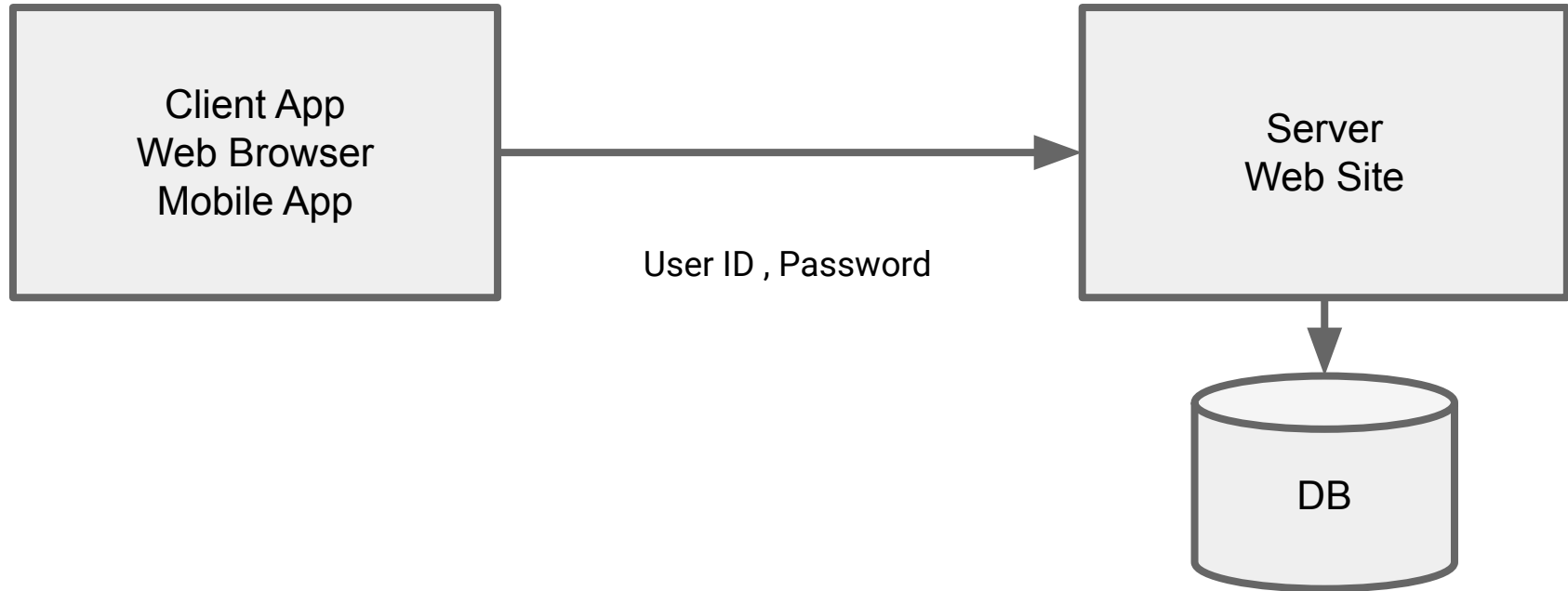
Many applications require  
you to log in to use some  
of its functionality



# How It's Traditionally Handled



# Client-Server Model



Traditionally, companies  
have written their own  
code to handle this

Some of the more famous  
“hacks” have been on  
custom created identity  
systems



Created by Peter van Driel  
from Noun Project

from Noun Project  
Created by Peter van Driel



# Hacks

Some companies were storing the password in “plain text”

Some companies were using a simple, reversible hash algorithm (MD5)

Some companies were storing the “salt” along with the data

Not enforcing password change policies

Not enforcing password complexity policies

Azure provides an identity  
management system based on  
their popular  
“Active Directory”

# Azure Active Directory (Azure AD or AAD)



Azure Active Directory

is not the same as

Active Directory

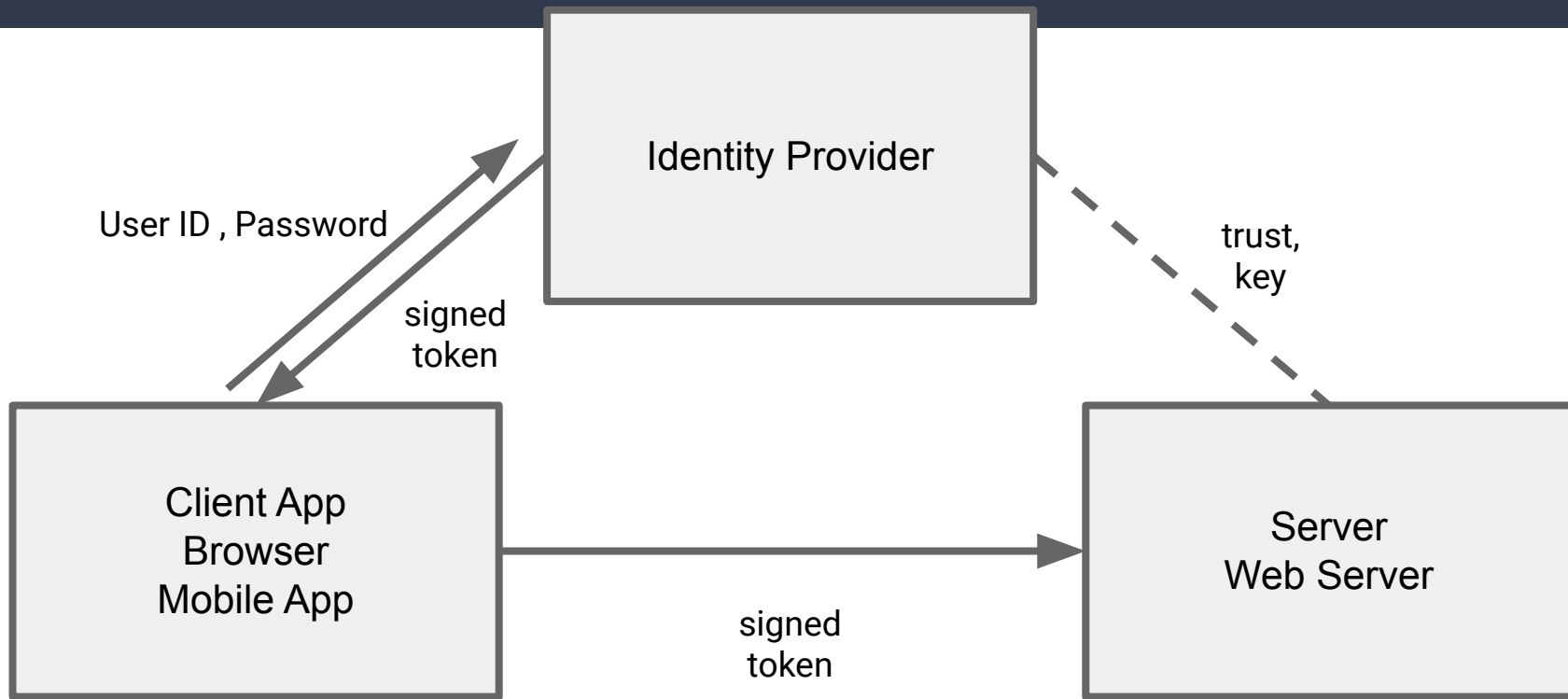


Traditional AD does not  
work with Internet  
protocols

Azure AD provides  
“identity as a service”

Instead of having to write  
code to handle users,  
passwords, password reset

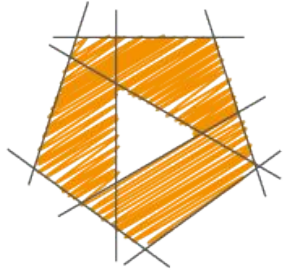
# The AAD Model



SAML

OpenID

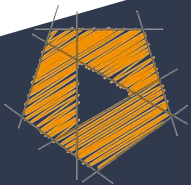
WS Federation



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# Benefits of Azure AD





# Security



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Reduced development  
time, easier support

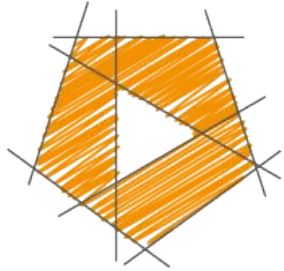
*More features*

# Centralized administration

Only one user ID and  
password

- Single Sign-On

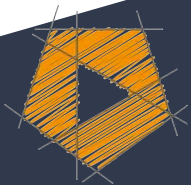
# Integration with other Azure services



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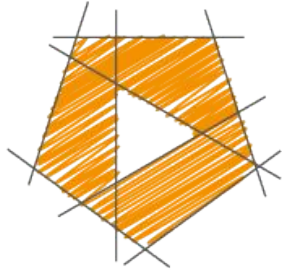
# The difference between Authentication and Authorization



Authentication is a user  
proving who they are - user id  
and password

Authorization is ensuring that a user is permitted to perform an action

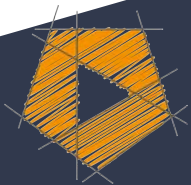
Move away from all  
authenticated users  
having admin access



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# Azure Active Directory



Microsoft's  
preferred solution for  
identity management



# Azure AD Powers Other Microsoft Services

Azure

Skype

Outlook

OneDrive

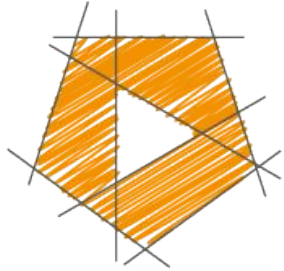
Xbox

Office 365 - Teams, SharePoint, PowerBI, etc

Complete solution for  
managing users, groups,  
roles

Single-sign on

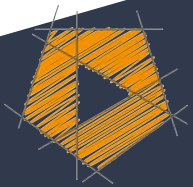
Synchronize with your  
corporate AD



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# Conditional Access



*User A* attempts to log in to the app from within the company office, as she does every day

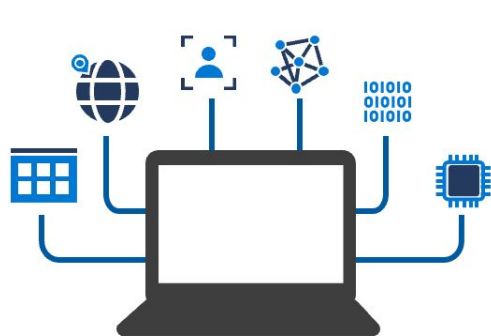


*User B* attempts to log in to  
the app for the first time  
in 4 months

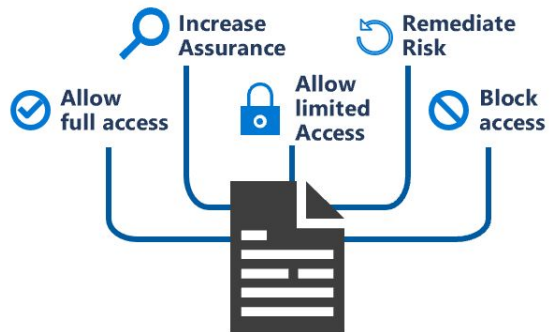
*Administrator C* attempts  
to log in to the app from  
their phone

*Administrator D* attempts  
to log in to the app from a  
location 1200 miles from  
the office

You can treat some access attempts as “routine”, and some as “not normal”



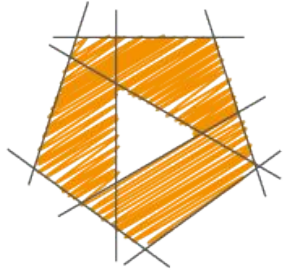
Signal



Decision



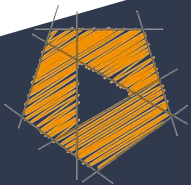
Enforcement



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# Azure Multi-Factor Authentication





Require 2 or more pieces  
of evidence (factors) in  
order to log in

# Three Factors

Something you **know** - i.e password

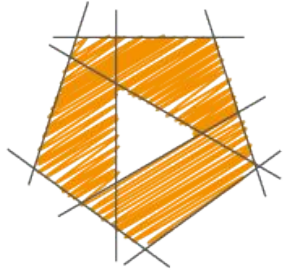
Something you **have** - i.e mobile phone, access to email account

Something you **are** - i.e fingerprint

Your unique password  
could be 1 piece of  
evidence

But a second piece of  
evidence is required – a  
unique, time-limited code  
sent to you

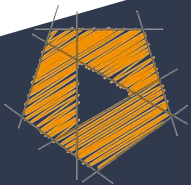
SMS, email, authenticator  
app, phone call



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# Role-Based Access Control (RBAC)





Microsoft's preferred  
solution for access control

Create roles that represent  
the common tasks of the  
job

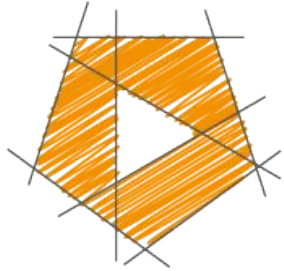
Accountant  
Developer  
Business Lead

Assign granular  
permissions to that role

Assign users to  
that role

Do not assign granular  
permissions to an  
individual

Reader  
Contributor  
Owner

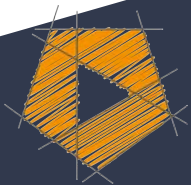


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# Zero Trust Methodology



Don't assume everything  
behind the firewall is safe

# Zero Trust Principles

- Verify explicitly
- Use least privileged access
- Assume breach

Use every available  
method to validate  
identity and authorization

Just-in-time (JIT)

Just-enough-access (JEA)

Security even inside the  
network; encryption,  
segmentation, threat  
detection





Identity: Verify and secure  
each identity

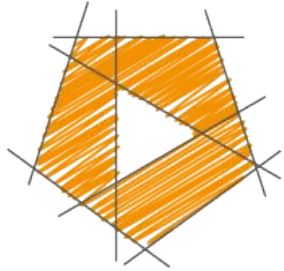
Devices: ensure  
compliance and health  
status

Applications: appropriate  
in-app permissions,  
monitor user actions

Data: data-driven  
protection, encrypt and  
restrict access

Infrastructure: robust  
monitoring to detect  
attacks, block and flag  
risky behavior

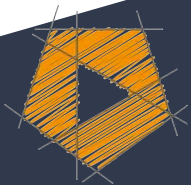
Network: encrypt all  
communications



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# Defense in Depth

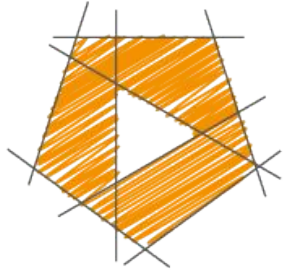


# Security Layers

- Data - i.e. virtual network endpoint
- Application - i.e. API Management
- Compute - i.e. Limit Remote Desktop access, Windows Update
- Network - i.e. NSG, use of subnets, deny by default
- Perimeter - i.e. DDoS, firewalls
- Identity & access - i.e. Azure AD
- Physical - i.e. Door locks and key cards

## Defense in Depth

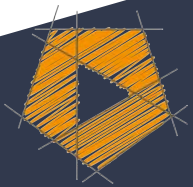
Identity & Access	Apps & Data Security	Network Security	Threat Protection	Security Management
Role-based access	Encryption	DDOS Protection	Antimalware	Log Management
Multifactor Authentication	Confidential Computing	NG Firewall	AI-Based Detection and Response	Security Posture Assessment
Central Identity Management	Key Management	Web App Firewall	Cloud Workload Protection	Policy and Governance
Identity Protection	Certificate Management	Private Connections	SQL Threat Protection	Regulatory Compliance
Privileged Identity Management	Information Protection	Network Segmentation	IoT Security	SIEM



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Describe Azure management and governance (30–35%)



## **Describe Azure management and governance (30–35%)**

### **Describe cost management in Azure**

- describe factors that can affect costs in Azure
- compare the Pricing calculator and the Total Cost of Ownership (TCO) calculator
- describe the Azure Cost Management and Billing tool
- describe the purpose of tags

### **Describe features and tools in Azure for governance and compliance**

- describe the purpose of Azure Blueprints
- describe the purpose of Azure Policy
- describe the purpose of resource locks
- describe the purpose of the Service Trust Portal

### **Describe features and tools for managing and deploying Azure resources**

- describe the Azure portal
- describe Azure Cloud Shell, including Azure CLI and Azure PowerShell
- describe the purpose of Azure Arc
- describe Azure Resource Manager and Azure Resource Manager templates (ARM templates)

### **Describe monitoring tools in Azure**

- describe the purpose of Azure Advisor
- describe Azure Service Health
- describe Azure Monitor, including Log Analytics, Azure Monitor alerts, and Application Insights

# Factors affecting costs





Different services are  
billed based on different  
factors

Free services

# Free services

Resource groups

Virtual network (up to 50)

Load balancer (basic)

Azure Active Directory (basic)

Network security groups

Free-tier web apps (up to 10)

kWh



KWHR

Rr 27  $\frac{7}{9}$

KILOWATT HOURS

68775-3

FM 2S CL 200 240 V Type **MX**  
TA 30 Kh 7.2 3W 60Hz

S F  
ALL ADJ.

**76 548 902** 0906



-546

Pay per usage  
(consumption model)

# Opportunity for cost savings

## Azure Functions:

- 1 million executions free per month
- \$0.20 per million executions
- Cheapest virtual machine is \$20 per month

# Pay per usage services

Functions

Logic Apps

Storage (pay per GB)

Outbound bandwidth

Cognitive Services API

# Pay for time (per second)



Created by Alvida Biersack  
from Noun Project

from Noun Project  
Created by Alvida Biersack



Per second billing means  
billing stops when the VM  
is stopped \*

# Stability in pricing

Pay a fixed price per month for computing power or storage capacity

Whether you use it or not

Discounts for 1-year or 3-year commitment in VM (Reserved Instances)

Multi-tenant or isolated environment

Pay for bandwidth

First 5 GB is free

Inbound data is free

# Bandwidth costs

Outbound data, \$0.05 to \$0.0875 / GB for Zone 1 (NA and EU)

Outbound data, \$0.08 to \$0.12 / GB for Zone 2 (Asia, Africa and Oceania)

Outbound data, \$0.16 to \$0.181 / GB for Zone 3 (Brazil)

(Availability zone pricing is different)

1 PB of data transfer =  
\$52,000

# Pricing calculator





<https://azure.microsoft.com/pricing/calculator/>

Estimates are hard to  
make 100% accurate

# Configurable Options

Region

Tier

Subscription Type

Support Options

Dev/Test Pricing

Export and share the  
estimate

# Total Cost of Ownership (TCO) calculator



The cost of a server is  
more than just the cost of  
the hardware

# Other costs

- Electricity
- Cooling
- Internet connectivity
- Rack space
- Setup labor
- Maintenance labor
- Backup

<https://azure.microsoft.com/pricing/tco/calculator/>



# Azure Cost Management



Another free tool inside  
Azure to analyze spending



Dashboard &gt; Cost Management + Billing | Overview &gt;



## Pay-As-You-Go (Azure Courses) | Cost analysis

Subscription



Search (Ctrl+/)



Save



Save as



Delete view



Share



Refresh



Download



Settings



Try preview



Help

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Security

Events

## Cost Management

Cost analysis

Budgets

Advisor recommendations

## Billing

Invoices

External services

Payment methods

Partner information

Scope : Scott's Course Management Group

VIEW

\* Accumulated costs

Invoice (Azure) : Jul 7-Aug 6

Add filter

ACTUAL COST (CAD ONLY)

CA\$115.37

FORECAST UNAVAILABLE

--

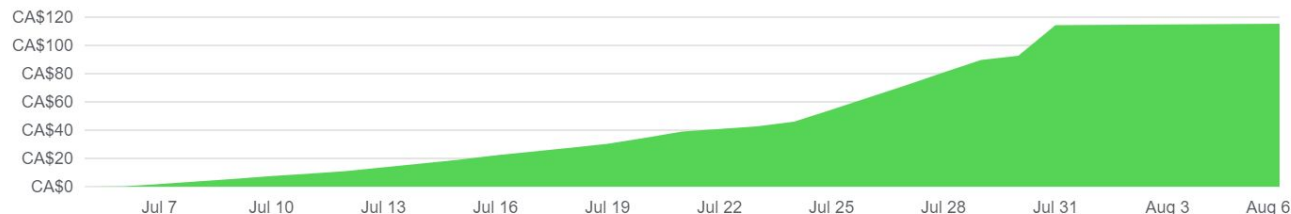
BUDGET: AZBUDGET

CA\$100

Group by: None

Granularity: Accumulated

Area



Accumulated cost

Service name

storage  
CA\$46....  
virtual machines  
CA\$39....

Location

us central  
CA\$59....  
us west  
CA\$37....

Resource group name

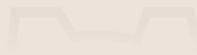
firstvnet-ra  
CA\$37....  
az304new  
CA\$37....

# Analyze spending over time



Created by VectorBakery  
from Noun Project

from Noun Project  
Created by VectorBakery



# Tracking against budgets



Created by Eucalyp  
from Noun Project

from Noun Project  
Created by Eucalyp



All your past invoices

Schedule reports

# Resource Tags





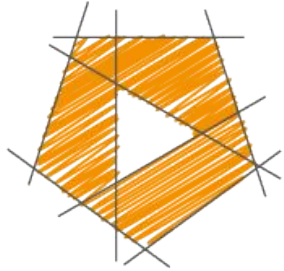
# Can add metadata to Azure resources



Created by Pascal Conil-lacoste  
from Noun Project

from Noun Project  
Created by Pascal Conil-lacoste

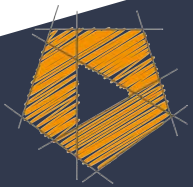
Helps with billing and  
support issues



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<http://sjd.ca/az900>

# Tools for Governance and Compliance



The leaders are your  
company might have  
certain IT rules that they  
want to implement

Example:

Always have daily backup  
enabled on every server

Option 1) Send an email  
with the rules and assume  
everyone reads it and  
remembers it



Option 2) Use Azure tools  
to enforce the rules (or  
simply audit compliance)

# Several Tools in Azure to Support Governance and Compliance

Azure Blueprints

Azure Policy

Resource Locks

Service Trust Portal

# Azure Blueprints



Azure Subscription  
templates with Roles and  
Policies already defined

# Azure Policy



Create rules across all of  
your Azure resources

# Evaluate compliance to those rules



Created by Shems Eddine Boukhatef  
from Noun Project

from Noun Project  
Created by Shems Eddine Boukhatef



# Examples of Built-In Policies

- Require SQL Server 12.0
- Allowed Storage Account SKUs
- Allowed Locations
- Allowed Virtual Machine SKUs
- Apply tag and its default value
- Not allowed resource types



Can create custom policies  
using JSON definition

# Locks



# Read Only Can Not Delete



Created by An Chi  
from Noun Project

from Noun Project  
Created by An Chi



# openvpnVM - Locks

Virtual machine

Search (Ctrl+/)

Extensions

Continuous delivery (Preview)

Availability set

Configuration

Identity

Properties

Locks

Export template

Operations



+ Add



Resource group



Subscription



Refresh

## Add lock

Lock name

dontdeleteme

Lock type

Delete



Notes

This is needed for production processes

OK

Cancel

Using RBAC, you can  
restrict who has access to  
locks

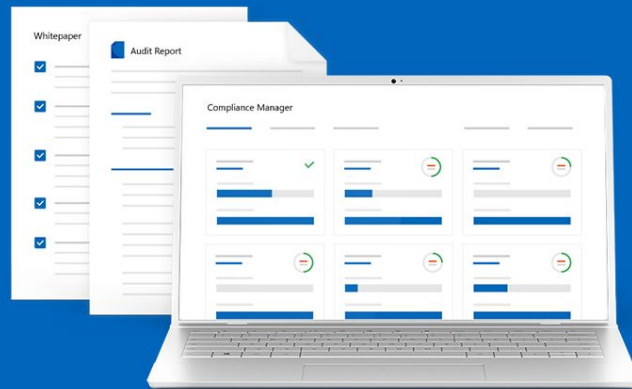
# Service Trust Portal



<https://servicetrust.microsoft.com/>

<https://aka.ms/STP>

Built upon a foundation of  
trust, security and  
compliance



## Audit Reports

Review the available independent audit reports for Microsoft's Cloud services, which provide information about compliance with data protection standards and regulatory requirements, such as International Organization for Standardization (ISO), Service Organization Controls (SOC), National Institute of Standards and Technology (NIST), Federal Risk and Authorization Management Program (FedRAMP), and the General Data Protection Regulation (GDPR)



SOC



FedRAMP



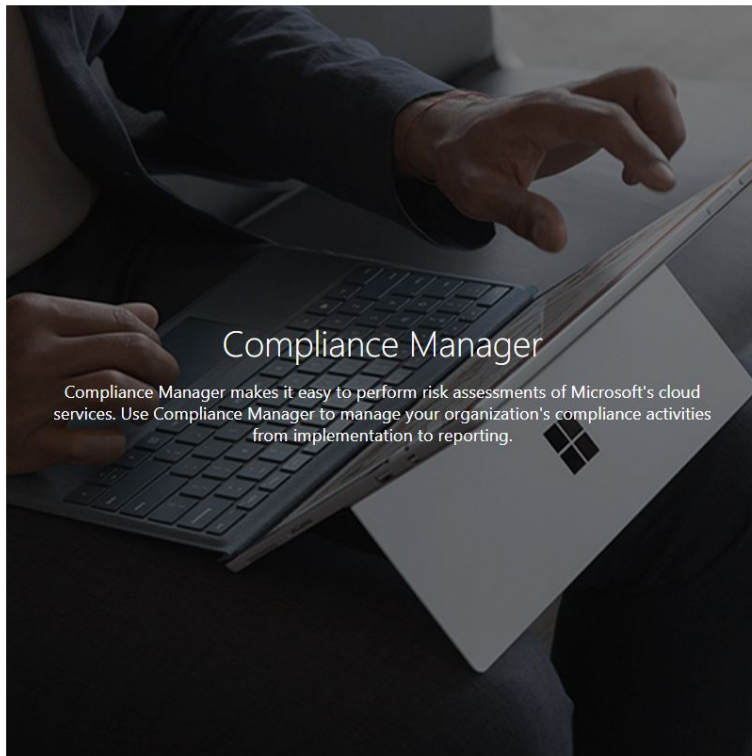
ISO 27001



PCI/DSS



## Documents & Resources



### Compliance Manager

Compliance Manager makes it easy to perform risk assessments of Microsoft's cloud services. Use Compliance Manager to manage your organization's compliance activities from implementation to reporting.

### Pen Tests & Security Assessments

View reports from independent third-party penetration tests and security assessments of Microsoft's cloud services

### Azure Blueprints

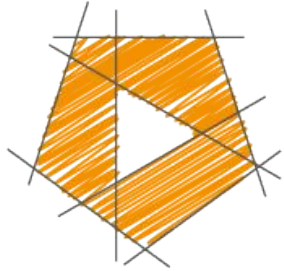
Define a repeatable set of Azure resources that implement and adhere to your organization's standards, patterns, and requirements and rapidly build new environments with a set of built-in components to speed up development and delivery

### White Papers, FAQs, & Compliance Guides

Review the wealth of available security implementation and design information with the goal of making it easier for you to meet regulatory compliance objectives by understanding how Microsoft Cloud services keep your data secure

[More Documents & Resources >](#)

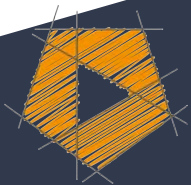




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# Azure Tools

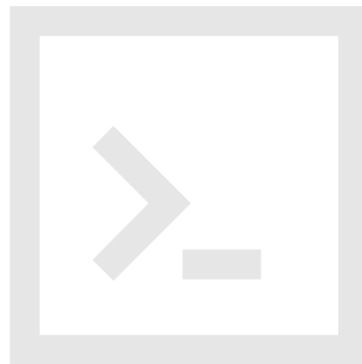
Azure CLI

PowerShell

Azure Portal

Azure Cloud Shell

Azure Mobile App



Created by Focus  
from Noun Project

from Noun Project  
Created by Focus

# Azure Portal

# PowerShell and CLI Command Line

# Azure Arc



A management tool that  
works with your  
non-Azure environments



Manage virtual machines,  
Kubernetes clusters, and  
databases as if they are  
running in Azure.

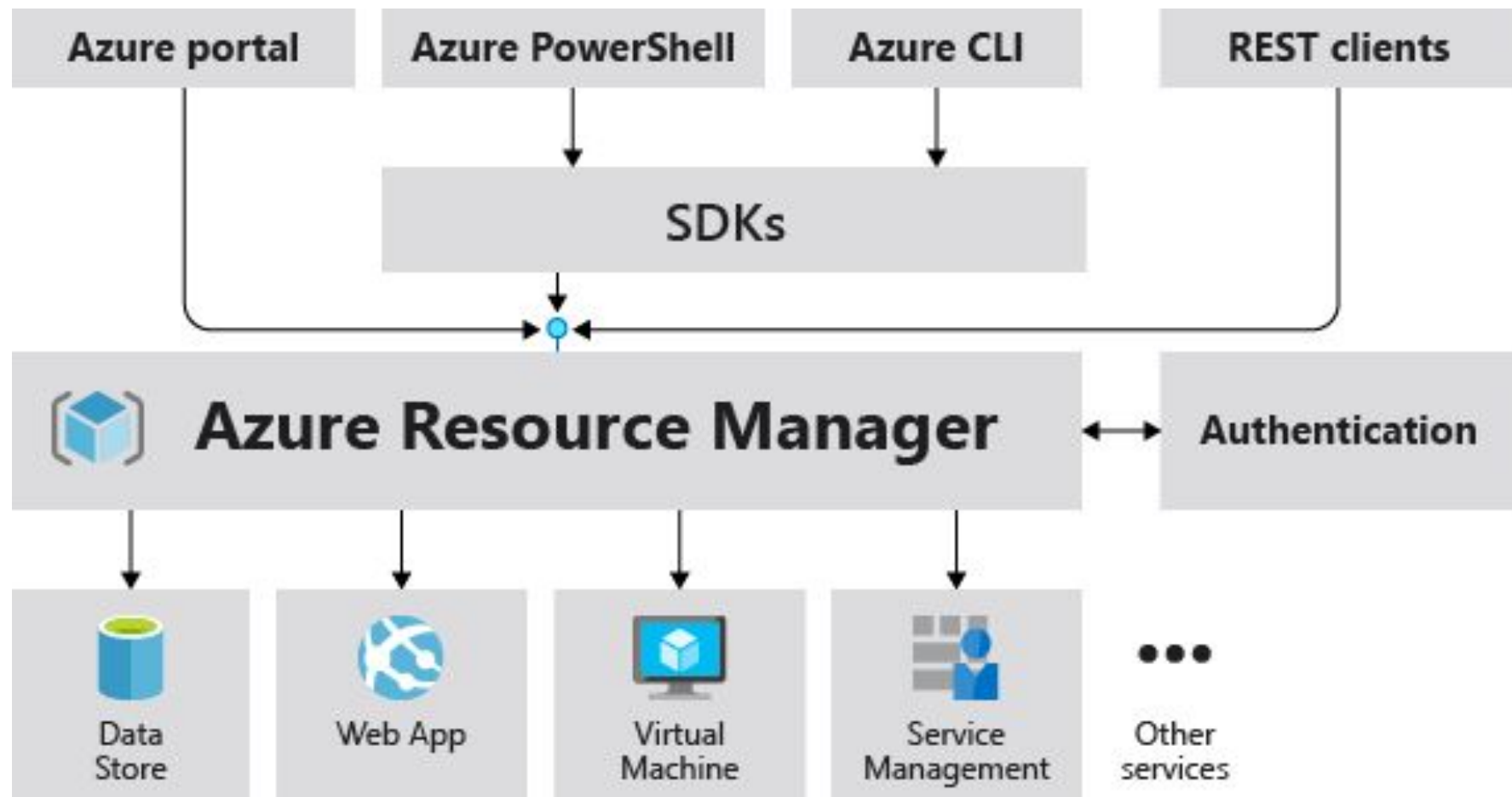
# ARM Templates



# Azure Resource Manager (ARM)

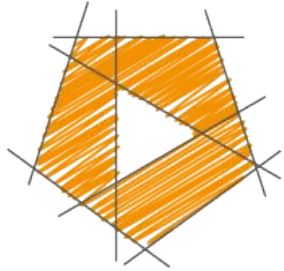
The deployment and management service for Azure Management layer that allows you to create, update, and delete resources called “**deployments**”

All actions that you take to manage your Azure resources goes through the ARM layer



```
"resources": [  
  {  
    "type": "Microsoft.Storage/storageAccounts",  
    "apiVersion": "2019-06-01",  
    "name": "[parameters('storageAccountName')]",  
    "location": "[parameters('location')]",  
    "sku": {  
      "name": "Standard_LRS",  
      "tier": "Standard"  
    },  
    "kind": "StorageV2",  
    "properties": {  
      "accessTier": "Hot"  
    },  
    "resources": [  
      {  
        "type": "blobServices/containers",  
        "apiVersion": "2019-06-01",  
        "name": "[concat('default/', parameters('containerName'))]",  
        "dependsOn": [  
          "[parameters('storageAccountName')]"  
        ]  
      }  
    ]  
  }  
]
```

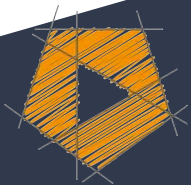
```
"resources": [  
  {  
    "type": "Microsoft.Storage/storageAccounts",  
    "apiVersion": "2019-06-01",  
    "name": "[parameters('storageAccountName')]",  
    "location": "[parameters('location')]",  
    "sku": {  
      "name": "Standard_LRS",  
      "tier": "Standard"  
    },  
    "kind": "StorageV2",  
    "properties": {  
      "accessTier": "Hot"  
    },  
    "resources": [  
      {  
        "type": "blobServices/containers",  
        "apiVersion": "2019-06-01",  
        "name": "[concat('default/', parameters('containerName'))]",  
        "dependsOn": [  
          "[parameters('storageAccountName')]"  
        ]  
      }  
    ]  
  }  
]
```



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# Azure Advisor



## Advisor recommendations

 Download as CSV  Download as PDF  ConfigureSubscriptions: 2 of 24 selected – Don't see a subscription? [Switch directories](#)

2 subscriptions

All types

Active

No grouping

Overview

 High Availability (8) Security (21) Performance (1) Cost (2) All (32)

## High Availability

8 Recommendations

1 High impact 7 Medium impact 0 Low impact

25 impacted resources



## Security

21 Recommendations

21 High impact 0 Medium impact 0 Low impact

63 impacted resources



## Performance

1 Recommendation

1 High impact 0 Medium impact 0 Low impact

1 impacted resource



## Cost

2,876 USD  
savings/mo \*





2 Recommendations

2 High impact 0 Medium impact 0 Low impact

11 impacted resources



## Tips &amp; tricks

-  You can customize Advisor to process recommendations for resources that matter to you the most.
-  You can optimize underutilized virtual machines to reduce your monthly Azure spend.
-  You can improve the performance of your SQL Azure databases.
-  You can enable virtual machine backup to protect your data from corruption or accidental deletion.



Download recommendations as PDF



Download recommendations as CSV

# Azure Service Health



# Service Health - Service issues

Search (Ctrl+/)

## ACTIVE EVENTS

Service issues

Planned maintenance

Health advisories

## HISTORY

Health history

## RESOURCE HEALTH

Resource health

## ALERTS

Health alerts

Select filter ...

Subscription

Pay-As-You-Go (Azure Courses)

Region

6 selected

Service

154 selected



Save filter



Delete filter



Pin filtered world map to dashboard



Create service health alert



No service issues found

See 1 resolved service issues in the last 24 hours, or see all past issues in the [health history](#).

Launch guided tour

# Service Health - Health history

Subscription

Pay-As-You-Go (Azure Courses)

Region

North Europe

Health Event Type

Service issue

Time Range

Last 24 hours

ISSUE NAME

TRACKING ID

EVENT TYPE

SERVICE(S)

REGION(S)

START TIME

UPDATE

Connectivity Issue - North Europe - RCA

V7KX-9BG

Incident

Network Infrastr...

North Europe

07:50 UTC, 05/22/2019

16 h ago

Summary Issue updates Root cause analysis

Last update (16 h ago)



Download the issue summary

**Summary of impact:** Between 07:50 and 08:36 UTC on 22 May 2019, a subset of customers may have experienced connectivity issues when accessing Azure services in North Europe.

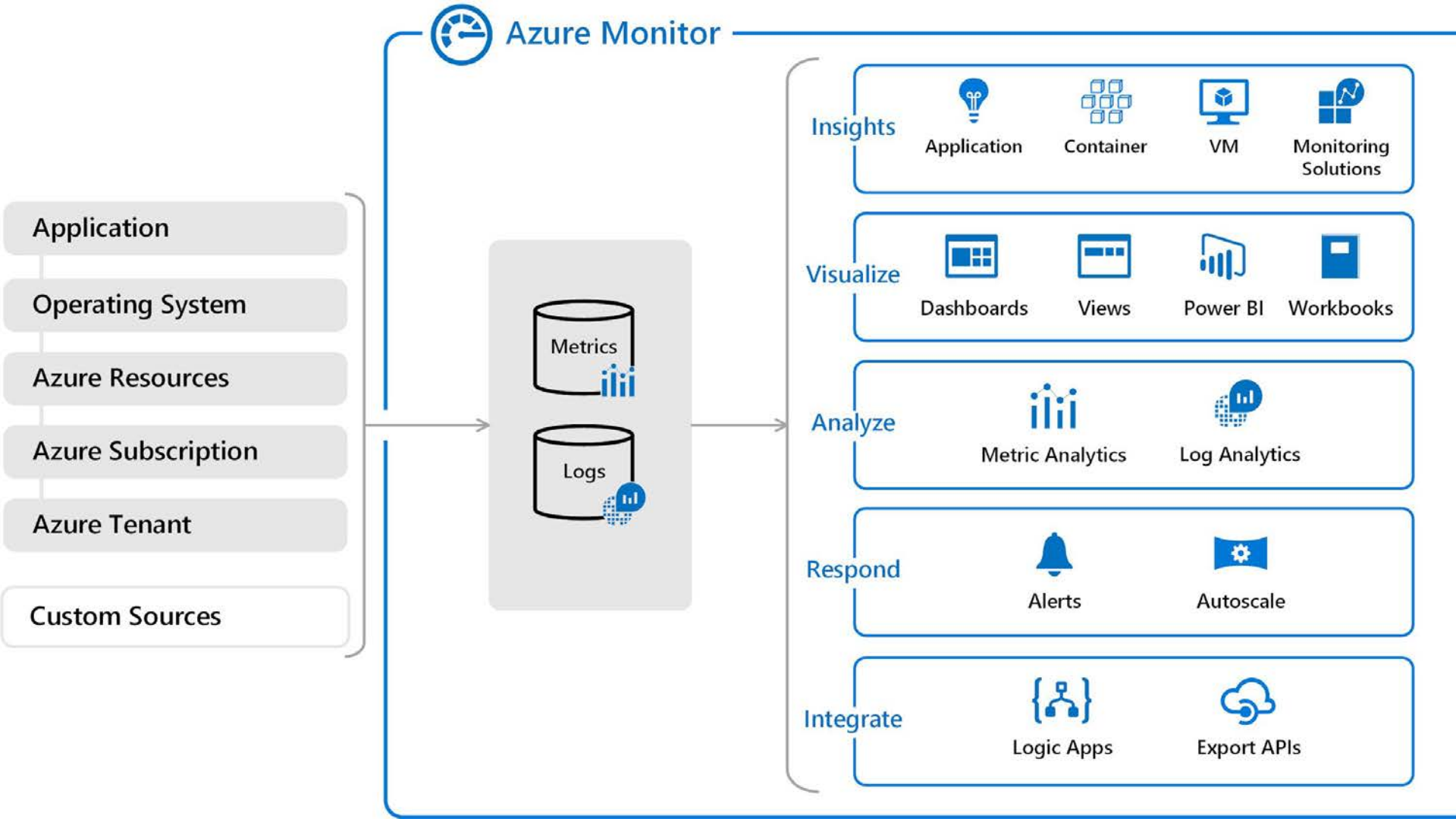
**Root Cause:** During this incident, approximately 12% of the network flows in or out of a single row of servers in a data center in North Europe would have failed.

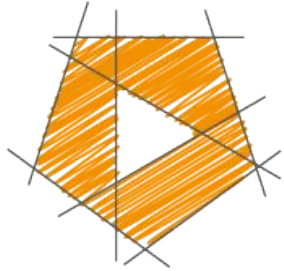
Each row of servers in an Azure data center (DC) is connected to the DC network spine by eight routers. During this incident, one of the eight routers in a single row of a DC in North Europe began dropping all packets that it was expected to forward. Flows are spread over the eight routers, so flows sent to this one router would have been

Was this helpful?

# Azure Monitor





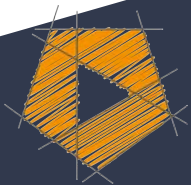


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Thank you and best of luck!



# Grab Your Free Resources

Located at the end of the course:

- Free PDF Study Guide
- Download the slides and MP3 audio if you like to study offline
- 50 question practice test

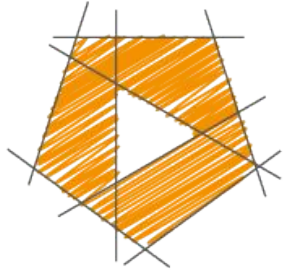


## Section 15: Thank You! ^

3 / 6 | 16min

- ☒ 63. Thank you!  
2min
- ☐ 64. An Overview of Azure Certifications (June 2021)  
14min
- ☐ Practice Test 1: 50 Question Practice Test
- ☐ 65. Other Exam Resources  
1min
- ☒ 66. Course Resources - Study Guide, Slides, Audio  
1min
- ☒ 67. Bonus: 50+ Hours of Hands-On Azure Practice for AZ-900  
1min

Resources ▾



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