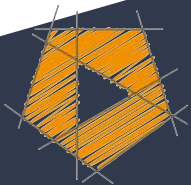


AZ-900 Microsoft Azure Fundamentals

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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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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Created by Timofei Rostilov

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

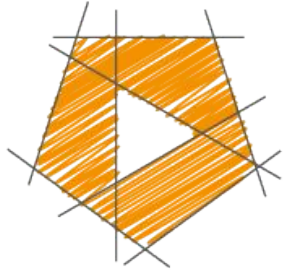


Section 15: Thank You! ^

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

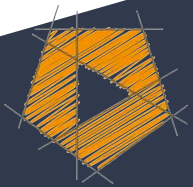
Resources ▾



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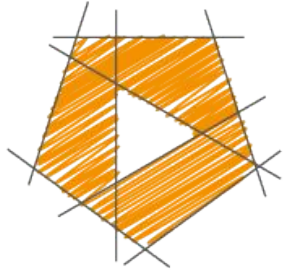
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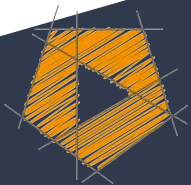
Let's have a look at
“The Cloud”



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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
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Describe cloud service types

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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.”

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

Hybrid cloud



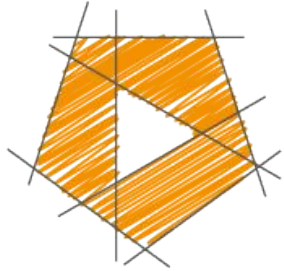
“A hybrid cloud... is a computing environment that combines a private cloud with a public cloud.”

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

Compare and Contrast



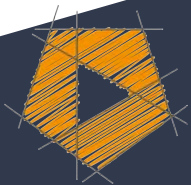
Public vs private vs hybrid



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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

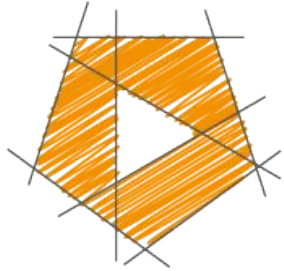
Some serverless offers just charge you for each time the program runs

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

6. Other metrics

Active Directory Premium services charge per assigned user

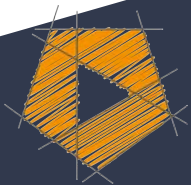
Pricing changes between
regions



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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

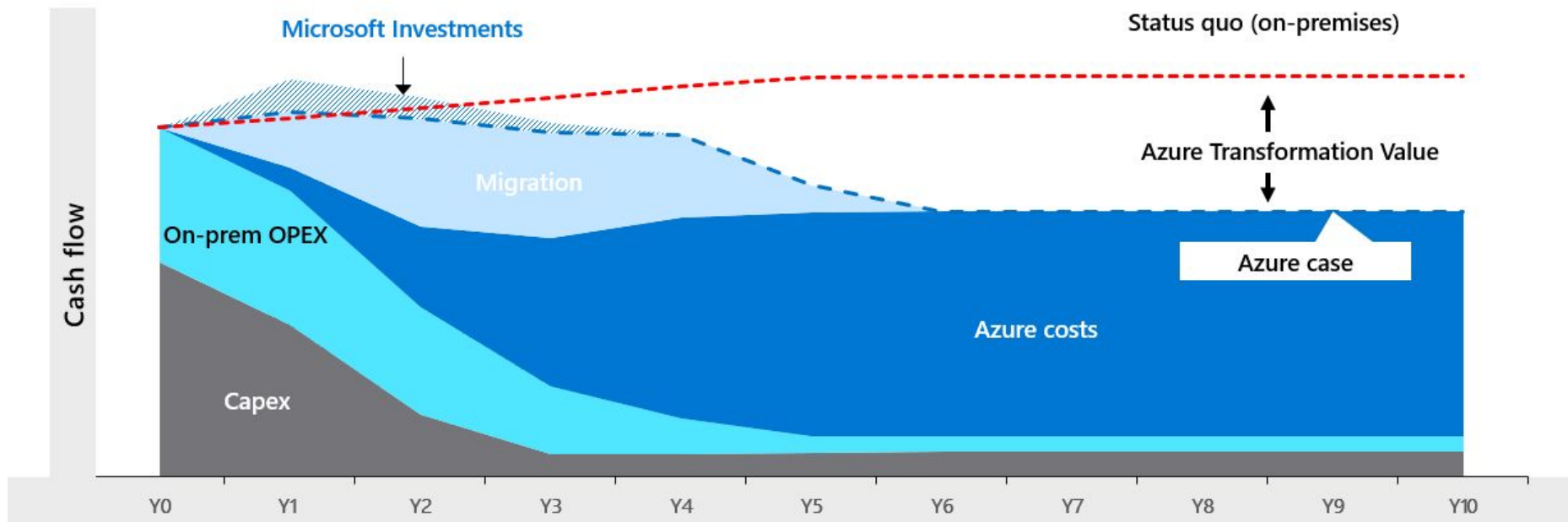


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Cost Savings





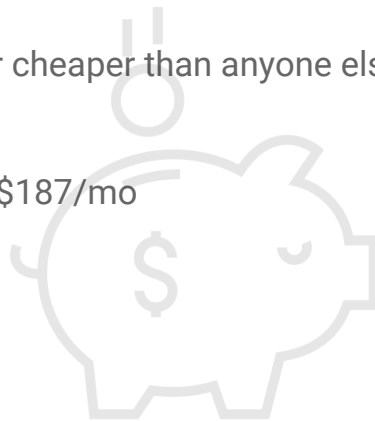
Cost Savings – Real

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

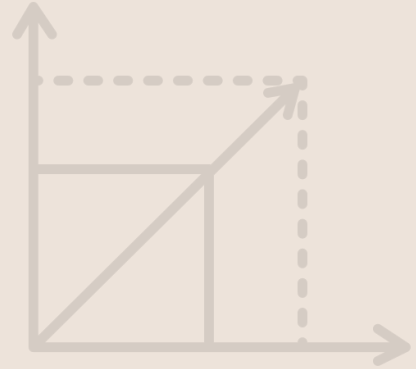


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You can take actions to
reduce your cost -
i.e. autoscaling



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To be continued...



High Availability



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

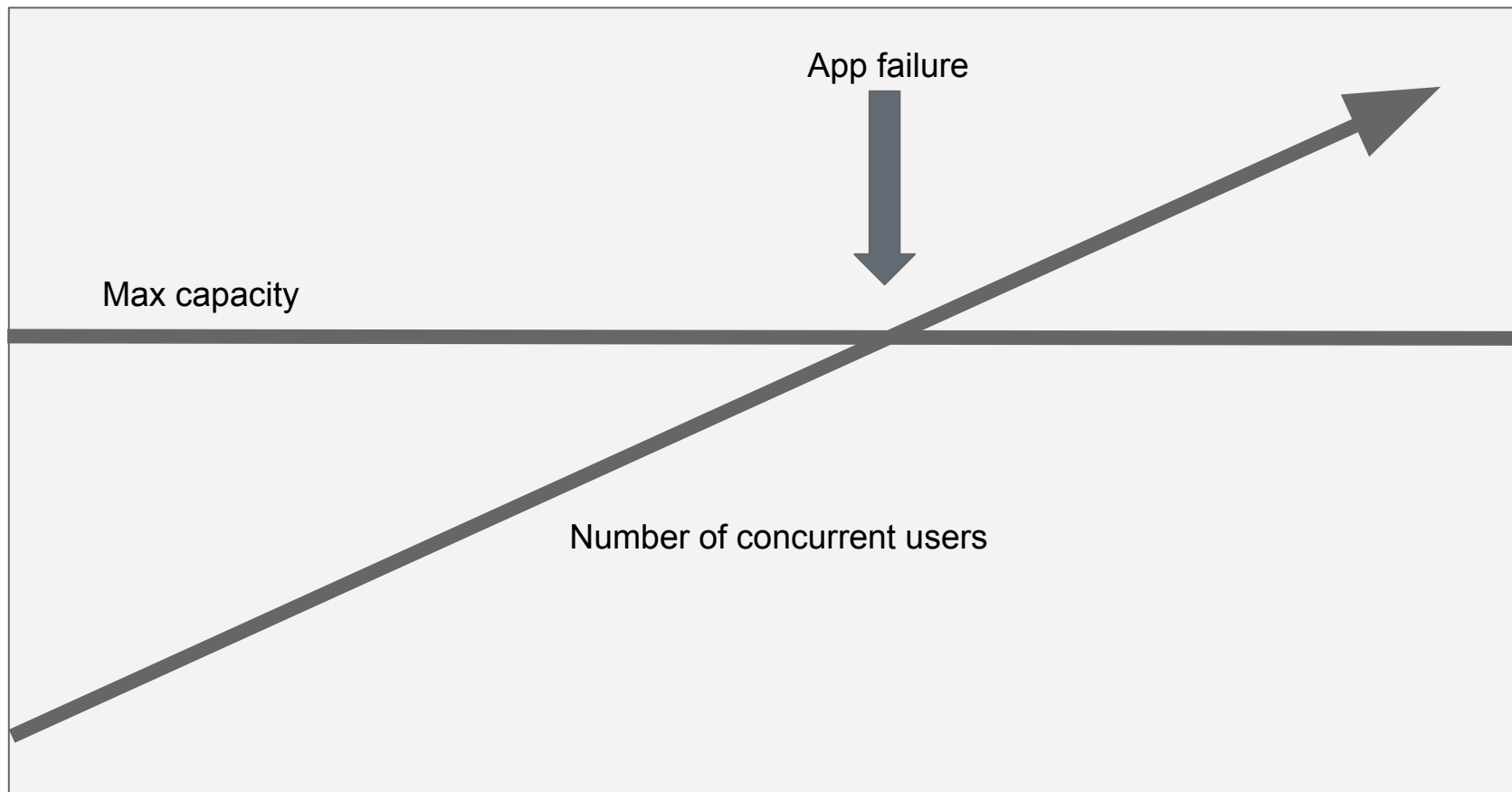
99.99%

Four nines, 4 minutes per month

Scalability



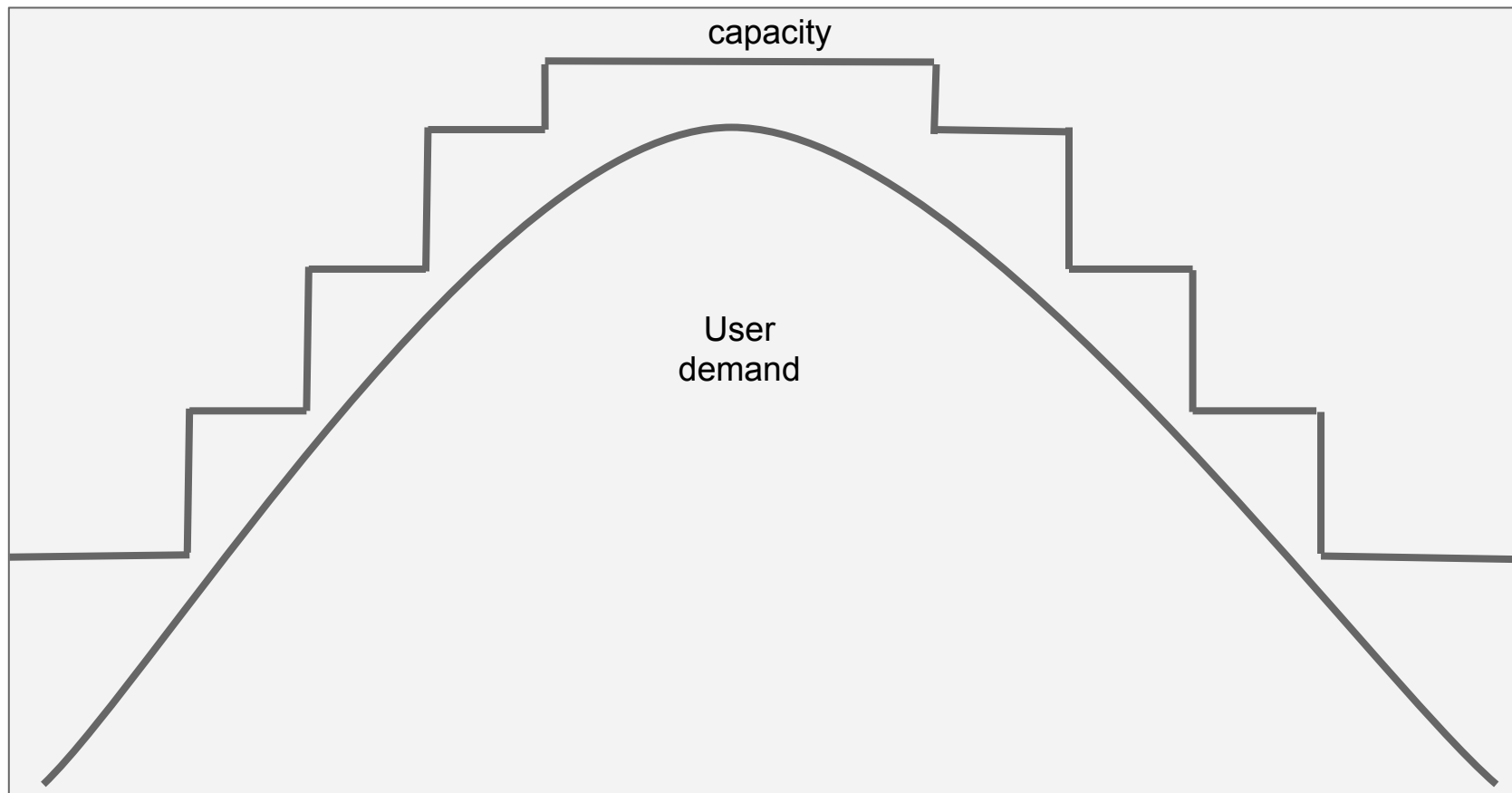
The ability of a system to handle
growth of users or work



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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from Noun Project
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

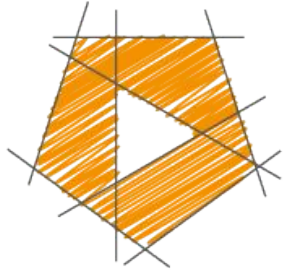
Basic DDoS protection free

Data governance

Azure Policy and Blueprints

Monitoring is important

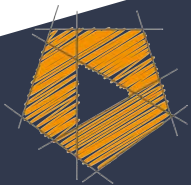
Automation to act on
events being monitored
without human
intervention required



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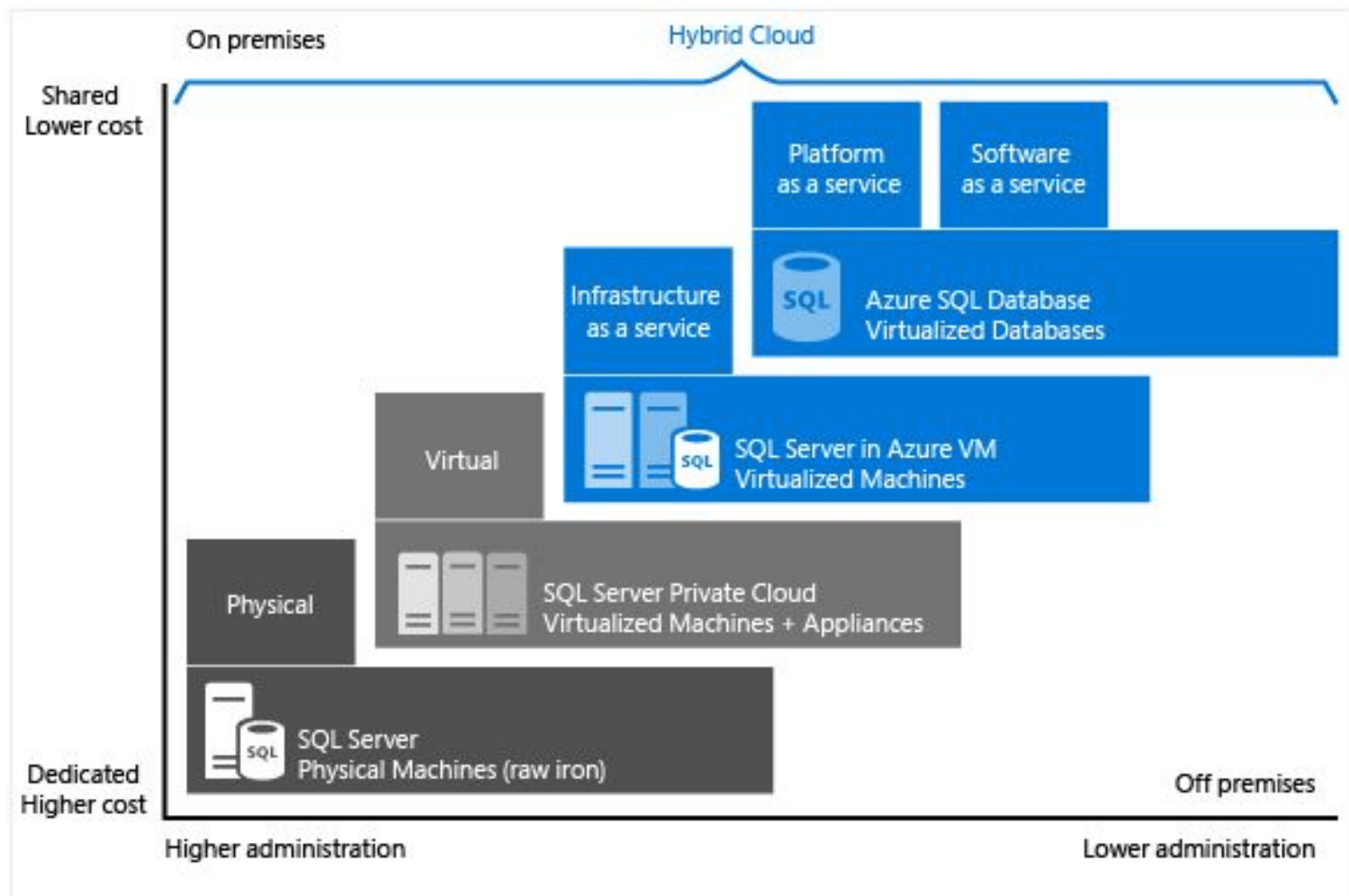
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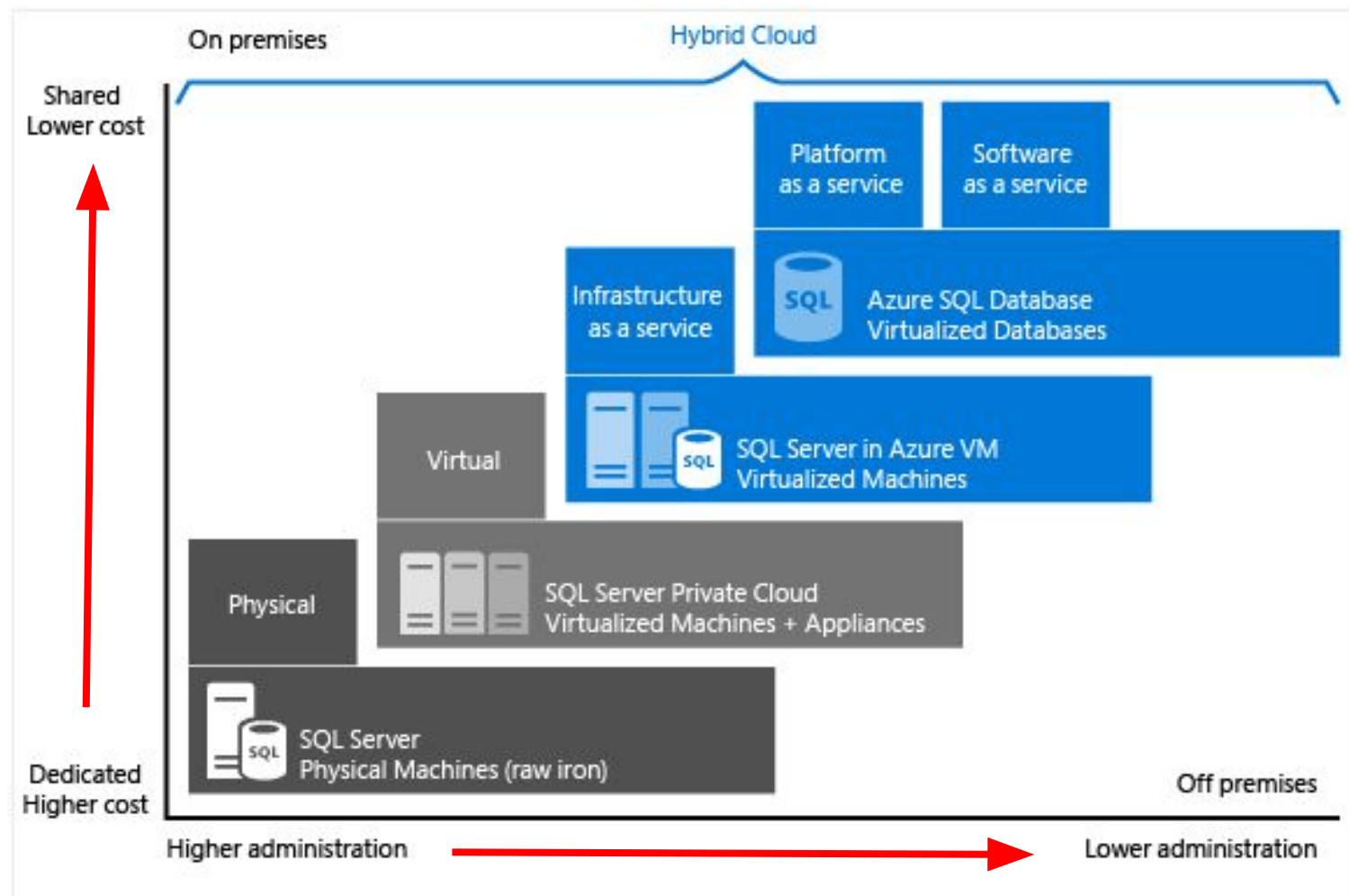
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Cloud Models

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)



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

“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

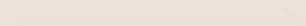
Even with PaaS, you have
to choose an App Service
Plan

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

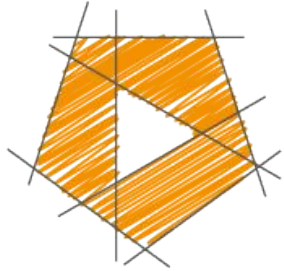
Azure Serverless Offers

Compute - Azure Functions

Compute - Serverless Kubernetes (Virtual Nodes w/ ACI)

Database - Azure SQL Database Serverless

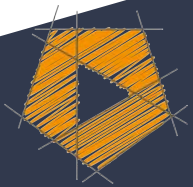
Database - Cosmos DB Serverless



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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



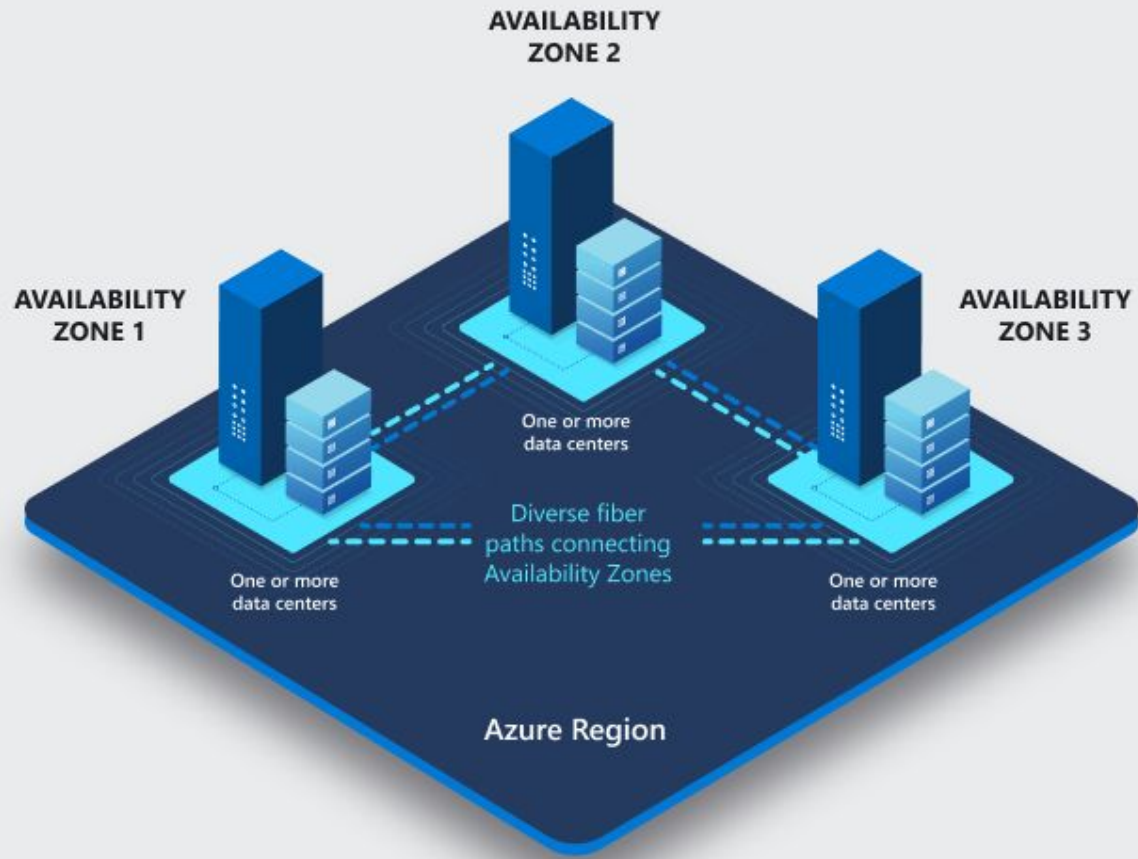
Sovereign Regions

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

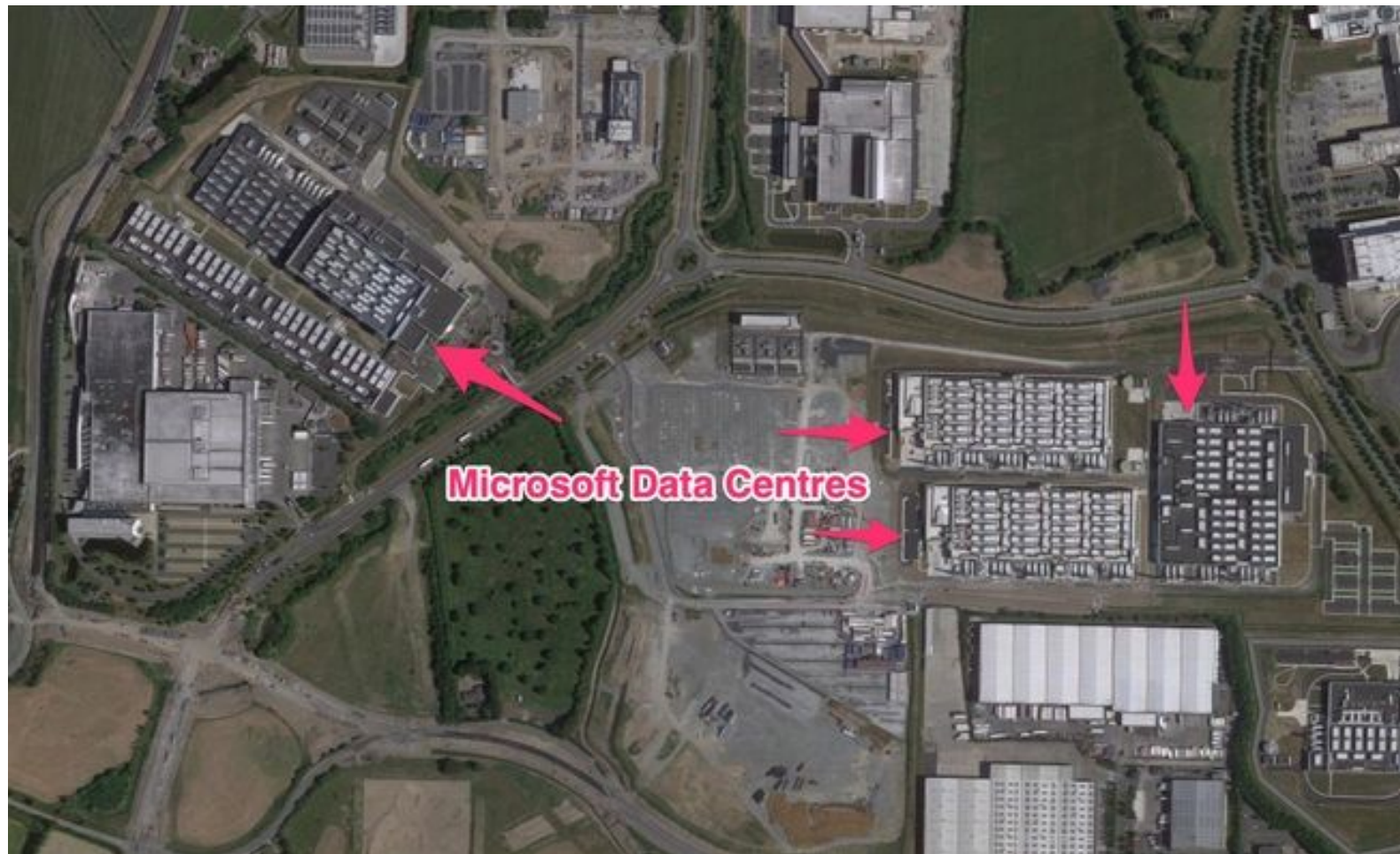
Korea Central

Southeast Asia - East Asia

China North 3

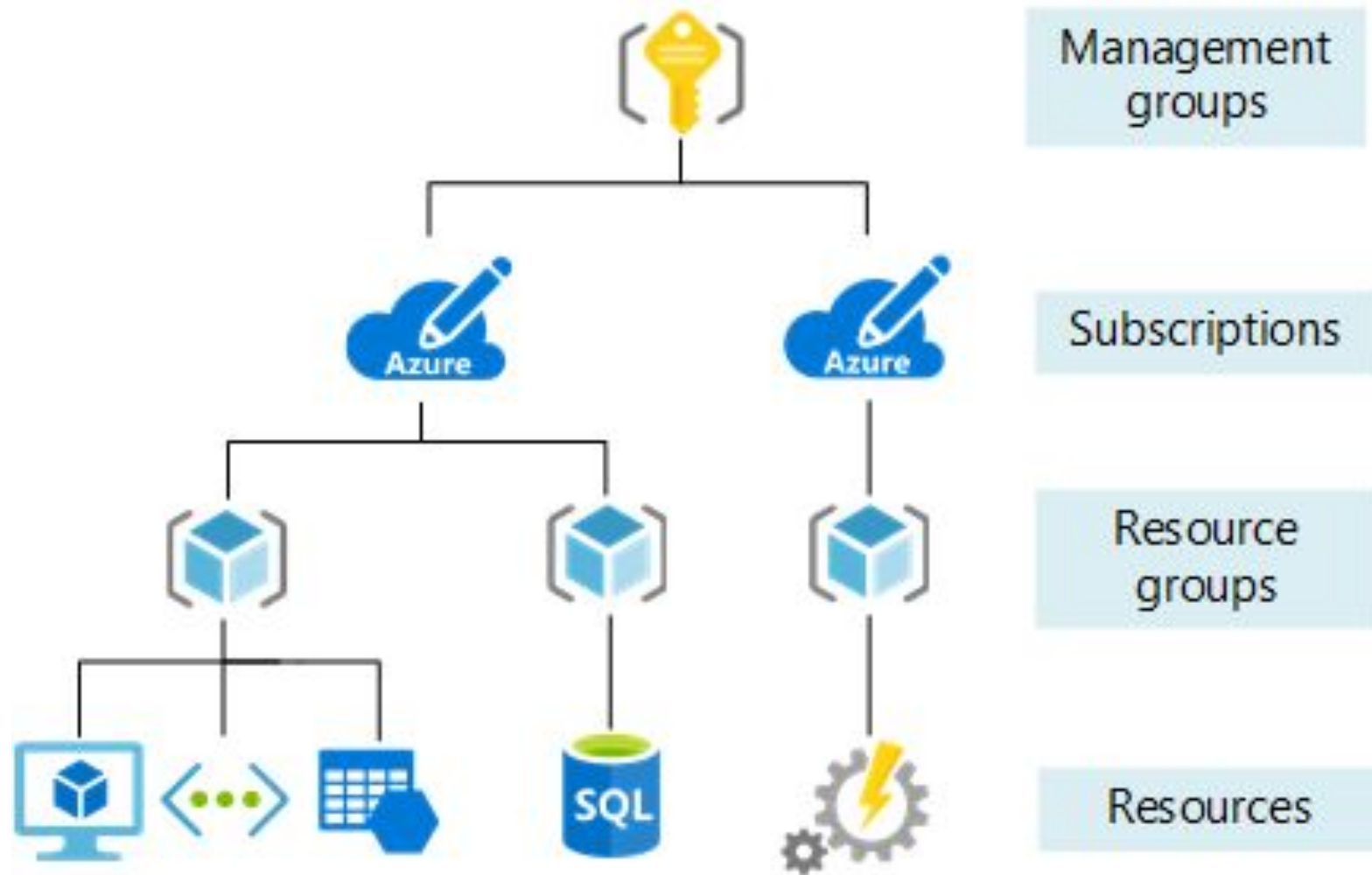
Data Centers





Resource Groups





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



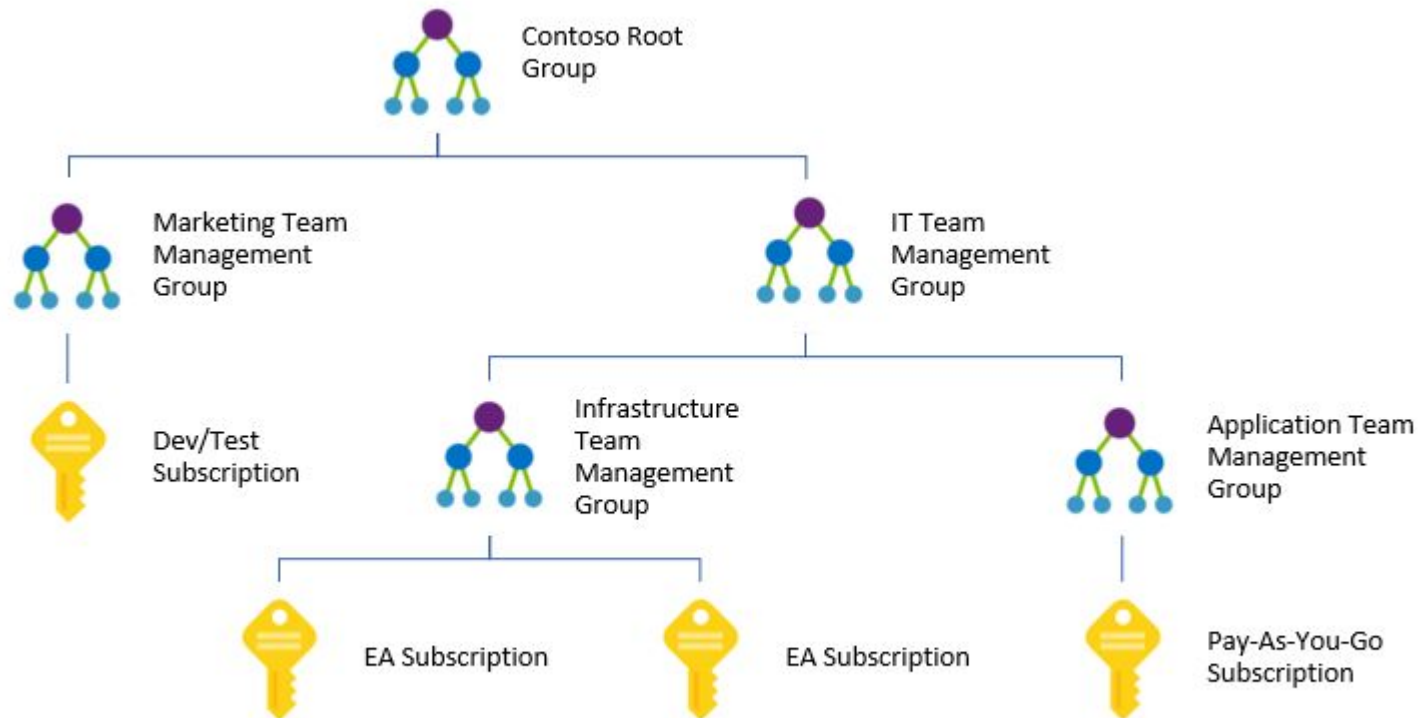
Traffic Manager

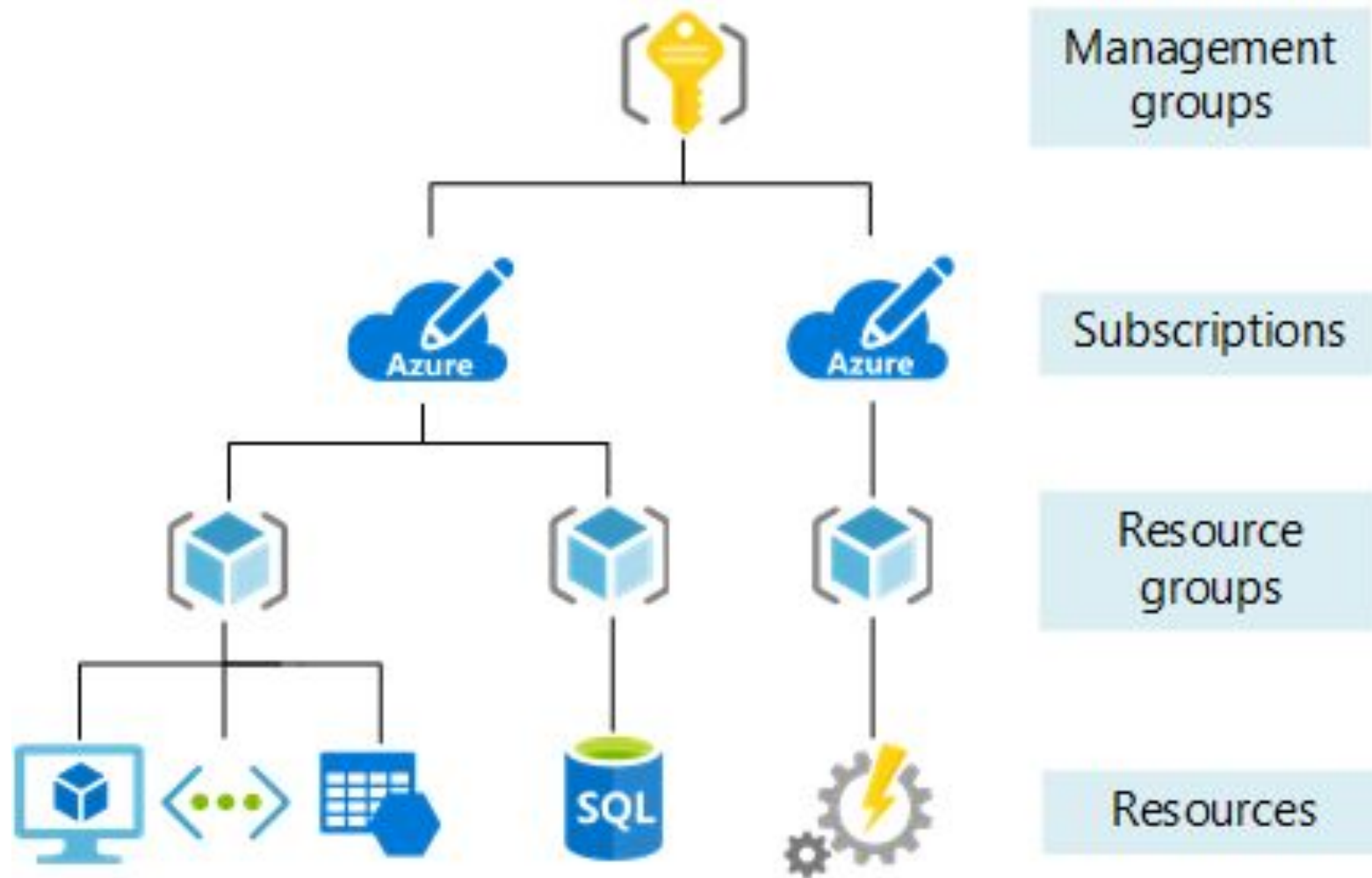


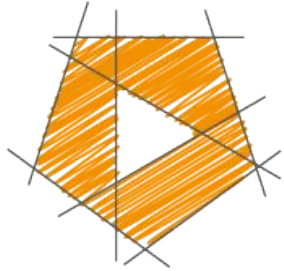
StorSimple

Management groups





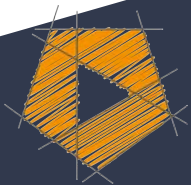




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Azure Compute and Networking

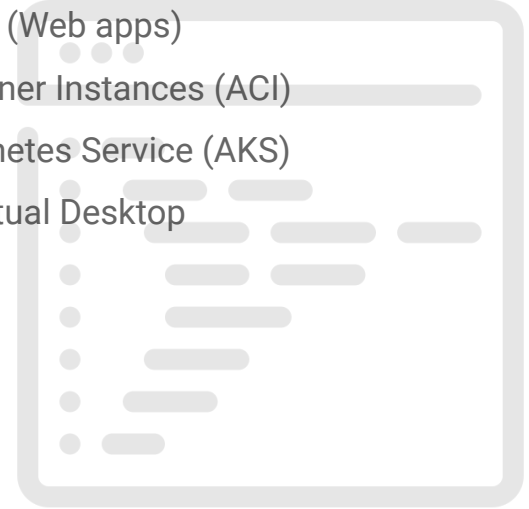


Getting Deep into the Technical

- **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



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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

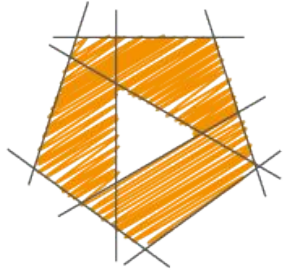
Azure Virtual Desktop

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

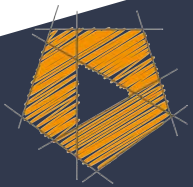
Runs on Azure



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AZ-900 Microsoft Azure Fundamentals

Scott Duffy, Instructor



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Networking Services Covered

Virtual Networks

VPN Gateway

VNet Peering

ExpressRoute



Created by Barracuda
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

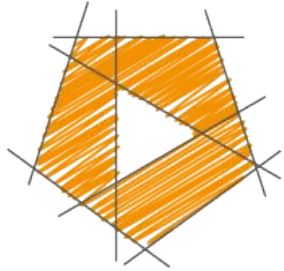
Azure Front Door Service - a load balancer, CDN and firewall all-in-one

Monitoring – Management Tools Section of the Course

Network Watcher

ExpressRoute Monitor

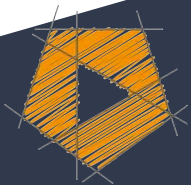
Azure Monitor



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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
- 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)

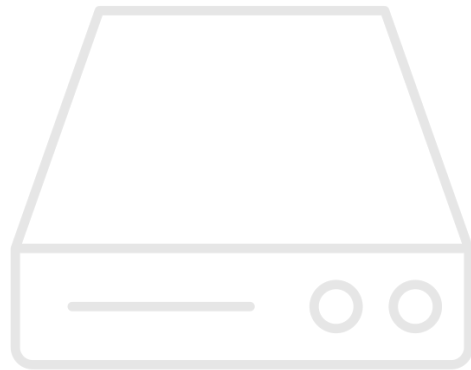
Storage Services Covered

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

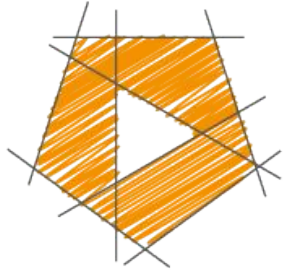
Disk Storage

Azure Virtual Machine Disks

Managed Disks

Reserve capacity in advance

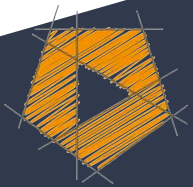
Optimized to virtual hard disks



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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

Monthly Payroll Application

The laser printer at 6th Floor West

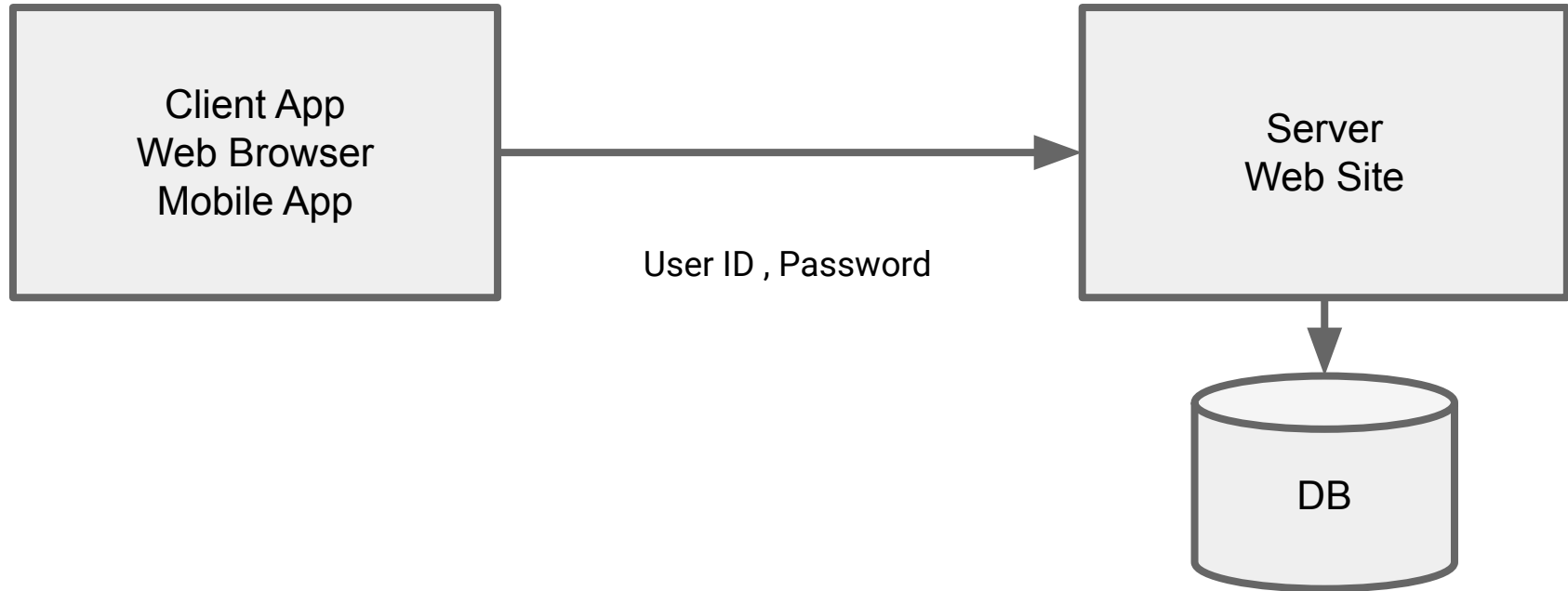
Usually requires a
password, a secret key or a
certificate to prove

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

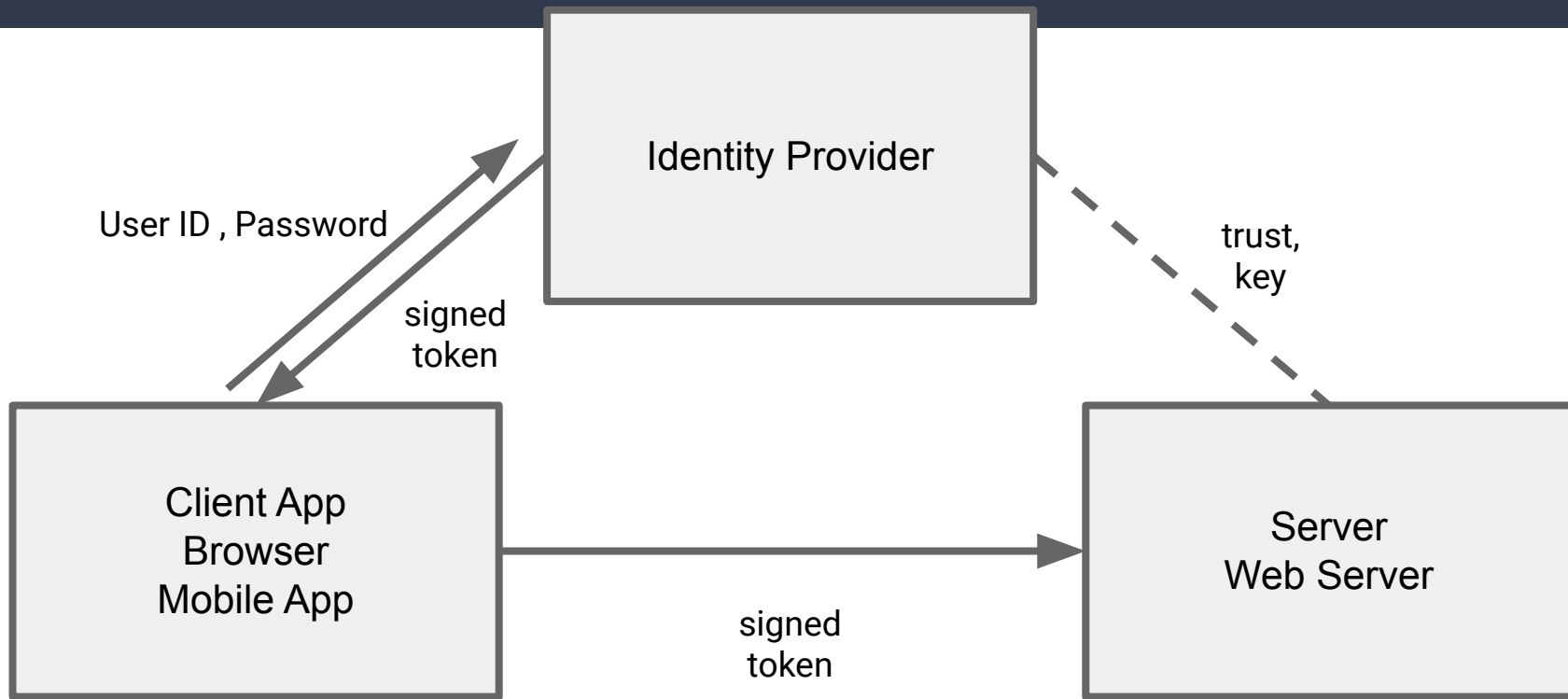
Active Directory

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

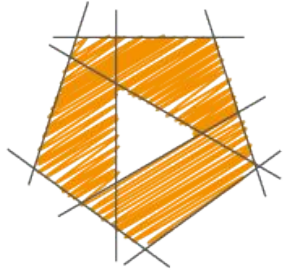
The AAD Model



SAML

OpenID

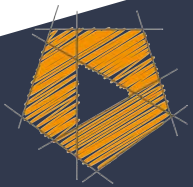
WS Federation



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Benefits of Azure AD



Security



Created by Peter van Driel
from Noun Project



Reduced development
time, easier support

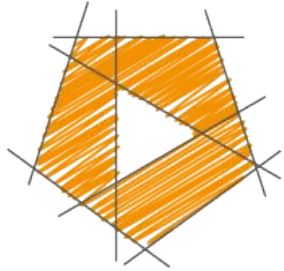
More features

Centralized administration

Only one user ID and
password

- Single Sign-On

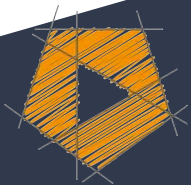
Integration with other Azure services



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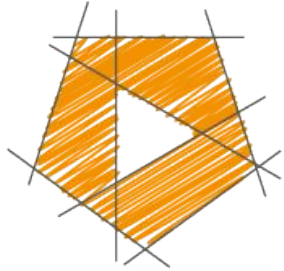
The difference between Authentication and Authorization



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

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

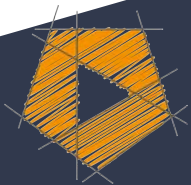
Move away from all
authenticated users
having admin access



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Azure Active Directory



Microsoft's
preferred solution for
identity management

Azure AD Powers Other Microsoft Services

Azure

Skype

Outlook

OneDrive

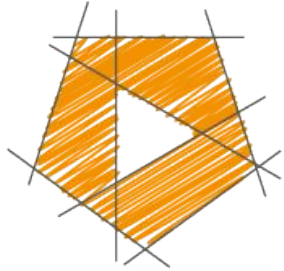
Xbox

Office 365 - Teams, SharePoint, PowerBI, etc

Complete solution for
managing users, groups,
roles

Single-sign on

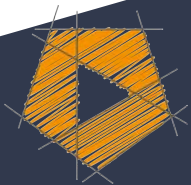
Synchronize with your
corporate AD



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Conditional Access



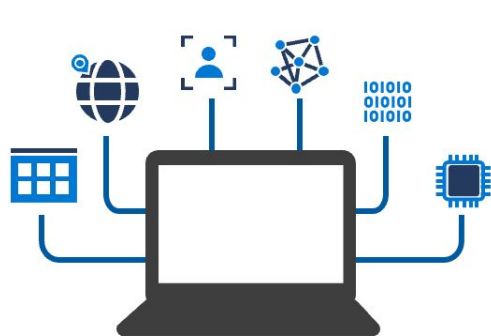
User A attempts to log in to the app from within the company office, as she does every day

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

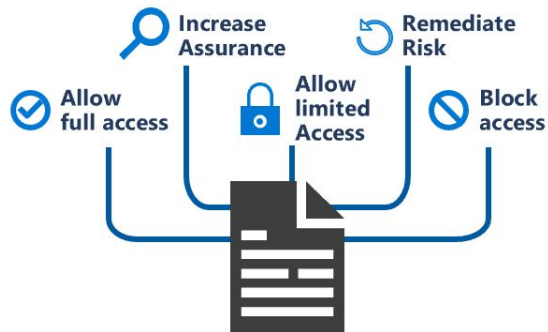
Administrator C attempts
to log in to the app from
their phone

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”



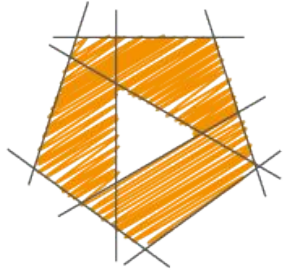
Signal



Decision



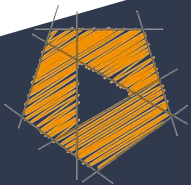
Enforcement



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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

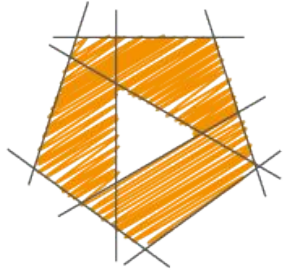
Something you **have** - i.e mobile phone, access to email account

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

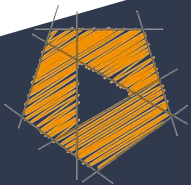
SMS, email, authenticator
app, phone call



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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

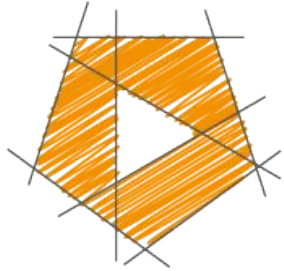
Accountant
Developer
Business Lead

Assign granular
permissions to that role

Assign users to
that role

Do not assign granular
permissions to an
individual

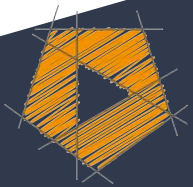
Reader
Contributor
Owner



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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

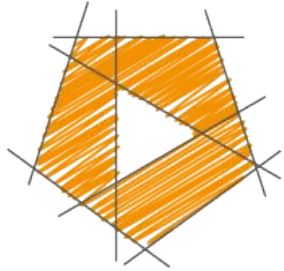
Devices: ensure
compliance and health
status

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

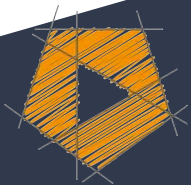
Network: encrypt all
communications



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Defense in Depth

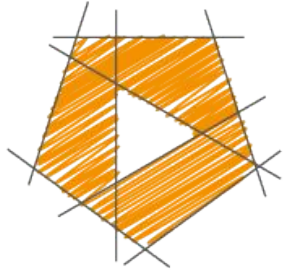


Security Layers

- 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

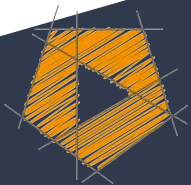
Identity & Access	Apps & Data Security	Network Security	Threat Protection	Security Management
Role-based access	Encryption	DDOS Protection	Antimalware	Log Management
Multifactor Authentication	Confidential Computing	NG Firewall	AI-Based Detection and Response	Security Posture Assessment
Central Identity 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 7/9

KILOWATT HOURS

68775-3

FM 2S CL 200 240 V Type **MX**
TA 30 Kh 7.2 3W 60Hz
76 548 902 0906

S ALL ADJ. F



-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

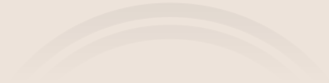
Cognitive Services API

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 > Cost Management + Billing | Overview >



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

--

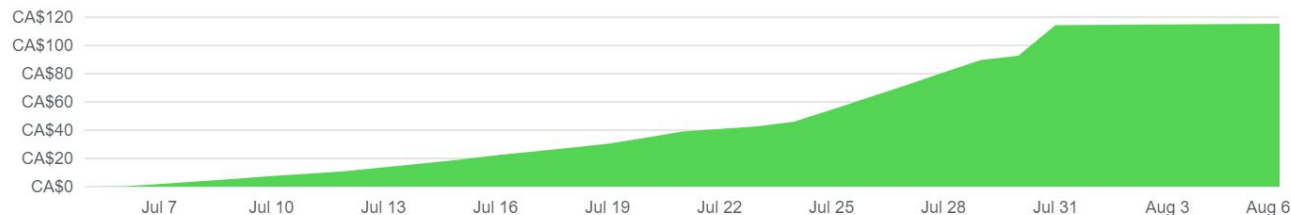
BUDGET: AZBUDGET

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

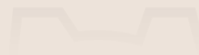
firstvnet-ra
CA\$37....
az304new
CA\$37....

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



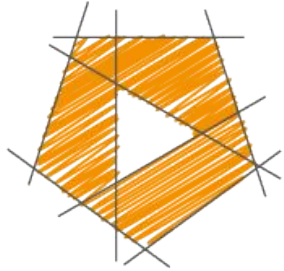
Can add metadata to Azure resources



Created by Pascal Conil-lacoste
from Noun Project

from Noun Project
Created by Pascal Conil-lacoste

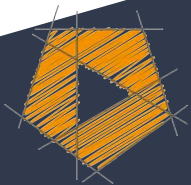
Helps with billing and
support issues



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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

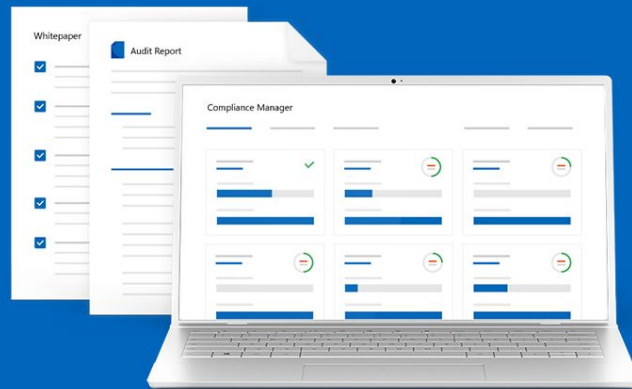
Service Trust Portal



<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

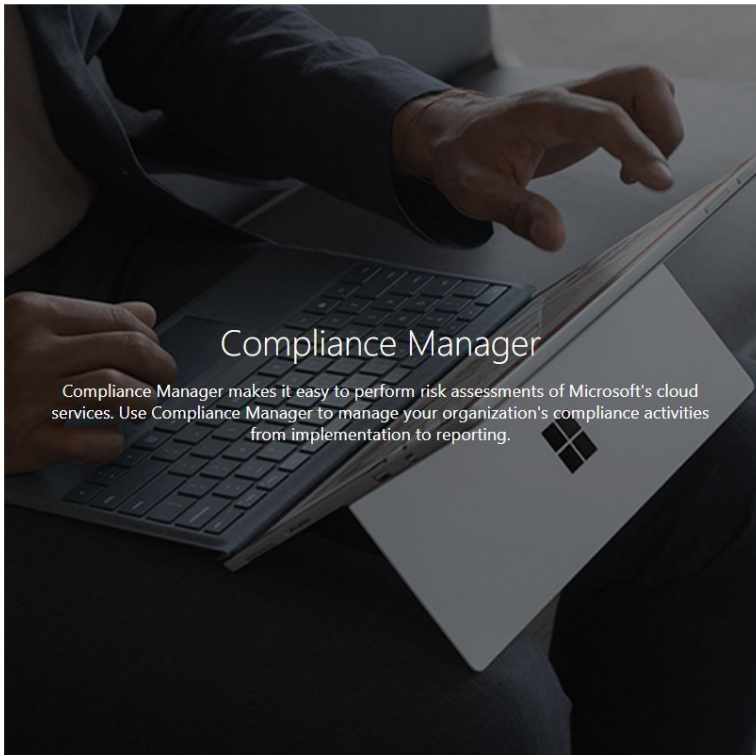


ISO 27001



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

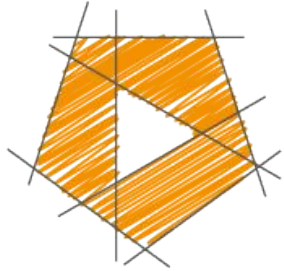
Define a repeatable set of Azure resources that implement and adhere to your organization's standards, patterns, and requirements and rapidly build new environments with a set of built-in components to speed up development and delivery

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 >](#)

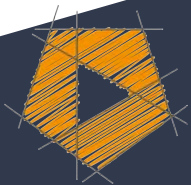




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Azure Tools

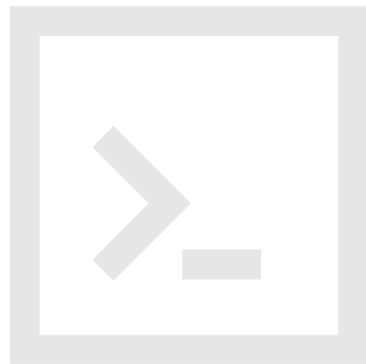
Azure CLI

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.

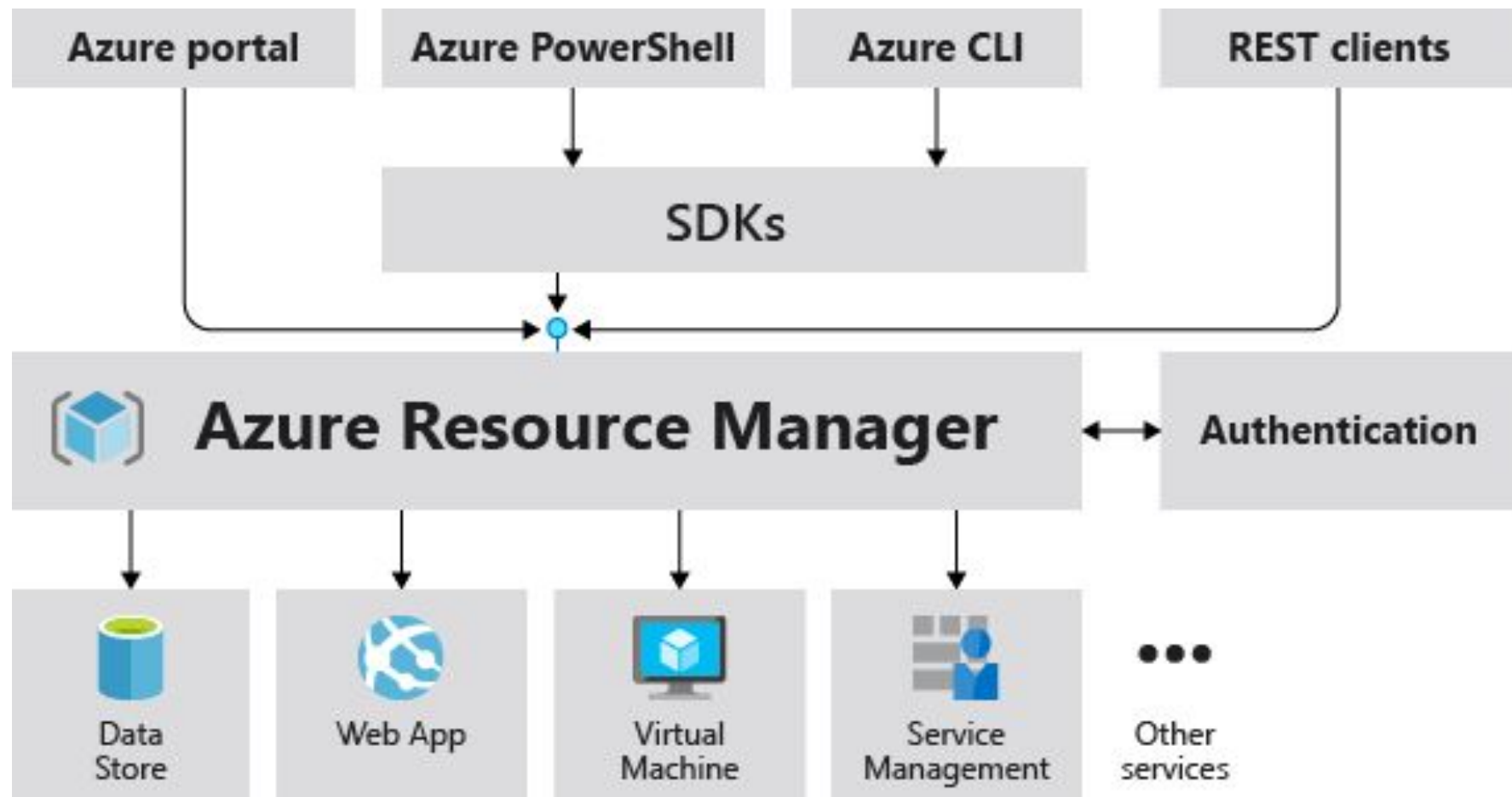
ARM Templates



Azure Resource Manager (ARM)

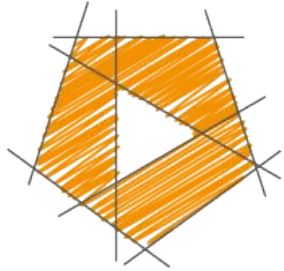
The deployment and management service for Azure Management layer that allows you to create, update, and delete resources called “**deployments**”

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')]"  
        ]  
      }  
    ]  
  }  
]
```

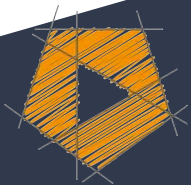
```
"resources": [  
  {  
    "type": "Microsoft.Storage/storageAccounts",  
    "apiVersion": "2019-06-01",  
    "name": "[parameters('storageAccountName')]",  
    "location": "[parameters('location')]",  
    "sku": {  
      "name": "Standard_LRS",  
      "tier": "Standard"  
    },  
    "kind": "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 & 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.

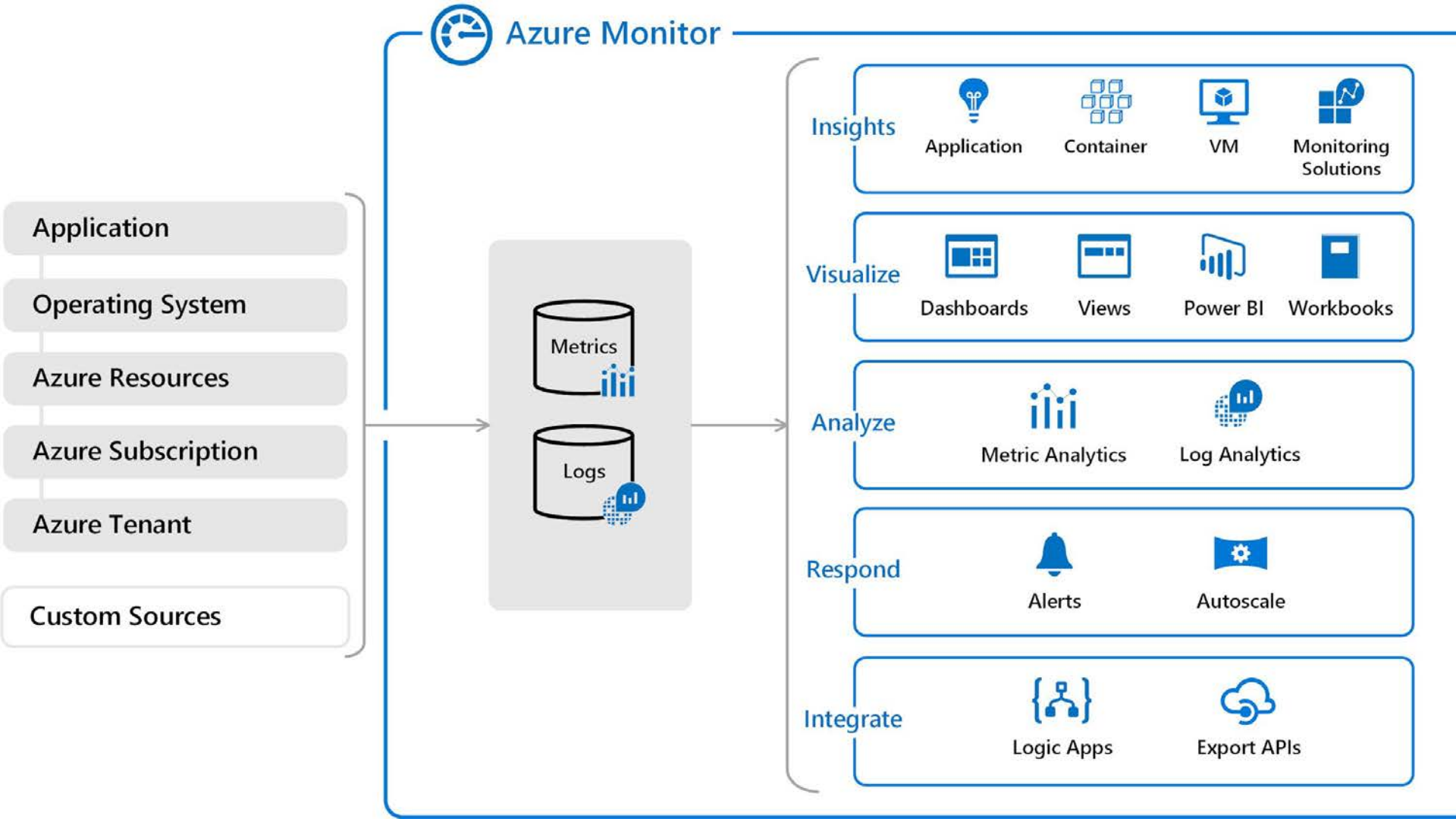
Root Cause: During this incident, approximately 12% of the network flows in or out of a single row of servers in a data center in North Europe would have failed.

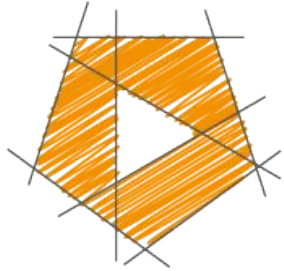
Each row of servers in an Azure data center (DC) is connected to the DC network spine by eight routers. During this incident, one of the eight routers in a single row of a DC in North Europe began dropping all packets that it was expected to forward. Flows are spread over the eight routers, so flows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

Was this helpful?

Azure Monitor



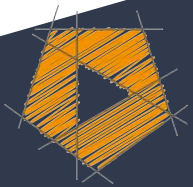




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Thank you and best of luck!



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

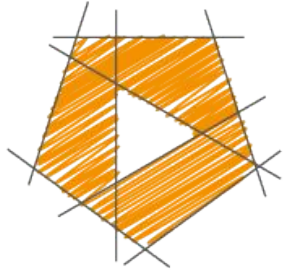


Section 15: Thank You! ^

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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