

Developing Scalable Apps on Azure

Designed to demonstrate enterprise software development, cloud development and delivery.

**With Siddharth Dhawan
Microsoft Certified Trainer - Azure**



Join Us in Making Learning Technology Easier

Our mission...

Over 16 years ago, we embarked on a journey to improve the world by making learning technology easy and accessible to everyone.

...impacts everyone daily.

And it's working. Today, we're known for delivering customized tech learning programs that drive innovation and transform organizations.

In fact, when you talk on the phone, watch a movie, connect with friends on social media, drive a car, fly on a plane, shop online, and order a latte with your mobile app, you are experiencing the impact of our solutions.



Over The Past Few Decades, We've Provided

Over
62,300,000
expert-led learning hours

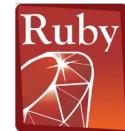
In 2019 Alone, We Provided

Training to over
13,500 engineers

Programs in
30 countries

Over **120**
active trainers, with
an average of over
two decades of
experience each.

We teach over 400 technology topics



You experience our impact on a daily basis!



Virtual Training Expectations for Me

I pledge to:

- Make this as interesting and interactive as possible
- Ask questions in order to stimulate discussion
- Use whatever resources I have at hand to explain the material
- Try my best to manage verbal responses so that everyone who wants to speak can do so
- Use an on-screen timer for breaks so you know when to be back

Prerequisites

- This course assumes you know how to program in any language minimally, along with virtualization fundamentals but never took a formal course.
- This course will not teach you how to program, but rather, how to build scalable applications - the Azure way!!
 - Azure Fundamentals
 - Designing and building global applications on Azure

Objectives

At the end of this course, you will be able to:

- Describe foundational concepts for cloud development using Azure
- Identify cloud best practices and design patterns as recommended by Microsoft
- Build globally distributed, secure, scalable and performant applications
- Explain how various services are used within Azure including Azure App Service, Storage Services, Azure Active Directory and Azure Kubernetes Service

What do leading companies care about?



“We may not timely identify or effectively **respond to consumer trends** or preferences, which could negatively affect our relationship with our customers, demand for the products and services we sell, our market share and the growth of our business.”

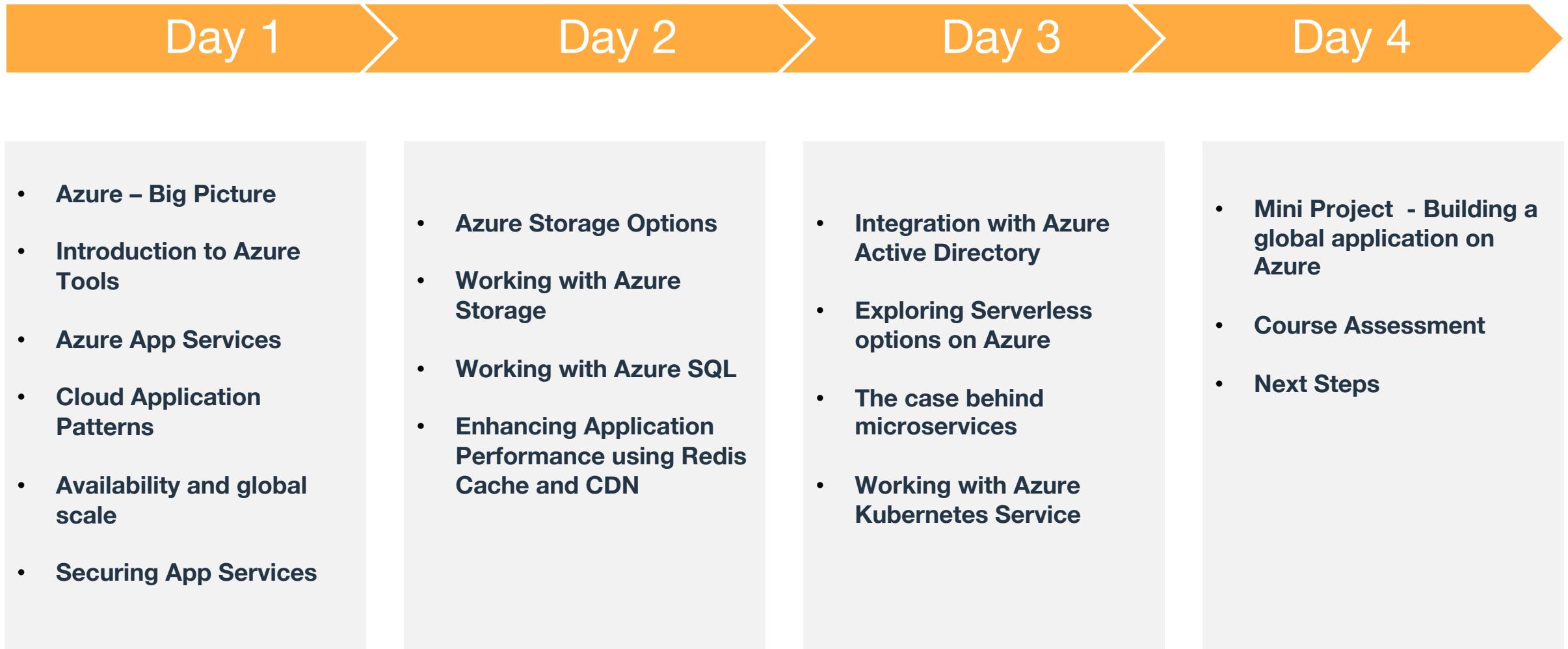


“If we fail to **develop and maintain satisfactory relationships** with physicians, hospitals and other service providers, our business could be materially and adversely affected.”



“We rely extensively on information systems to process transactions, summarize results and manage our business. **Disruptions in our systems** could harm our ability to conduct our operations”

Structure of the Course / Course Takeaways



What's Expected of our Software Today?

Valued by
customers

Constantly and
easily changed

Available at all
times

Scalable to meet
demand

Secure in all
respects

Maintainable at
scale

Module Layout – Day 1

Microsoft Azure –
The Big Picture

Azure App Services

Common Cloud Application
Patterns

Availability and Global Scale

Monitoring, Diagnostics and
Logging

Securing App Services

Module Layout – Day 1

Microsoft Azure –
The Big Picture

Azure App Services

Common Cloud Application
Patterns

Availability and Global Scale

Monitoring, Diagnostics and
Logging

Securing App Services



Understanding Microsoft Azure



Before



After

What is a Cloud?



Infrastructure as a Service



Platform as a Service



Software as a Service

Cloud Computing



- Reduced time and cost to provision
- Increased flexibility in scale and deployment
- Lower overall TCO
- New solutions possible

5000 feet view of Azure



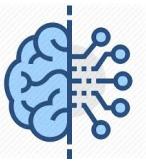
Productive

Reduce time to market, by delivering features faster with over 100 end-to-end services.



Hybrid

Develop and deploy where you want, with the only consistent hybrid cloud on the market. Extend Azure on-premises with Azure Stack.



Intelligent

Create intelligent apps using powerful data and artificial intelligence services.



Trusted

Join startups, governments and 90 percent of Fortune 500 businesses who run on the Microsoft Cloud today.

Microsoft's Cloud: Azure



Azure Subscription

An active agreement with Microsoft which is needed to provision in Microsoft Azure



Account Owner

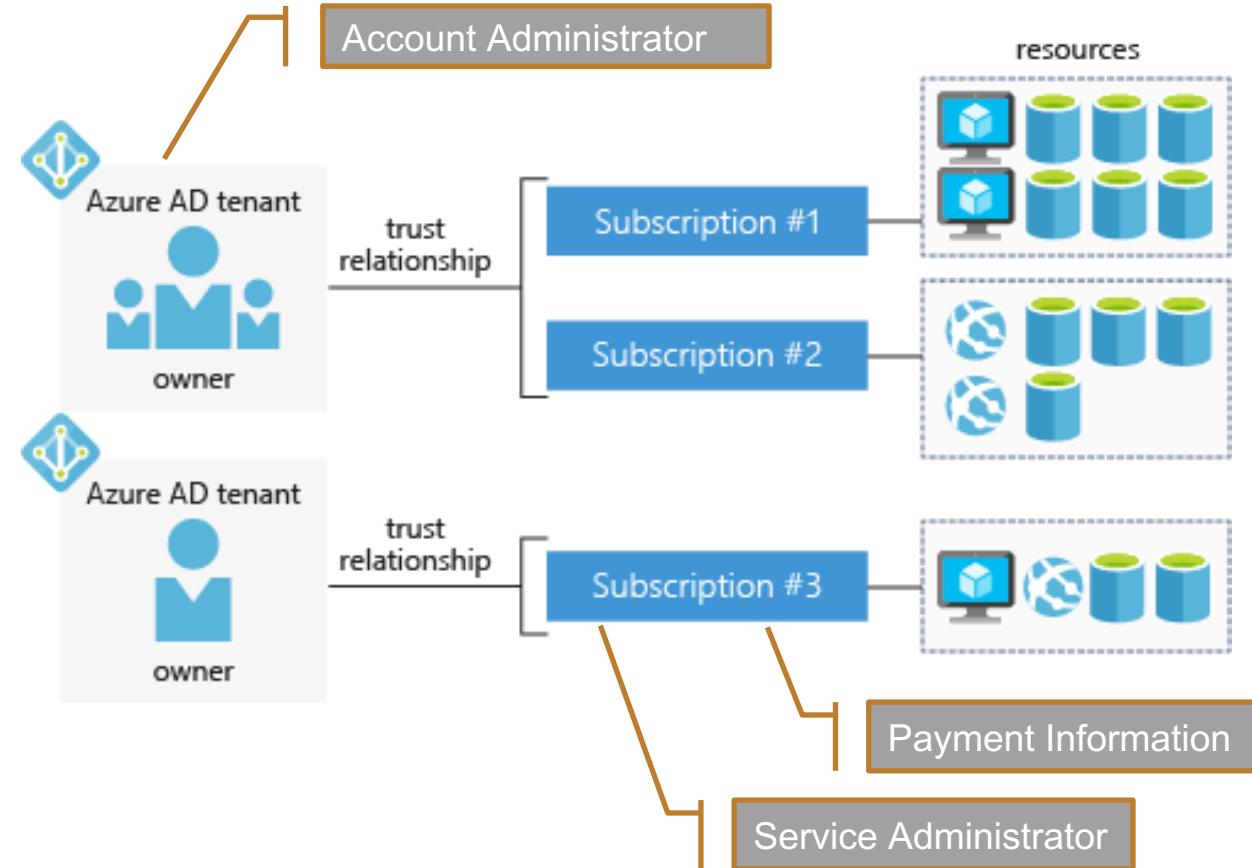
Azure Active Directory (AAD) Account that is responsible financially for the Microsoft Azure subscription



Service Administrator

Can deploy to Azure or create new resources

Microsoft's Cloud: Azure



Azure Developer Tools



Azure SDK



PowerShell

Azure CLI 2.0

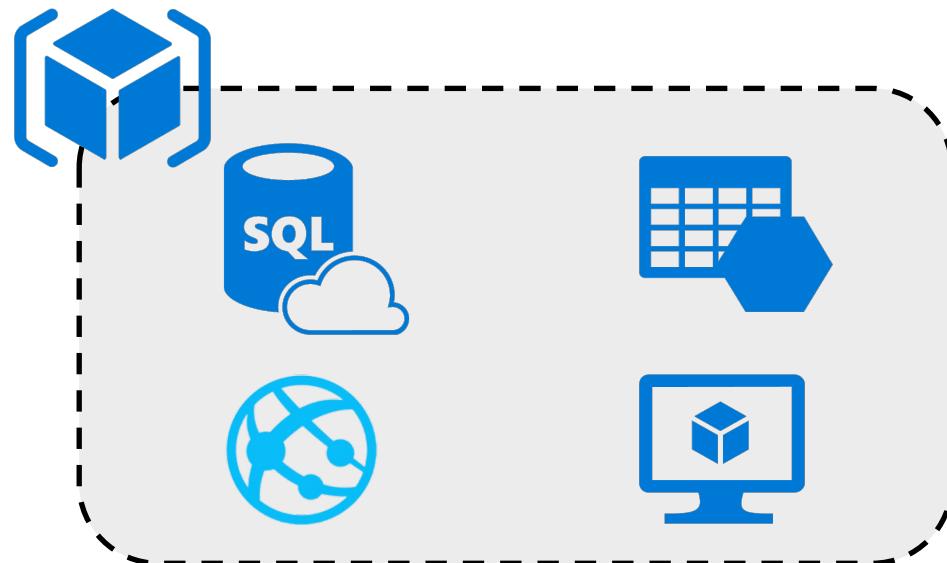


Visual Studio®

.NET SDK
Java SDK
Node SDK
Python SDK
Ruby SDK
PHP SDK
Xamarin
Android
iOS
Swift
Windows

Azure Resource Groups

- Container that holds related resources for an Azure solution
- Logically organize all the resources in your subscription
- You can deploy, manage, and monitor all the resources for your solution as a group, rather than handling these resources individually



Azure CLI

- Designed for managing and administering Azure resources from the command line
- Building automation scripts that work against the Azure Resource Manager
- Some cmdlets:

```
# Login to Azure account
```

```
az login
```

```
# Set default Azure subscription
```

```
az account set --subscription "RG-Name"
```

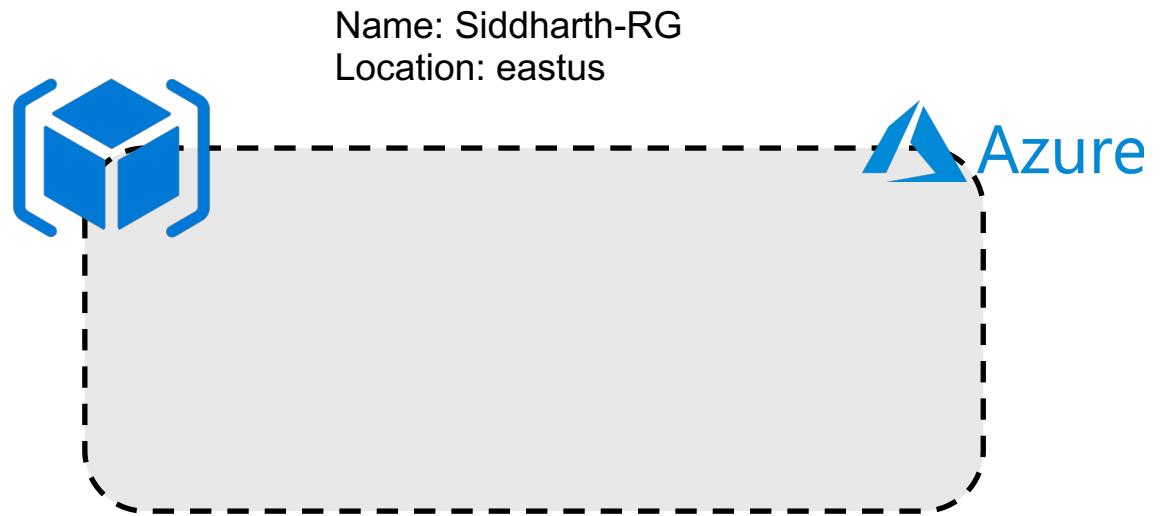
```
# Create Resource Group
```

```
az group create --name MyResourceGroup --location eastus
```

```
# get the current default subscription using list
```

```
az account list --query "[?isDefault]"
```

Demo - Create Azure Resource Group



1. Using Azure Portal
2. Using Azure CLI

Azure Free Trial Account

\$200 credit

to explore services for 30 days

+

12 months

of popular free
services

+

Always free

25+ services

Microsoft's Cloud: Azure

Compute

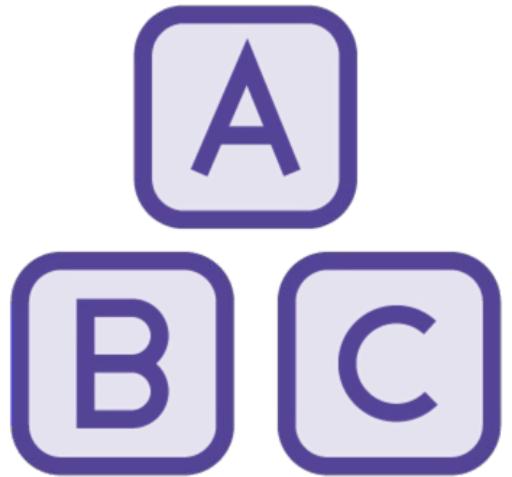
Data Storage /
Processing

Integration

Networking

Management

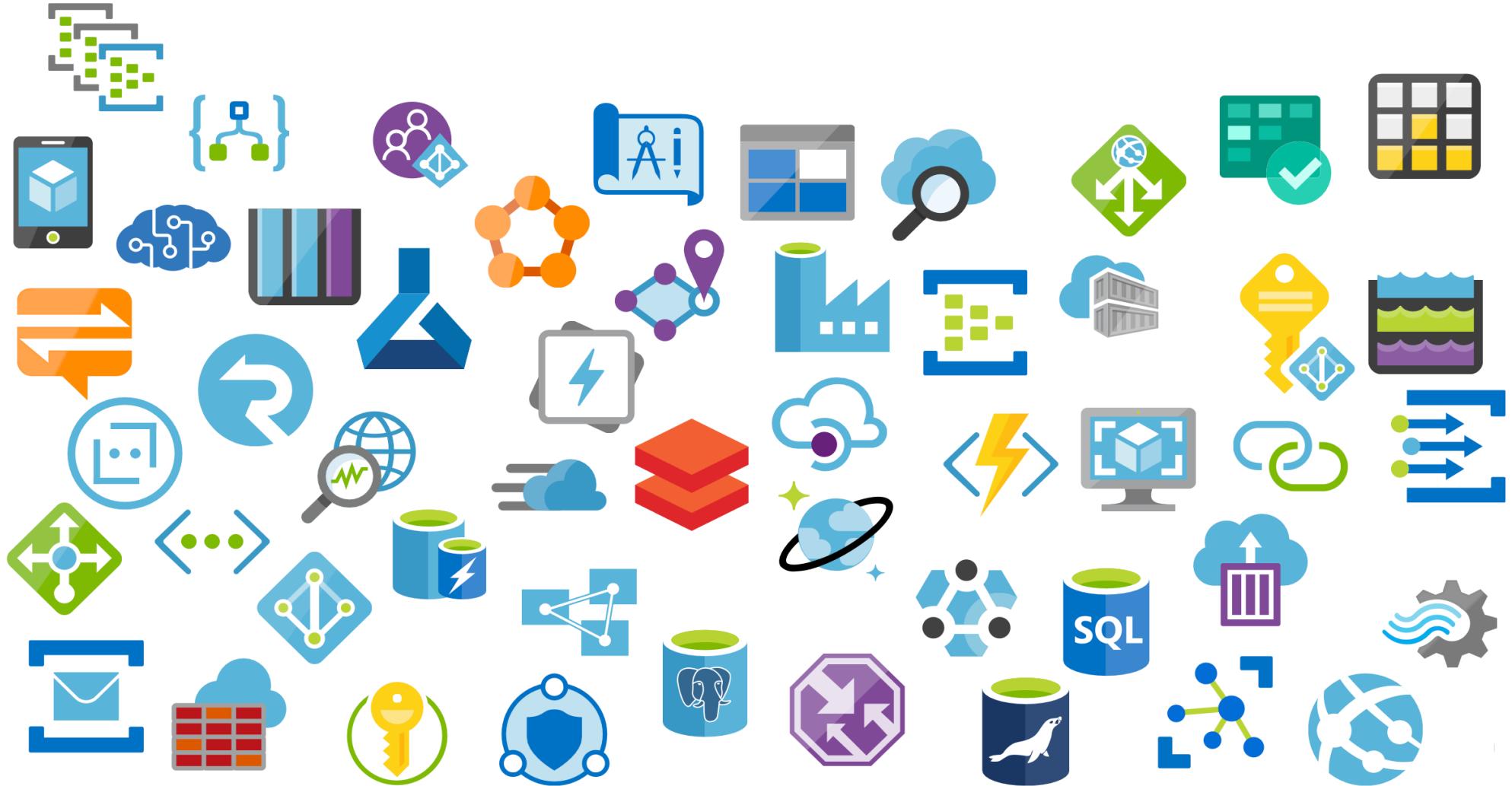
Identity



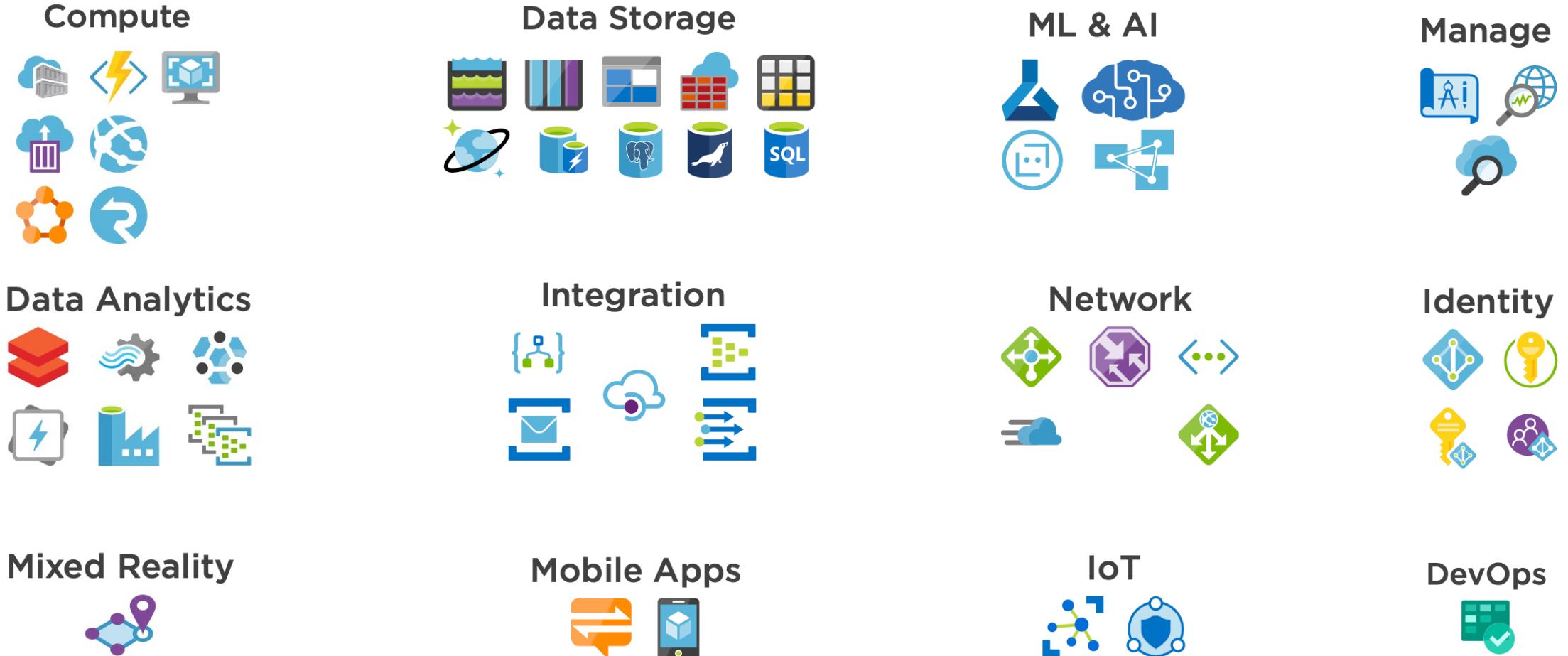
How do you put them together?

What blocks do you have?

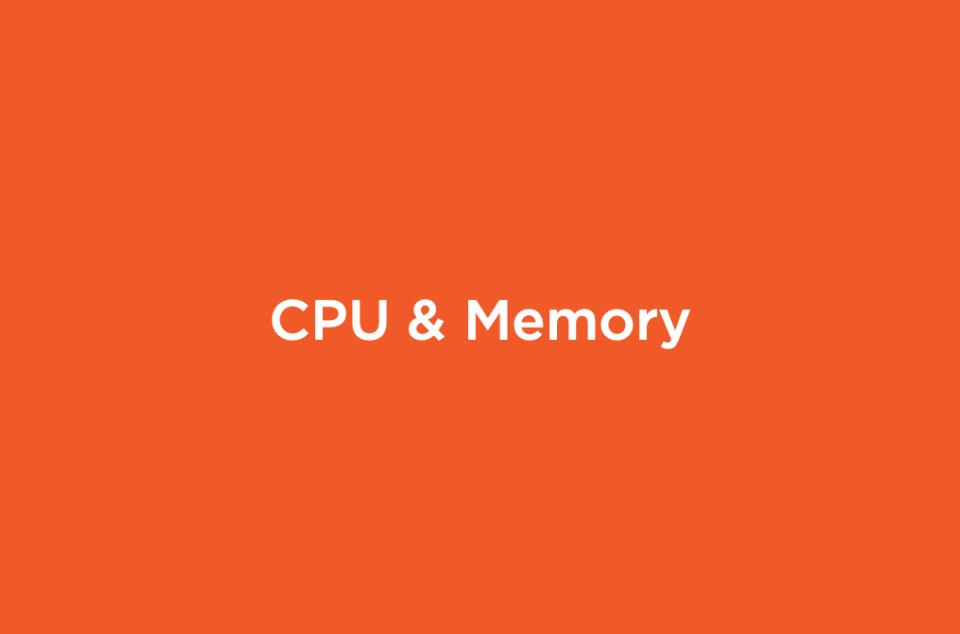
Understanding Microsoft Azure



Microsoft Azure - Understood



What is Compute?



CPU & Memory



Application code execution

Azure Compute



Virtual Machines



App Services



Containers



Serverless

Virtual Machines in Azure



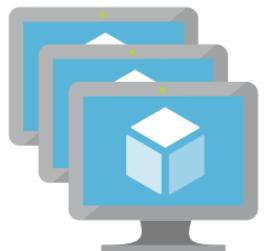
Linux VM



Windows VM



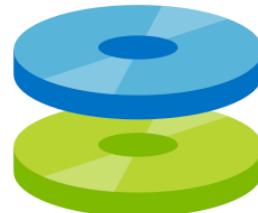
VM Images



Scale Sets



Availability Sets



Managed Disks

Module Layout – Day 1

Microsoft Azure –
The Big Picture

Azure App Services

Common Cloud Application
Patterns

Availability and Global Scale

Monitoring, Diagnostics and
Logging

Securing App Services

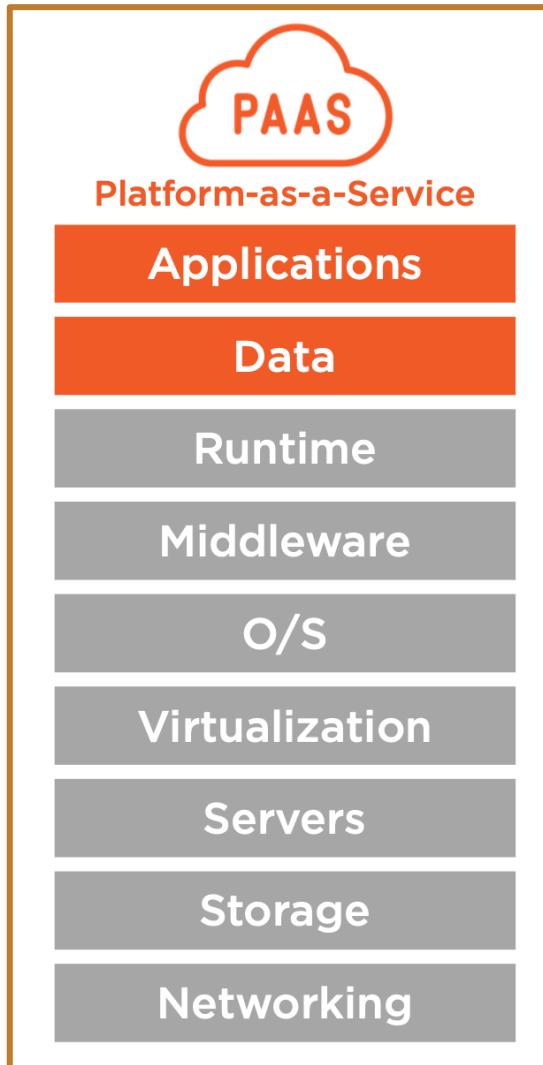
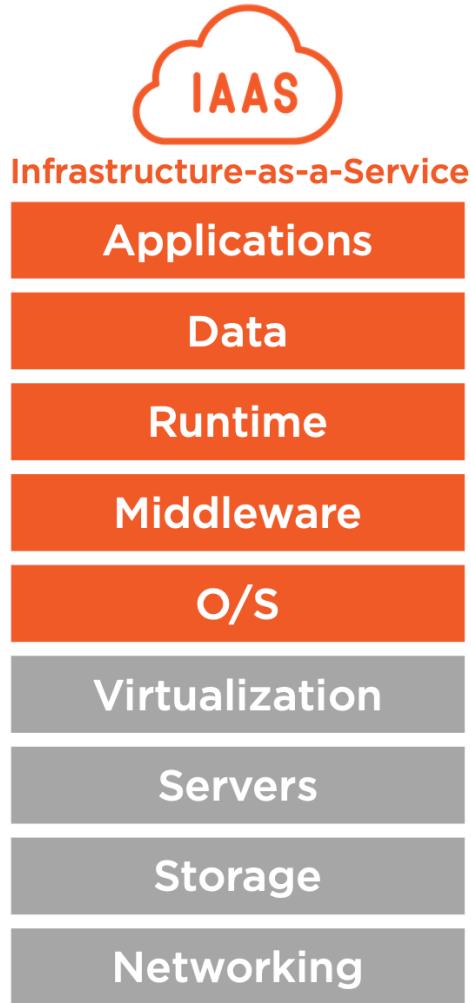
Azure App Service

Azure App Service

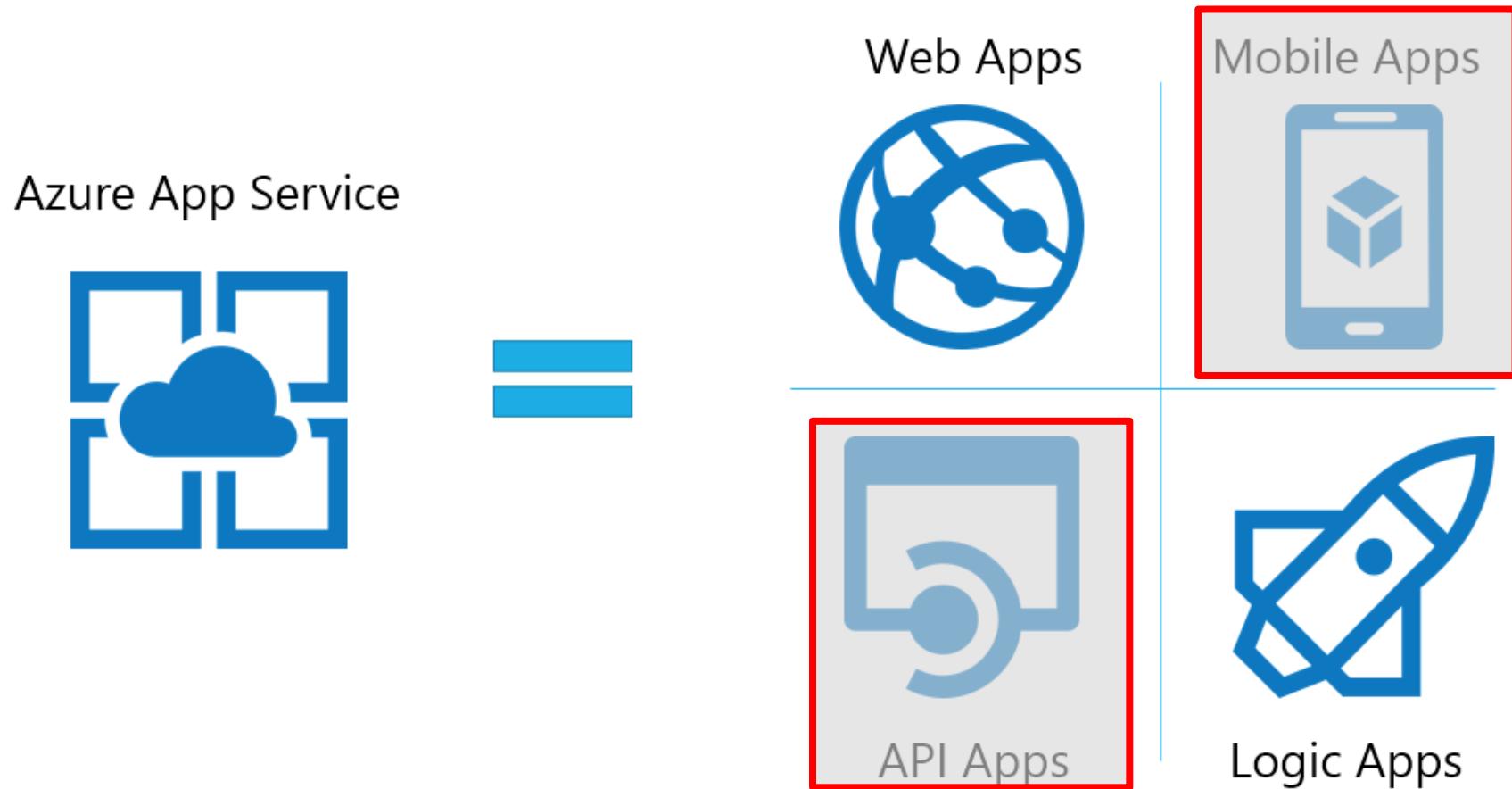


.NET
.NET Core
Java
PHP
Node
Python
Ruby ...
Custom Containers

Azure App Service



Azure App Service Pre 2019



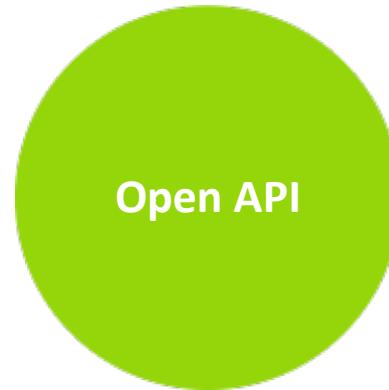
App Service – REST API Features



CORS settings

Browser security restrictions

Server sends header to indicate allowed source domains



Open API (Swagger)

Interactive documentation and help pages

Exposed as json endpoint Helps with integration

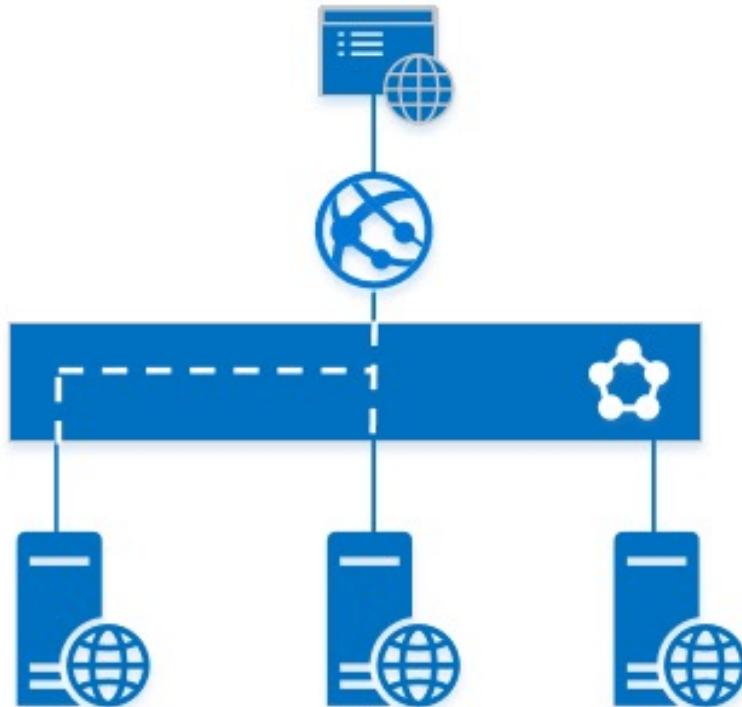


Azure API Management

Monitor and throttle usage

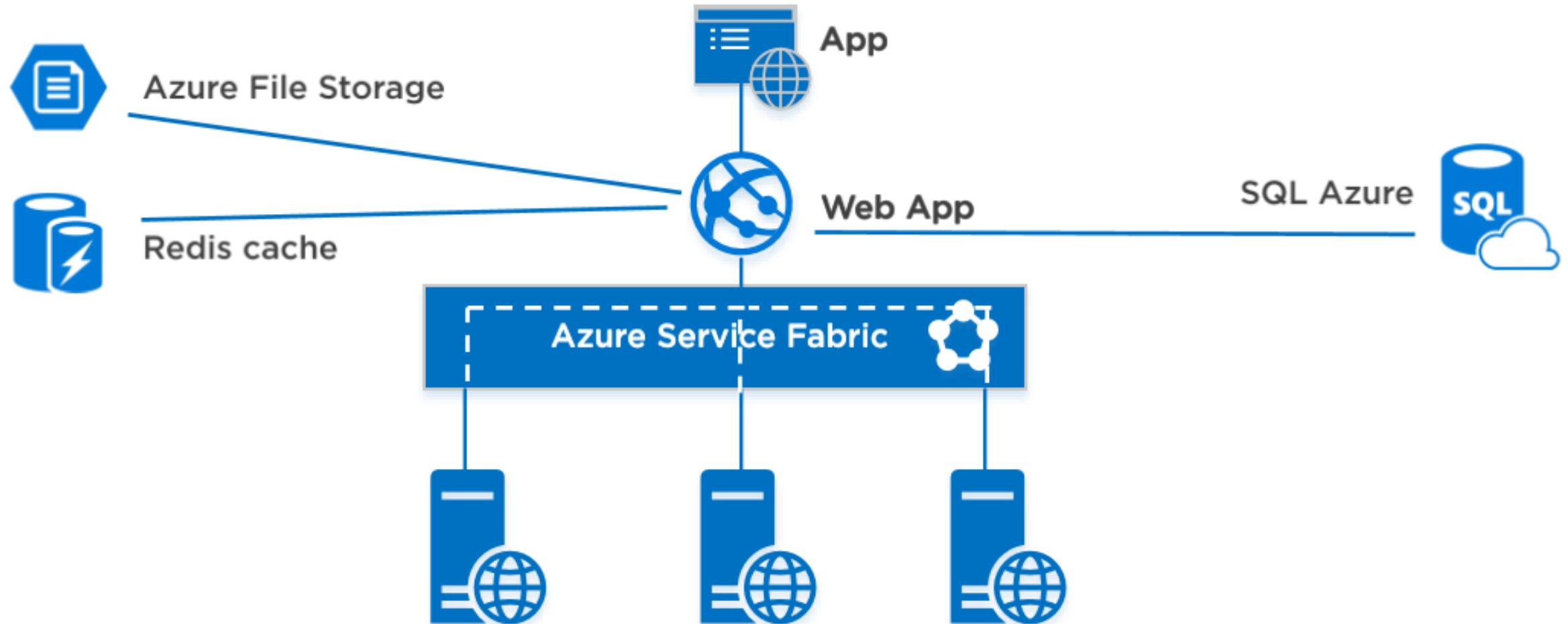
Manipulate input/output
Portal for developers

Cloud Application Patterns

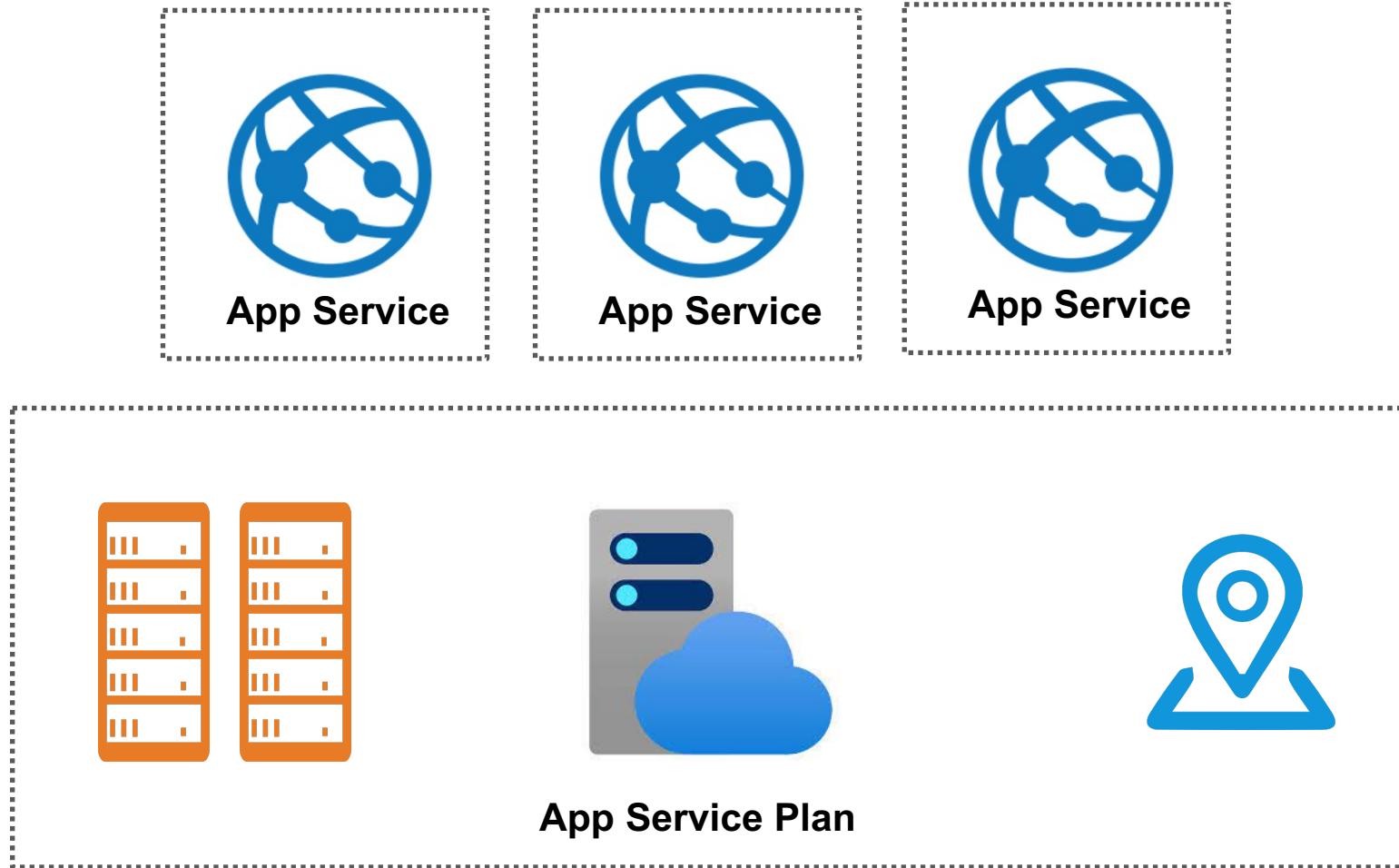


- Assume that the underlying machine would change
- Don't use local resources
- Try to achieve statelessness
- Put the state outside of your app
- Assume multiple machines

Cloud Application Patterns



App Service Plan



App Service Plan



- Azure Region
- Number of VM instances (Scale-out)
- Size of VM instances (CPU, RAM, Storage)
- Pricing Tier
 - Disk Space
 - Maximum number of App Services
 - Number of Instances
 - Features Available

<https://azure.microsoft.com/en-us/pricing/details/app-service/windows/>

Demo



- Create App Service Plan
- Create Web App in the App Service Plan

Code Deployment to Azure App Service



Visual Studio

- Publish dialog - connect to Azure - Import publish profile

Continuous deployment

- Azure DevOps - Bitbucket
- GitHub

Local Git deployment

OneDrive/Dropbox deployment

FTP Deployment

Zip/War file deployment

Demo



- Deploy a .NET Core web app using Visual Studio
- Kudu console walkthrough

Module Layout – Day 1

Microsoft Azure –
The Big Picture

Azure App Services

Common Cloud Application
Patterns

Availability and Global Scale

Monitoring, Diagnostics and
Logging

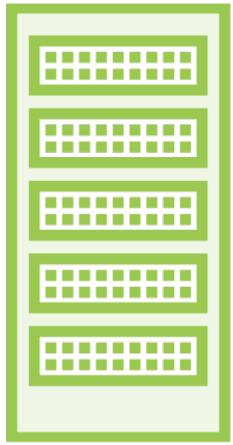
Securing App Services

12 – Factor Applications



1. One codebase in source control
2. Declared dependencies
3. Config stored in the environment
4. Backing services as attached resources
5. Separate build and run stages
6. App executed as stateless processes
7. Services exported as port bindings
8. Scale out processes
9. Disposability
10. Environment parity
11. Treat logs like event streams
12. Run admin processes as one-off processes

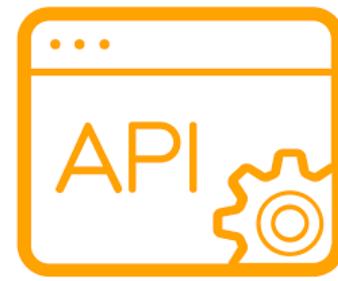
API Driven Infrastructure



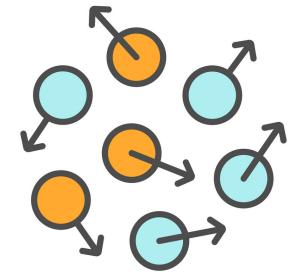
Immutable
Infrastructure



Observable
Systems



APIs for
interacting with
infrastructure



Chaos
Engineering to
fight fragility

Empowered, Customer-Focused Teams

**DevOps-style
teams build and
run services**

**Platform Ops for
managing
underlying
systems**

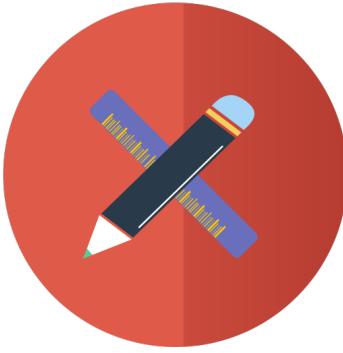
**Site Reliability
Engineering
applies software
engineering
approach to
operations**

Challenges in Cloud Development



Data Management

- Data Quality
- Data Consistency
- Geo-Location
- Performance, Scalability and Availability



Design and Implementation

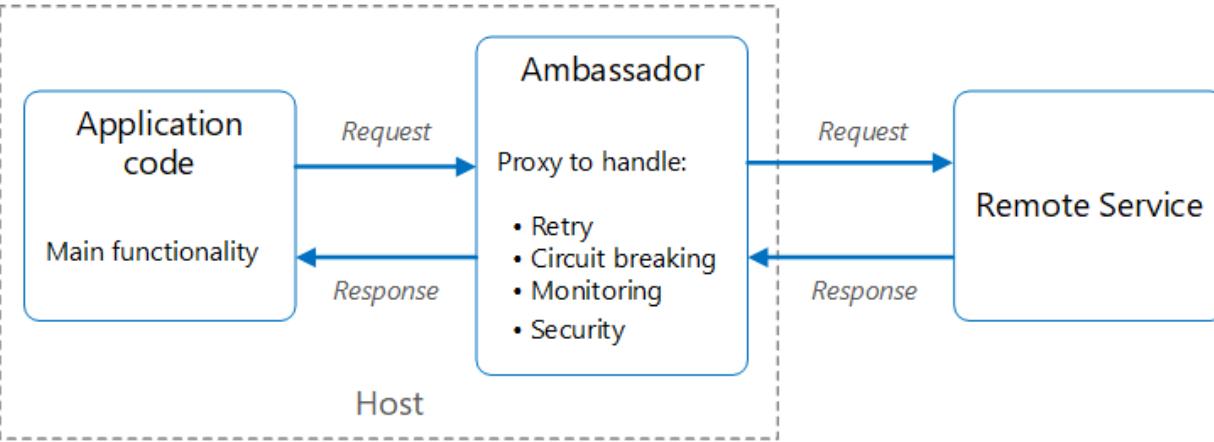
- Coherence in component design and deployment
- Maintainability and reusability
- TCO



Messaging

- Ordering of messages
- Poison message management
- Idempotency, and more

Ambassador pattern



Context and Problem

- Ability to make network-related configuration updates
- Difficult or impossible to update legacy applications
- Network calls may also require substantial configuration for connection, authentication, and authorization

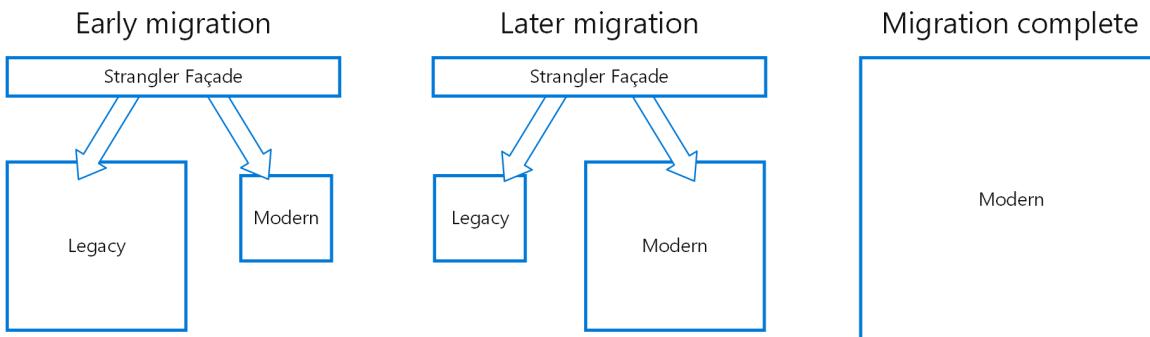
Solution

- Put client frameworks and libraries into an external process that acts as a proxy between your application and external services.
- Deploy the proxy on the same host environment as your application to allow control over routing, resiliency, security features, and to avoid any host-related access restrictions.

Considerations

- The proxy adds some latency overhead
- Consider how you will package and deploy the proxy
- Consider whether to use a single shared instance for all clients or an instance for each client

Strangler Fig Pattern



Context and Problem

- Complex increasingly obsolete systems and applications
- Need to gradually migrate to a new system

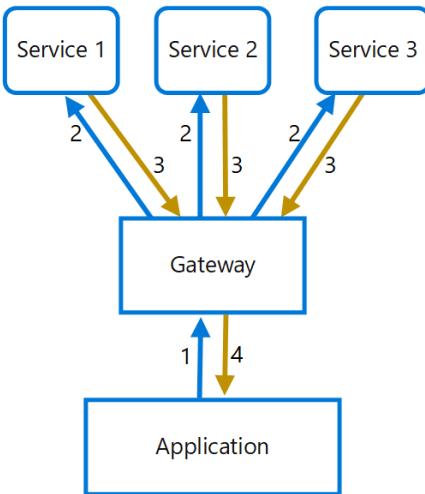
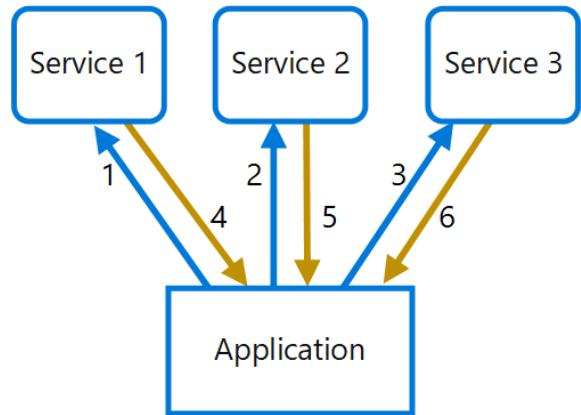
Solution

- Incrementally replace specific pieces of functionality with new applications and services.
- Create a façade that intercepts requests going to the backend legacy system.
- Existing features can be migrated to the new system gradually, and consumers can continue using the same interface, unaware that any migration has taken place.

Considerations

- Make sure the façade keeps up with the migration.
- Make sure the façade doesn't become a single point of failure or a performance bottleneck.

Gateway Aggregation Pattern



Context and Problem

- Multiple calls to various backend services required to perform a single task.
- This chattiness can adversely impact the performance and scale of the application.

Solution

- Use a gateway to reduce chattiness between the client and the services.
- This pattern can reduce the number of requests that the application makes to backend services and improve application performance over high-latency networks.

Considerations

- The gateway should be located near the backend services to reduce latency as much as possible.
- Perform load testing against the gateway to ensure you don't introduce cascading failures for services.
- Monitor request metrics and response sizes.

Module Layout – Day 1

Microsoft Azure –
The Big Picture

Azure App Services

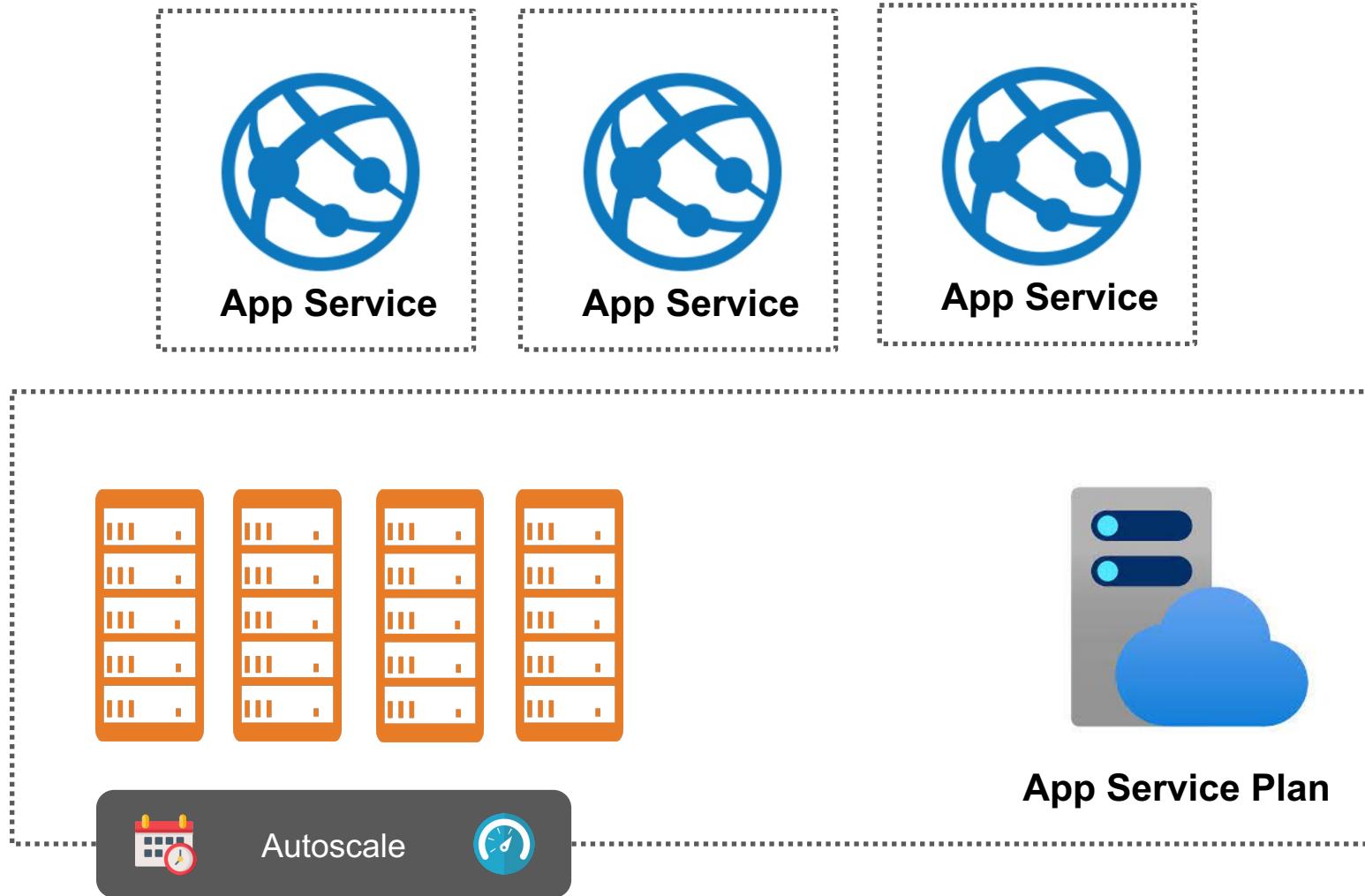
Common Cloud Application
Patterns

Availability and Global Scale

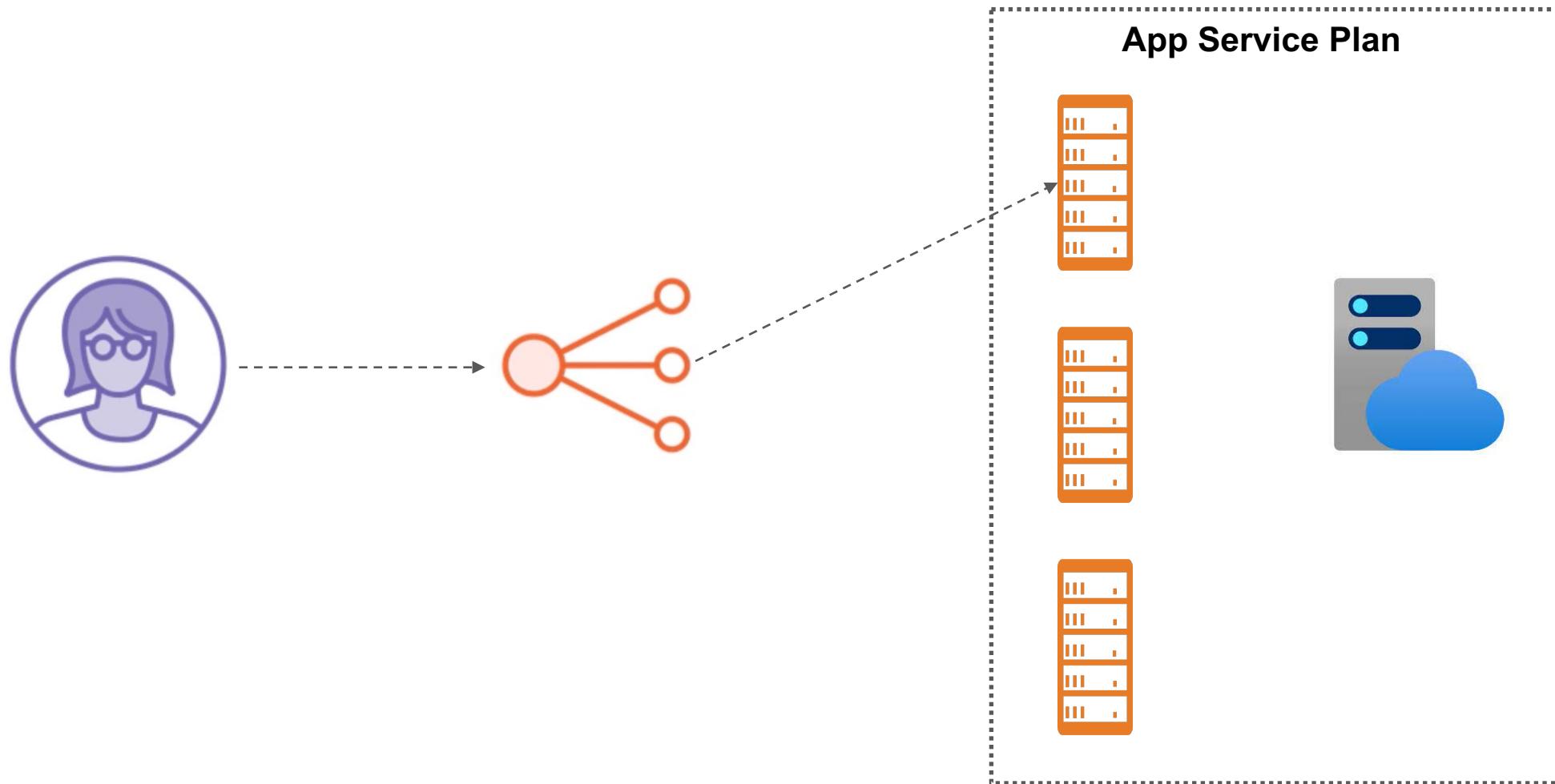
Monitoring, Diagnostics and
Logging

Securing App Services

Scaling



Load Balancing



Demo



- Configure an App Service Plan
- Scale Up
- Scale Out (Auto and Manual)

Deployment Slots



PROD	https://mysite.azurewebsites.net
STAGING	https://mysite-staging.azurewebsites.net
DEV	https://mysite-dev.azurewebsites.net

Deployment Slots



STAGING	https://mysite-staging.azurewebsites.net
PROD	https://mysite.azurewebsites.net
DEV	https://mysite-dev.azurewebsites.net

Deployment Slots



Auto-swap

- Warms up deployed code
- Automatically swaps configured deployment slots.

Traffic routing

- Route % of production traffic to another deployment slot
- Test features with limited users

Deployment Slots

Settings that Swap

- General Settings (framework version, web socket setting, etc.)
- Handler mappings
- Monitoring and diagnostic settings
- WebJobs content
- Application Settings *
- Connection Strings *

* Can be configured to stay with deployment slot

Setting that DO NOT Swap

- Publishing endpoints
- Custom domain names
- SSL certificates
- App Service scale settings
- Web Job schedulers

Deployment Slots



Swap with Preview (2 stage swap)

- Stage 1
 - Test staging deployment slot with production settings
- Stage 2
 - Complete swap
 - Or rollback swap

Demo

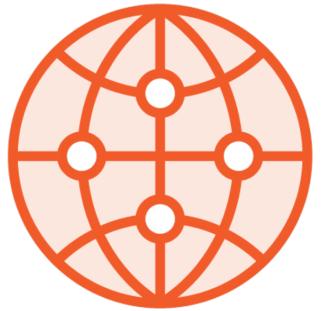


- Create a staging slot
- Swap it with Production

Deployment slots run on the same
infrastructure as Production!

Conduct Load Testing in ANOTHER App
Service Plan

Azure Custom Domains



1

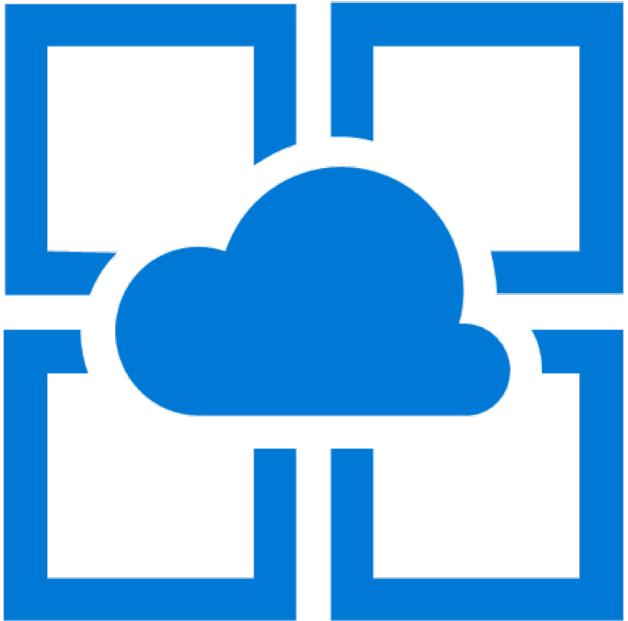
Change DNS at your
domain registrar or
Azure

2

Couple domain to
your Web App in
Azure

Custom Domains require paid pricing tier >= Shared Tier

IP Addresses in Azure App Services



App Service Environment
Isolated Pricing Tier
Static inbound/outbound IP
addresses



App Service Inbound/outbound IPs can be different
App Service Plan apps share IP address
New static IP for app by creating IP- based SSL
binding

Custom Domains

Using Custom Domains and TLS

URL: `https://yourappname.azurewebsites.net`

VIP: `52.157.45.223`

- May Change**
- Recreate web app
 - Change to free

DNS Records



Root domain

- e.g., exampleorg.com

Subdomain

- admin.exampleorg.com
- www.exampleorg.com

Domain Name System (DNS) Servers

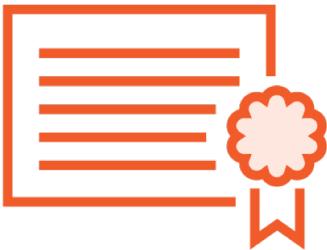
- “A Record” maps domain to an IP Address
- “CNAME Record” maps subdomain to another domain/subdomain
- “TXT Record” stores strings for any purpose

Demo



Azure Custom Domains

SSL Certificates

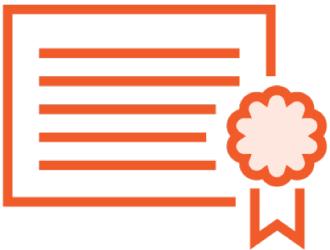


Basic pricing tier or higher

Upload your own certificate

- Signed by trusted certificate authority
- Password protected pfx file
- Private key length of at least 2048 bits
- Must contain all intermediate certificates

Azure SSL Certificates



App Service Certificate

- Create and manage certificates within Azure
- Store certificate in Azure Key Vault - Uses GoDaddy issued certificates

SSL Certificate Binding

IP-based SSL

Traditional approach

One certificate per IP address/Port combination

App Service assigns your site a new dedicated IP address

SNI-based SSL

Multiple certificates can secure the same IP address / port combination

Server Name Indication

Client browser must tell server hostname it's trying to access

Multiple websites can be hosted on same IP without using same certificate

TLS in Azure



Import to App Service

Generate Externally



Upload to Key Vault

Generate in Key Vault
or Externally



App Service Managed
Certificates
Created in Azure

Renewed automatically
Free for Dev/Production

Don't support wildcards and A
Records



App Service Managed
Certificates
Purchased through Azure

Demo



- Map a Custom Domain
- Add SSL Binding

Web Jobs

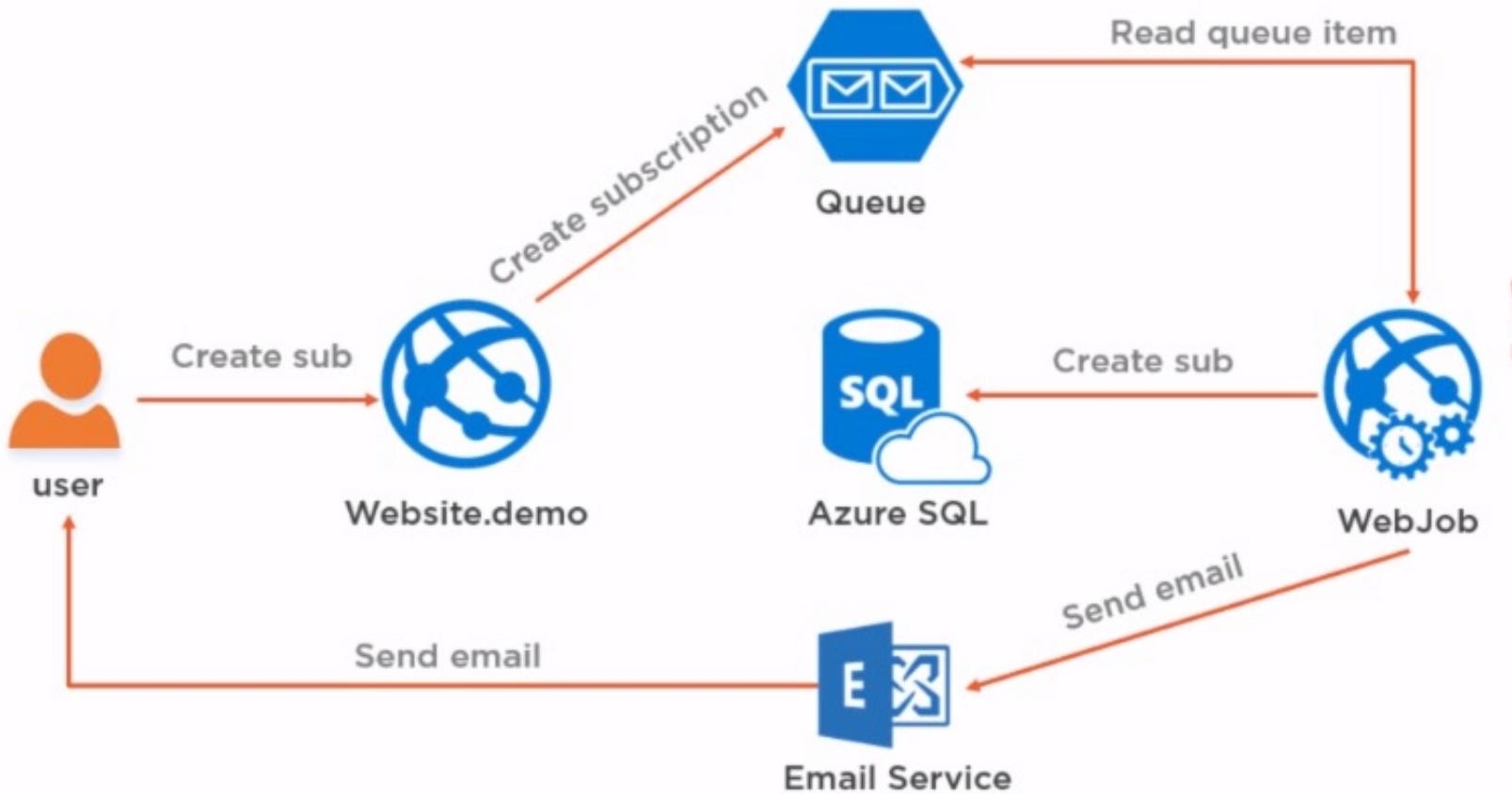


WebJobs run within an App Service

Run program or script in the background

- .exe, .bat, .cmd (Windows cmd)
- .ps1 (PowerShell)
- .sh (Bash)
- .php (PHP)
- .py (Python)
- .js (Node.js)
- .jar (Java)

A scenario



You can deploy a batch job to be a WebJob

.exe, .cmd, .bat, .sh, .php, .py, .js, jar, ps1

WebJobs use resources from the Web App

Web Jobs



Execution models

- Run continuously
- Run on a schedule
- Run when triggered

View history and logs for WebJobs

WebJobs SDK

- For custom development
- Azure Functions built on WebJobs SDK

No additional cost

Module Layout – Day 1

Microsoft Azure –
The Big Picture

Azure App Services

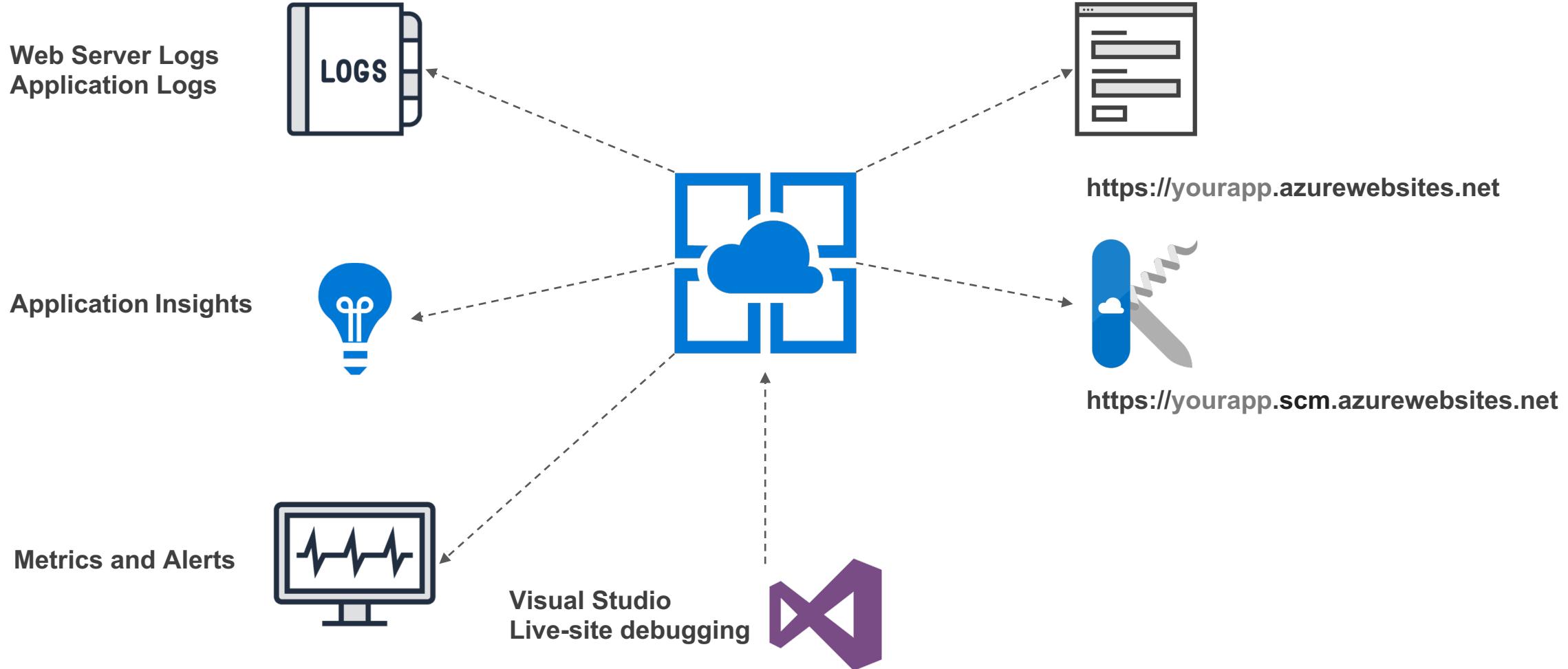
Common Cloud Application
Patterns

Availability and Global Scale

Monitoring, Diagnostics and
Logging

Securing App Services

Monitoring and Diagnostics



Diagnostic Log Types

Application
logging



Application

Diagnostic trace
information

Web server
logging



Diagnostic
information
from the web
server

Detailed error
messages



Server

Messages from
exceptions

Failed request
tracing

500.X

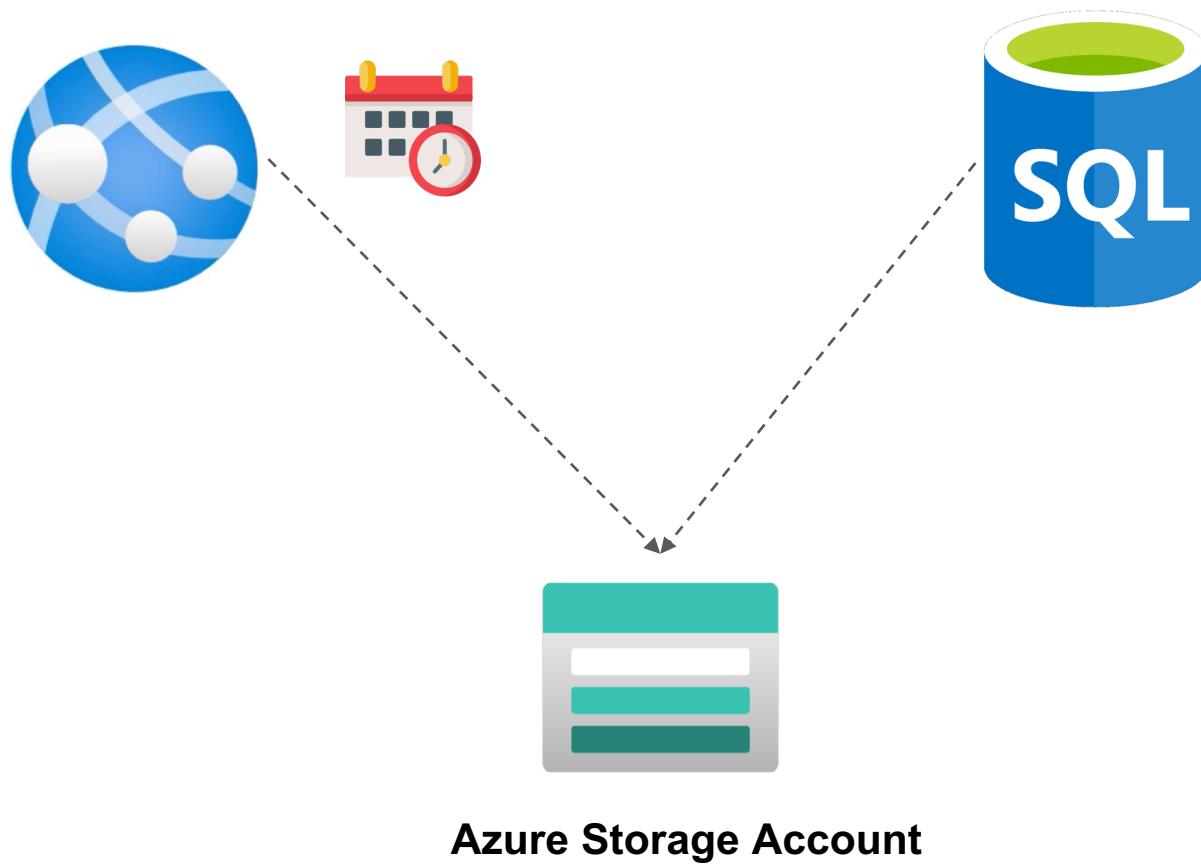
Complete trace
files of failed
requests

Demo



- App Service Diagnostics in Action
- Enable Logging in Azure

Backups and Restore



What gets backed up?

- App configuration
- File content
- Database connected to your app
- Can be manual or scheduled

Demo



- Enable Backups
- See Backup and Restore in action

Getting the Facts with Application Insights



Measures application metrics

- Usage
- Availability(requires web tests)
- Failures and Exception
- Dependence performance and status

7 days raw data retained

90 days aggregated data

Continuous export of raw data- json

Analytics

Demo



Implement Application Insights

Module Layout – Day 1

Microsoft Azure –
The Big Picture

Azure App Services

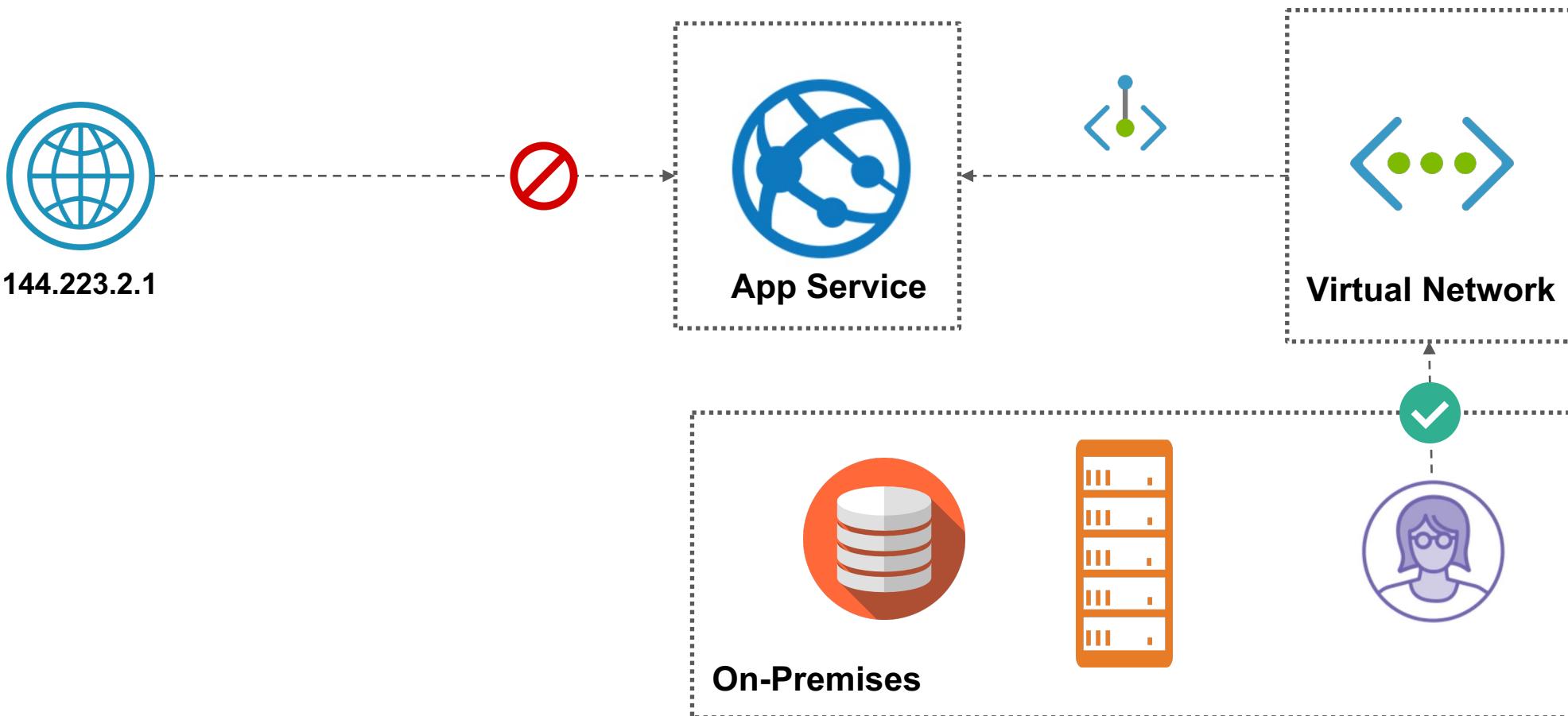
Common Cloud Application
Patterns

Availability and Global Scale

Monitoring, Diagnostics and
Logging

Securing App Services

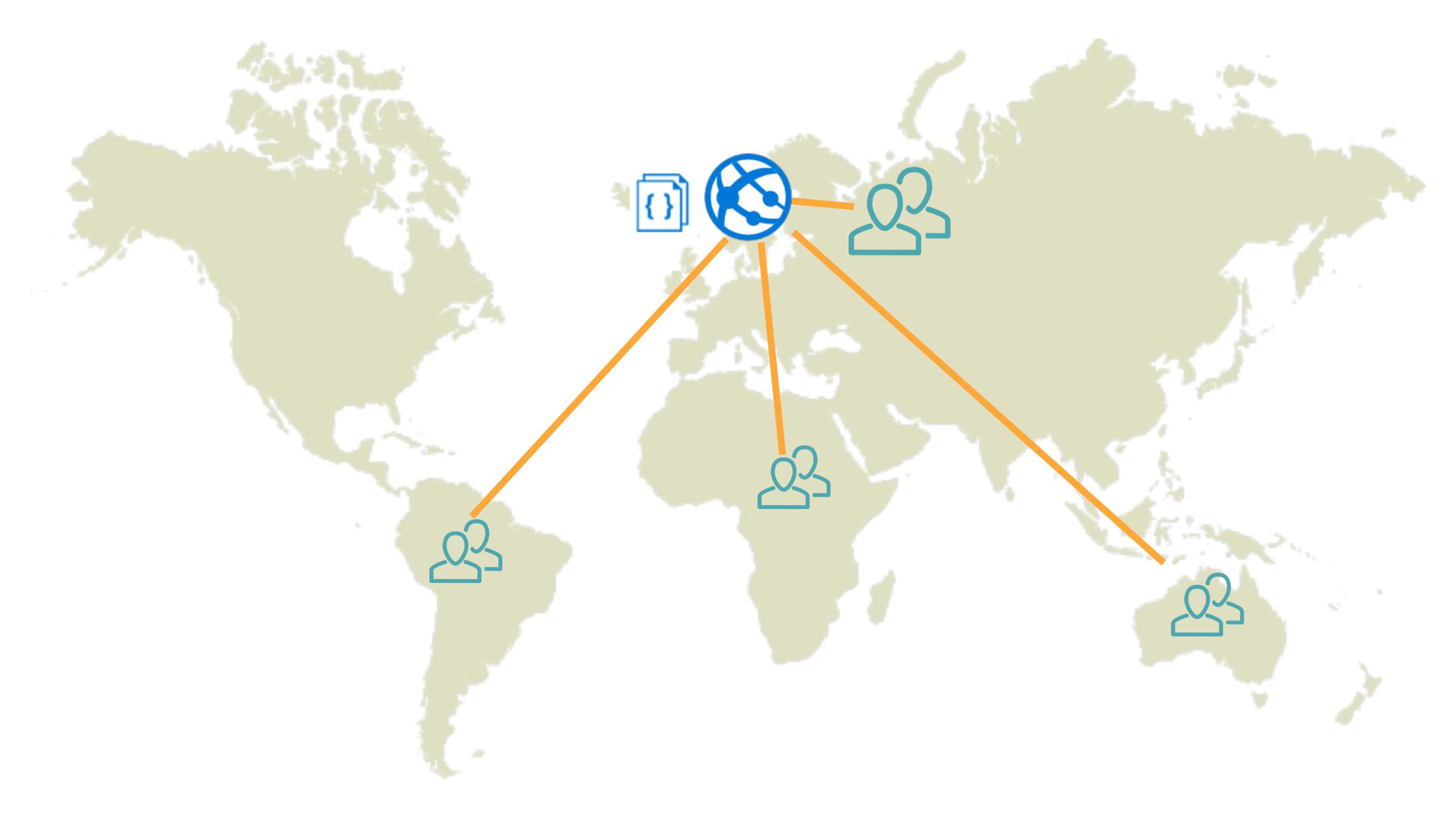
Private Endpoints

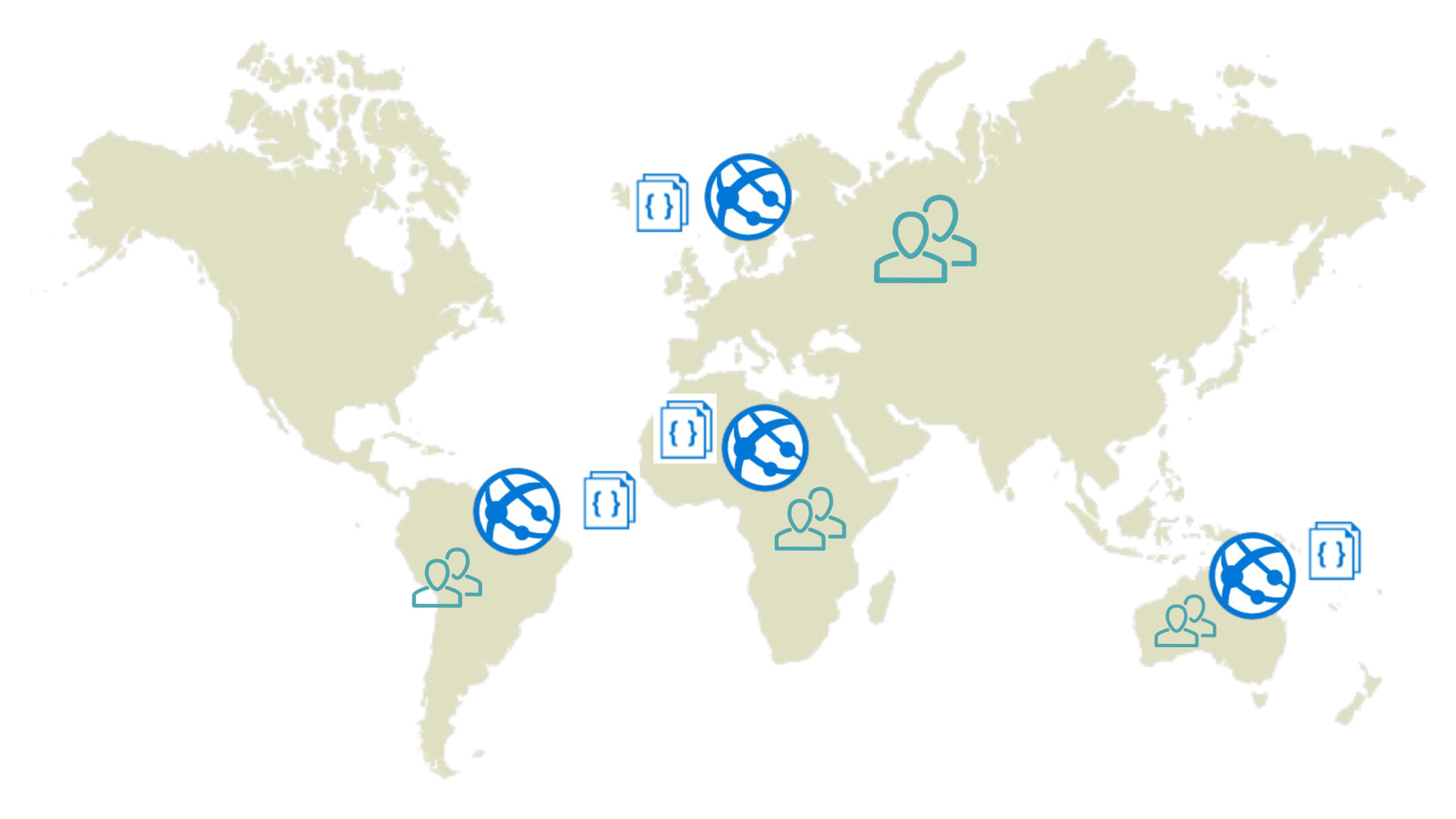


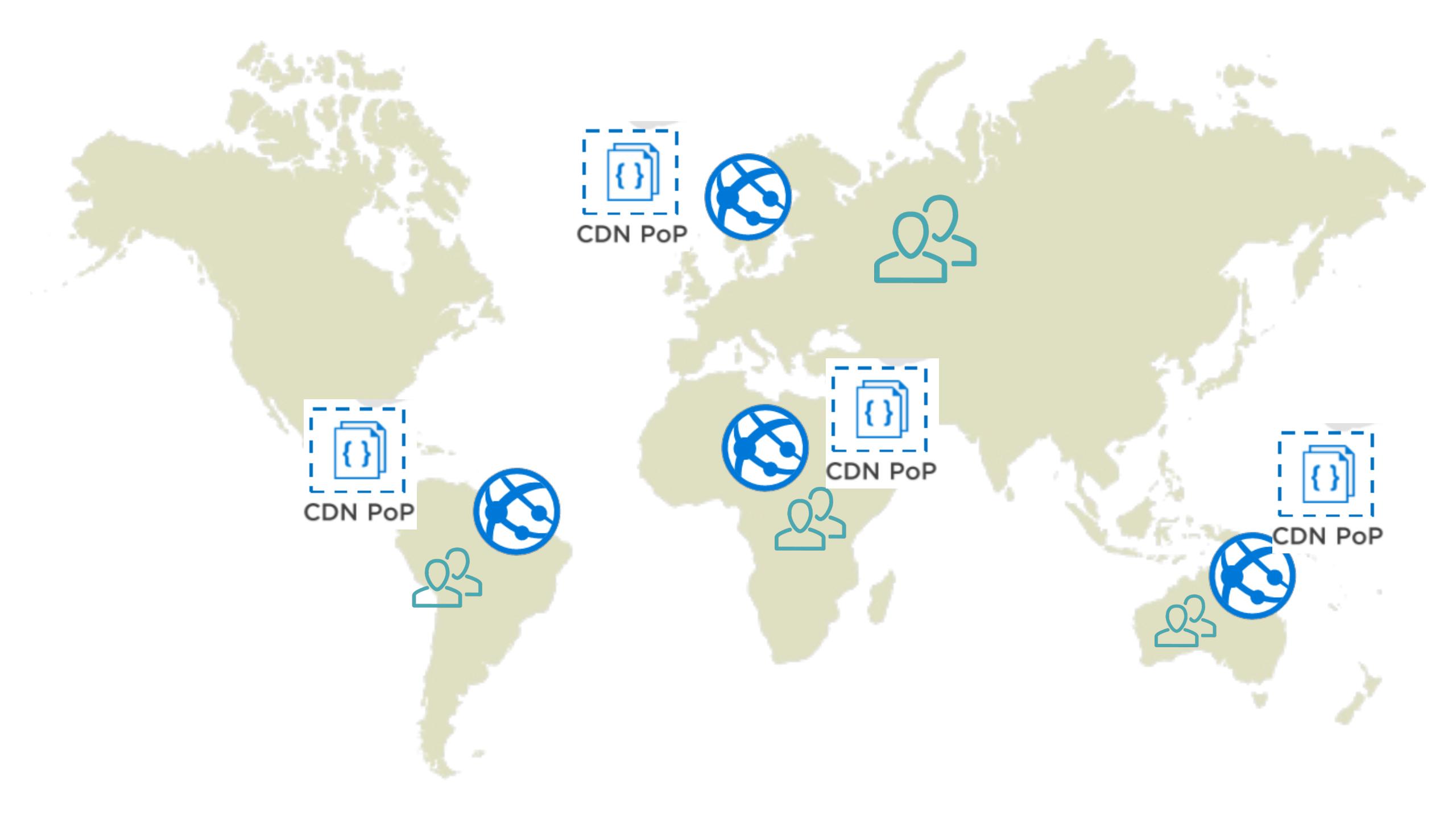
Enhancing Application Performance



Making applications more
performant using **Azure CDN**



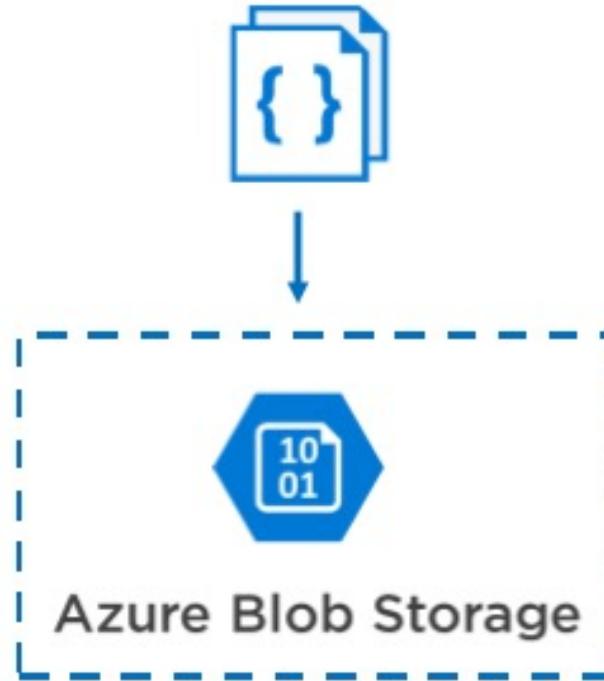




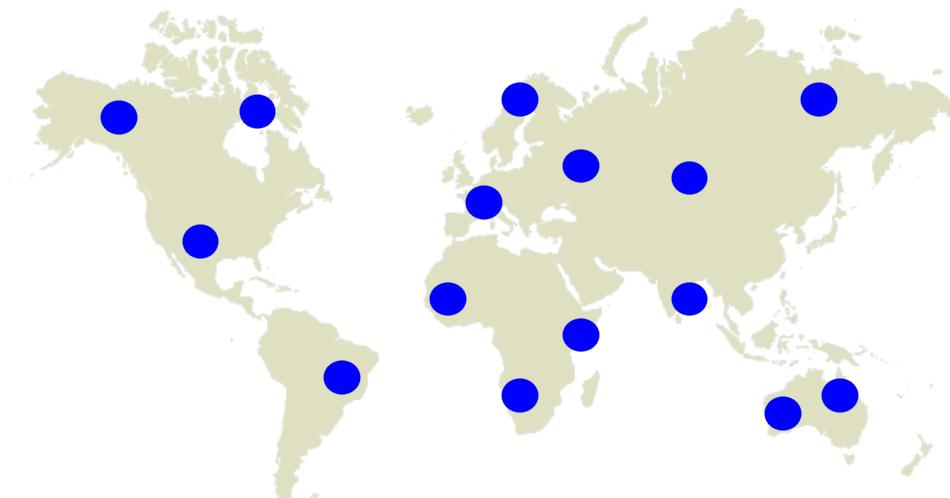


Azure CDN Profile

Verizon
Akamai
Microsoft



Web App

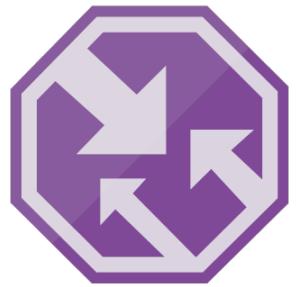


Points of Presence (POP)

Demo



CDN Profile and Endpoints in action



Global traffic distribution using
Azure Traffic Manager

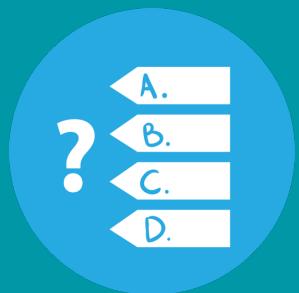


Demo



Implementing *Azure Traffic Manager*

Quiz



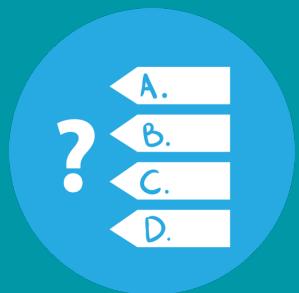
1. True or false: Azure App service can automatically scale your web application to meet traffic demand?
 - a. True
 - b. False

2. Which of the following isn't a valid automated deployment source?
 - a. GitHub
 - b. Azure DevOps
 - c. SharePoint

3. Which of the following services can be used to automatically trigger a failover to the DR site?
 - a. Azure CDN
 - b. Azure Traffic Manager
 - c. Azure Functions
 - d. All the Above



Quiz



1. Which of the following App Service plans supports only function apps?
 - a. Dedicated
 - b. Isolated
 - c. Consumption

2. Which of the following networking features of App Service can be used to control outbound network traffic?
 - a. GitHub
 - b. Azure DevOps
 - c. SharePoint

3. Which of the following services can be used to enhance application performance?
 - a. Azure CDN
 - b. Azure Traffic Manager
 - c. Azure Functions
 - d. All the Above





Thank you!

