Microsoft

# Microsoft Azure from Zero to Hero

Michael Petersen, Microsoft Cloud Solution Architect

# In this workshops

1. **Introduction into Azure**

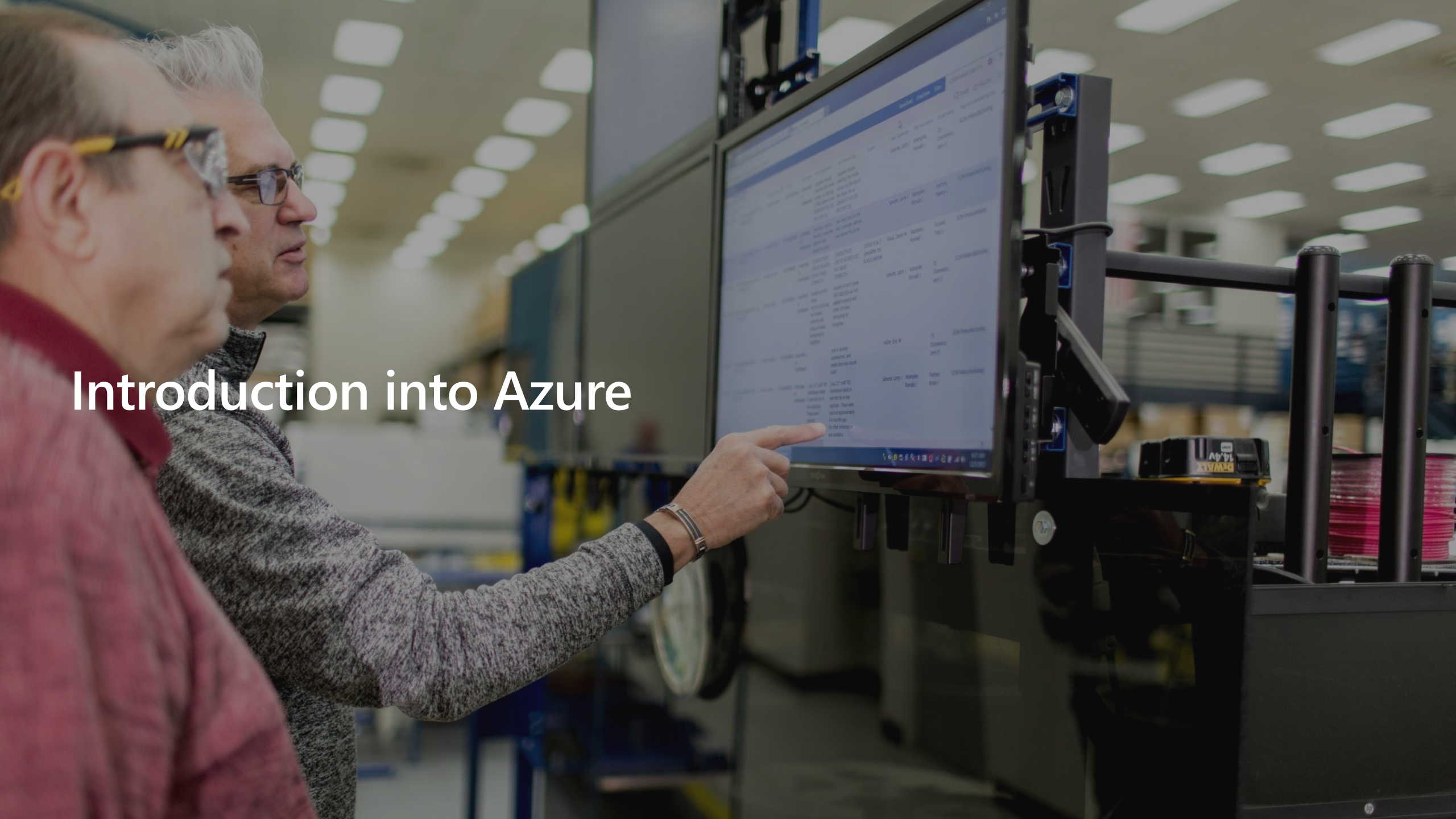
2. **Azure AD for Azure**
   Tenants and Auditing
   Roles in AD and in Azure
   Identities and external Collaboration

3. **Cloud Security and Governance**
   Organize your Enrollment
   Enforce Governance and Security

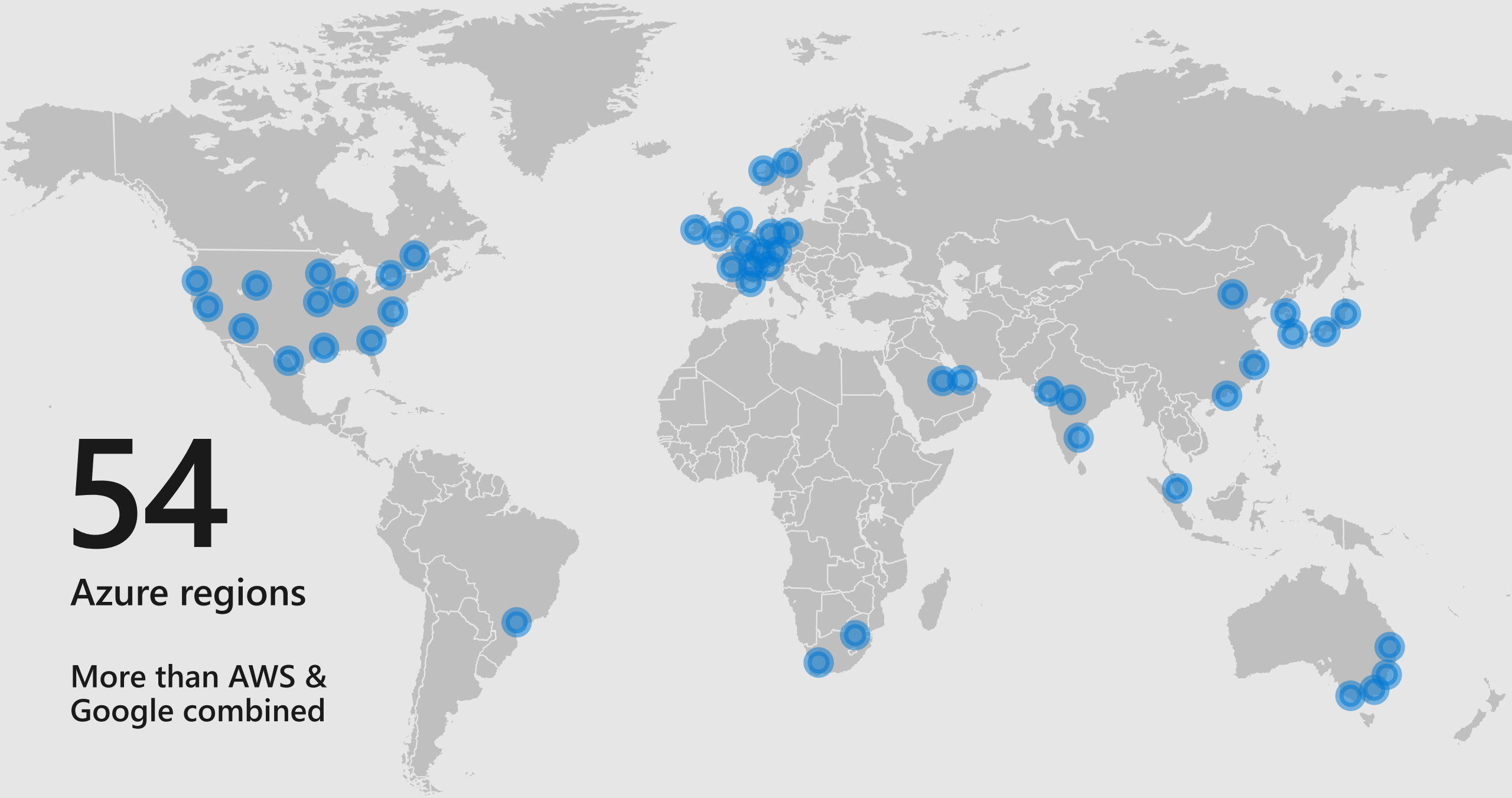
4. **Operations and Automation**
   High Availability and Resiliency
   Monitoring and Alerting
   Automate Hybrid Operations
   Automate Builds and Deployments
   Encryption and Keys

Workshop 1

Workshop 2



# Introduction into Azure


54
Azure regions
More than AWS &
Google combined

# Azure Compliance

## Global

- ISO 27001
- ISO 27018
- ISO 27017
- ISO 22301
- SOC 1 Type 2
- SOC 2 Type 2
- SOC 3
- CSA STAR Self-Assessment
- CSA STAR Certification
- CSA STAR Attestation

## US gov

- Moderate JAB P-ATO
- High JAB P-ATO
- DoD DISA SRG Level 2
- DoD DISA SRG Level 4
- SP 800-171
- FIPS 140-2
- Section 508 VPAT
- ITAR
- CJIS
- IRS 1075

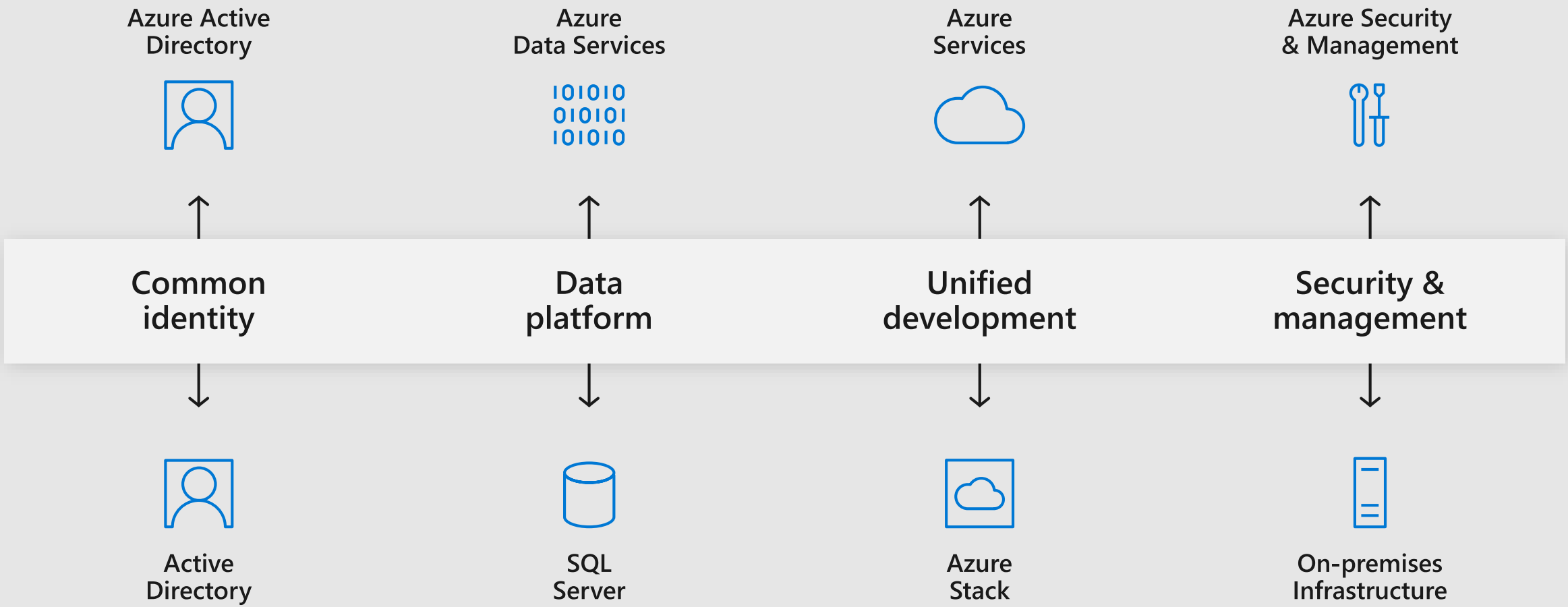
## Industry

- PCI DSS Level 1
- CDSA
- MPAA
- FACT UK
- Shared Assessments
- FISC Japan
- HIPAA /HITECH Act
- HITRUST
- GxP 21 CFR Part 11
- MARS-E
- IG Toolkit UK
- FERPA
- GLBA
- FFIEC

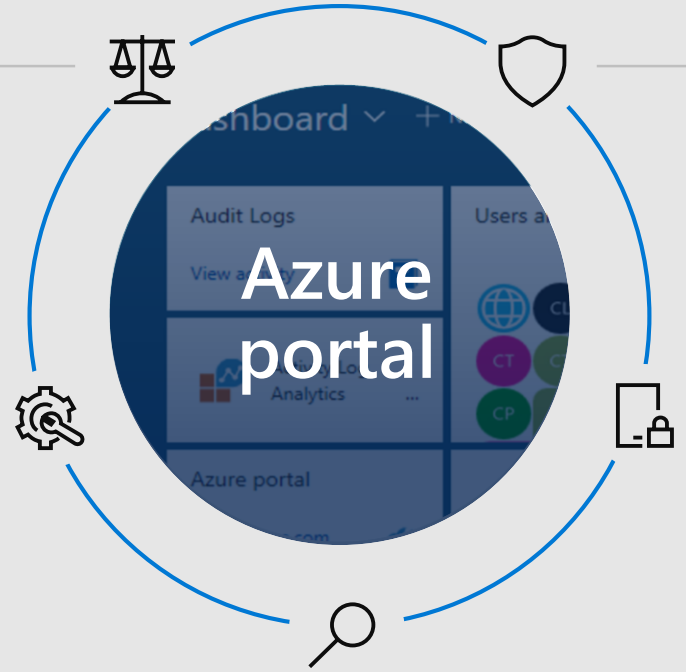
## Regional

- Argentina PDPA
- EU Model Clauses
- UK G-Cloud
- China DJCP
- China GB 18030
- China TRUCS
- Singapore MTCS
- Australia IRAP/CCSL
- New Zealand GCIO
- Japan My Number Act
- ENISA IAF
- Japan CS Mark Gold
- Spain ENS
- Spain DPA
- India MeitY
- Canada Privacy Laws
- Privacy Shield
- Germany IT Grundschutz workbook

# Consistent hybrid environment



# Azure portal offers enterprise-grade management




**Govern**

Policy management
Cost management

**Secure**

Security management
Threat protection

**Configure**

Update management, scripting
automation, configuration

**Protect**

Backup and
disaster recovery

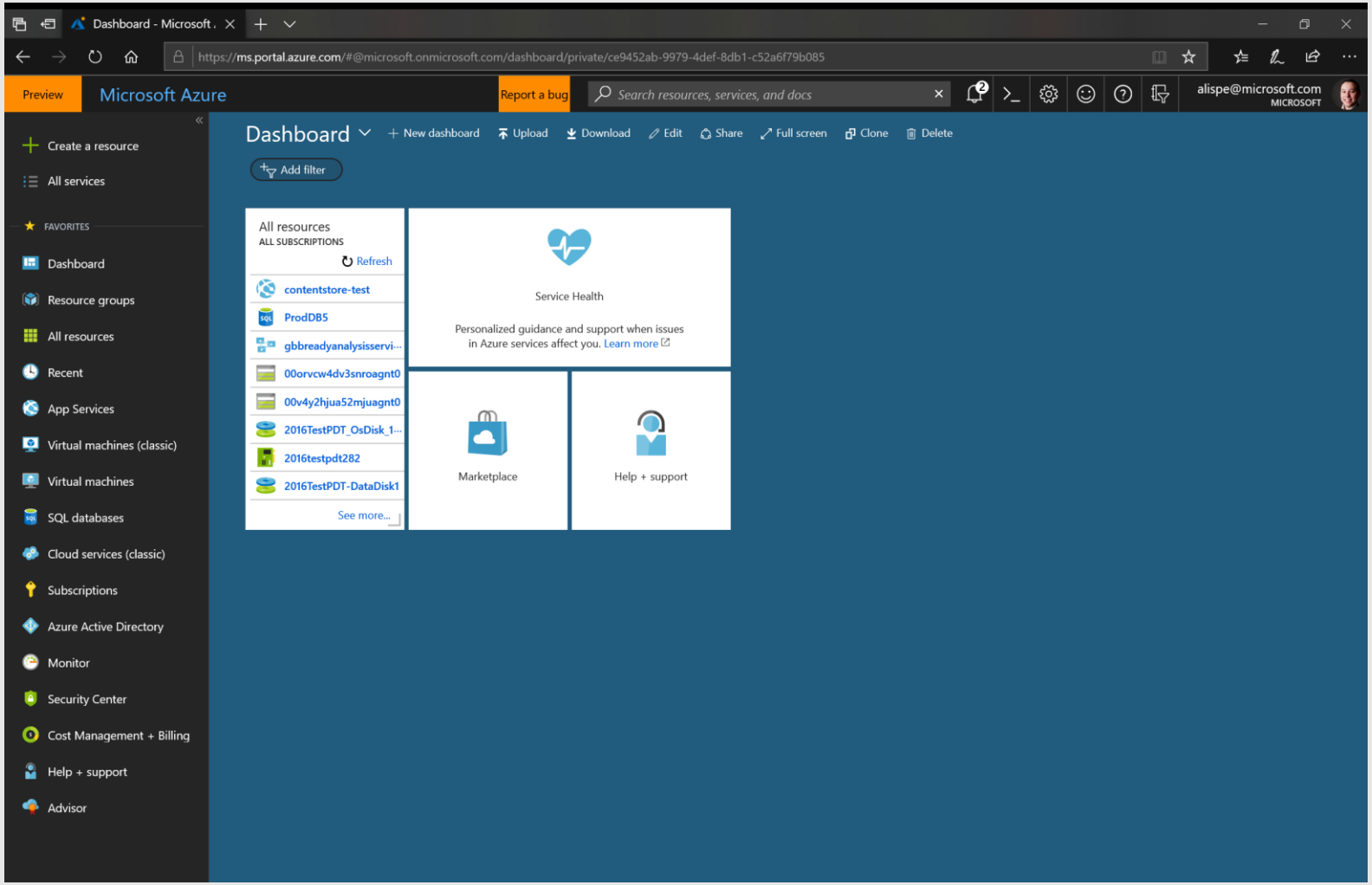
**Monitor**

App, infrastructure and network monitoring
log analytics, and diagnostics

# Azure portal is customizable—portal.azure.com

**Recommendation:**

Create portal dashboards by key roles, (e.g., operations, finance, development), key projects, and key service KPIs.

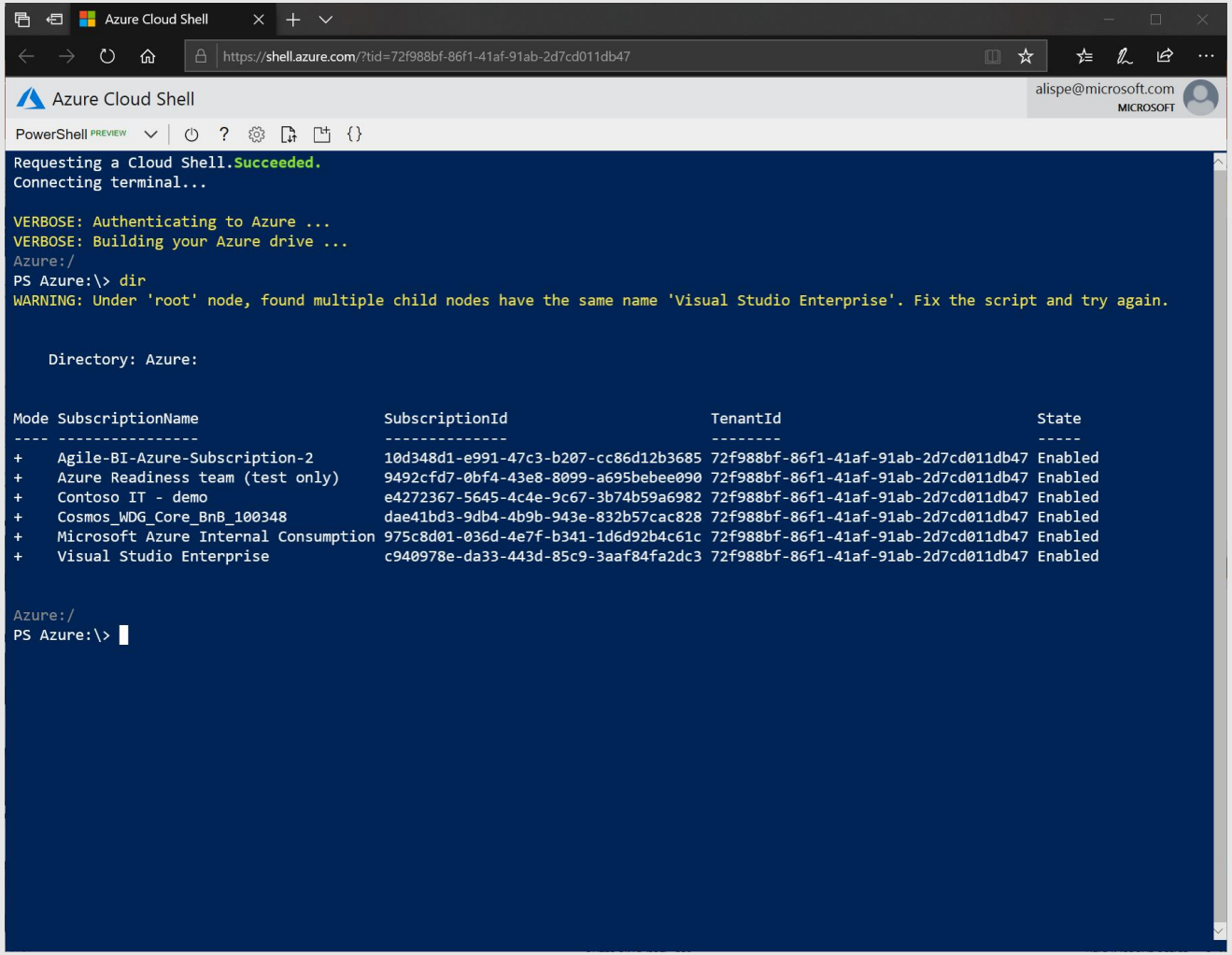


# Azure supports automation

## Recommendations:

Define ARM templates for commonly used resource configurations

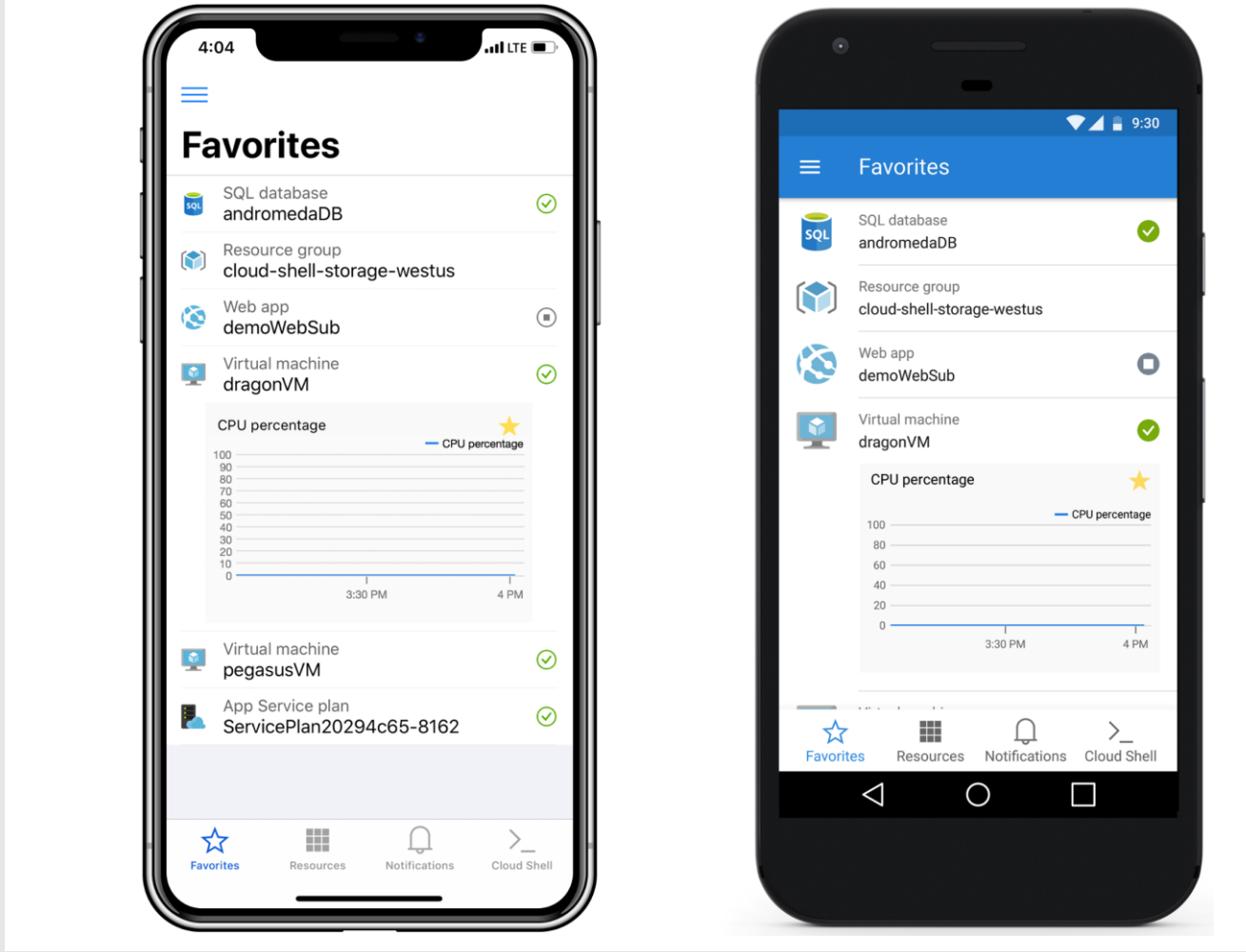
Use Azure Policy to define which resources you allow teams to provision



# Azure mobile app

**Stay connected to your Azure resources – anytime, anywhere**

- Monitor the health and status of your Azure resources on the go
- Get quick access to your favorite resources
- Get notifications and alerts about important health issues
- Quickly diagnose and fix issues from your mobile device
- Run Azure Cloud Shell scripts (PowerShell or Bash) from the app
- Control access to resources using Role Based Access Control
- Now available on iOS and Android



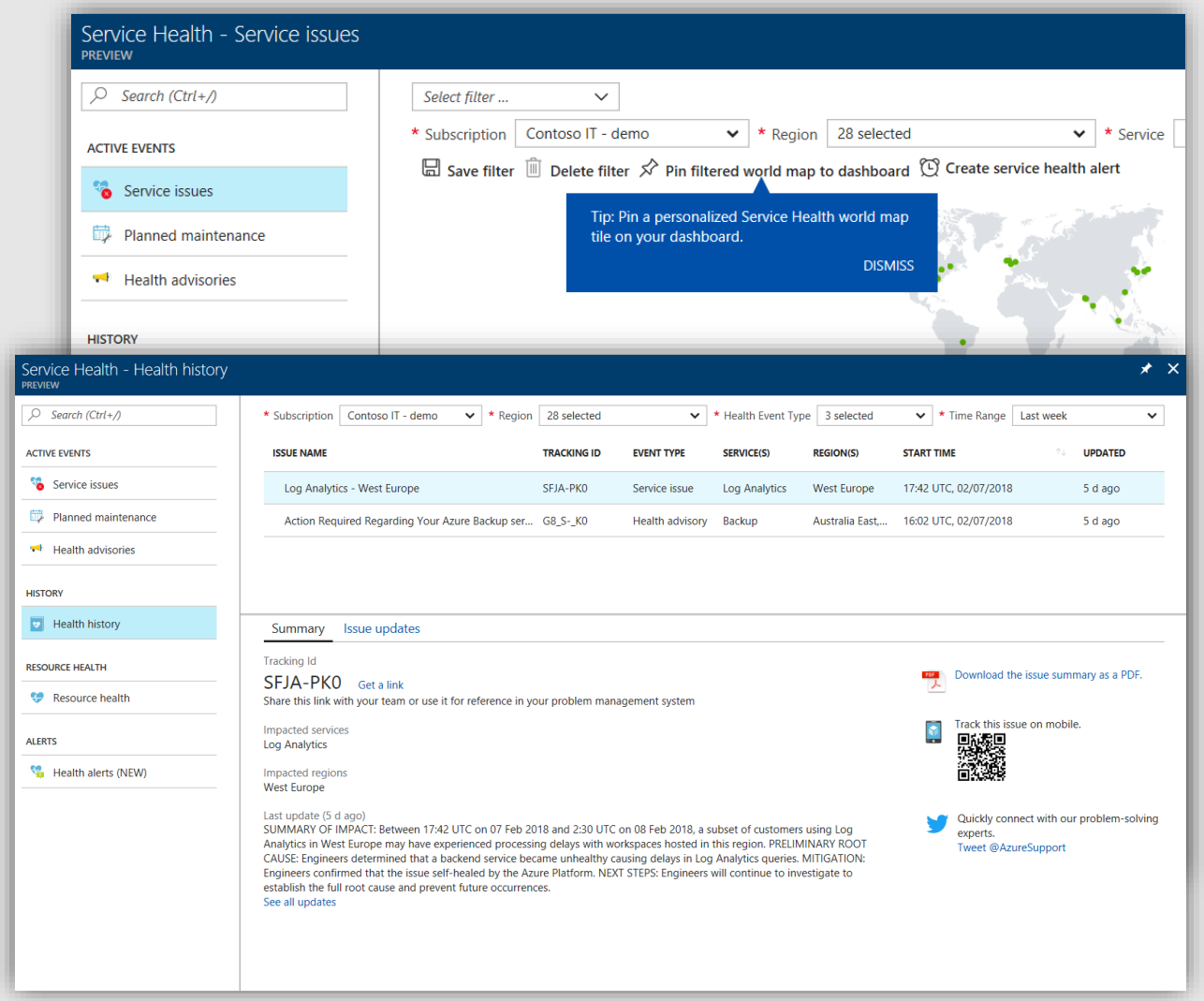

[Learn more.]

# Azure communicates incidents, upcoming maintenance and health advisories via Azure Service Health

## Recommendation:

Set up Azure Service Health alerts, for example:

- An alert to email your dev team when a resource in a test/dev subscription is impacted
- An alert to update ServiceNow via webhook when a resource in production is impacted
- An alert to send an SMS to a specific number when resources in a given region are impacted



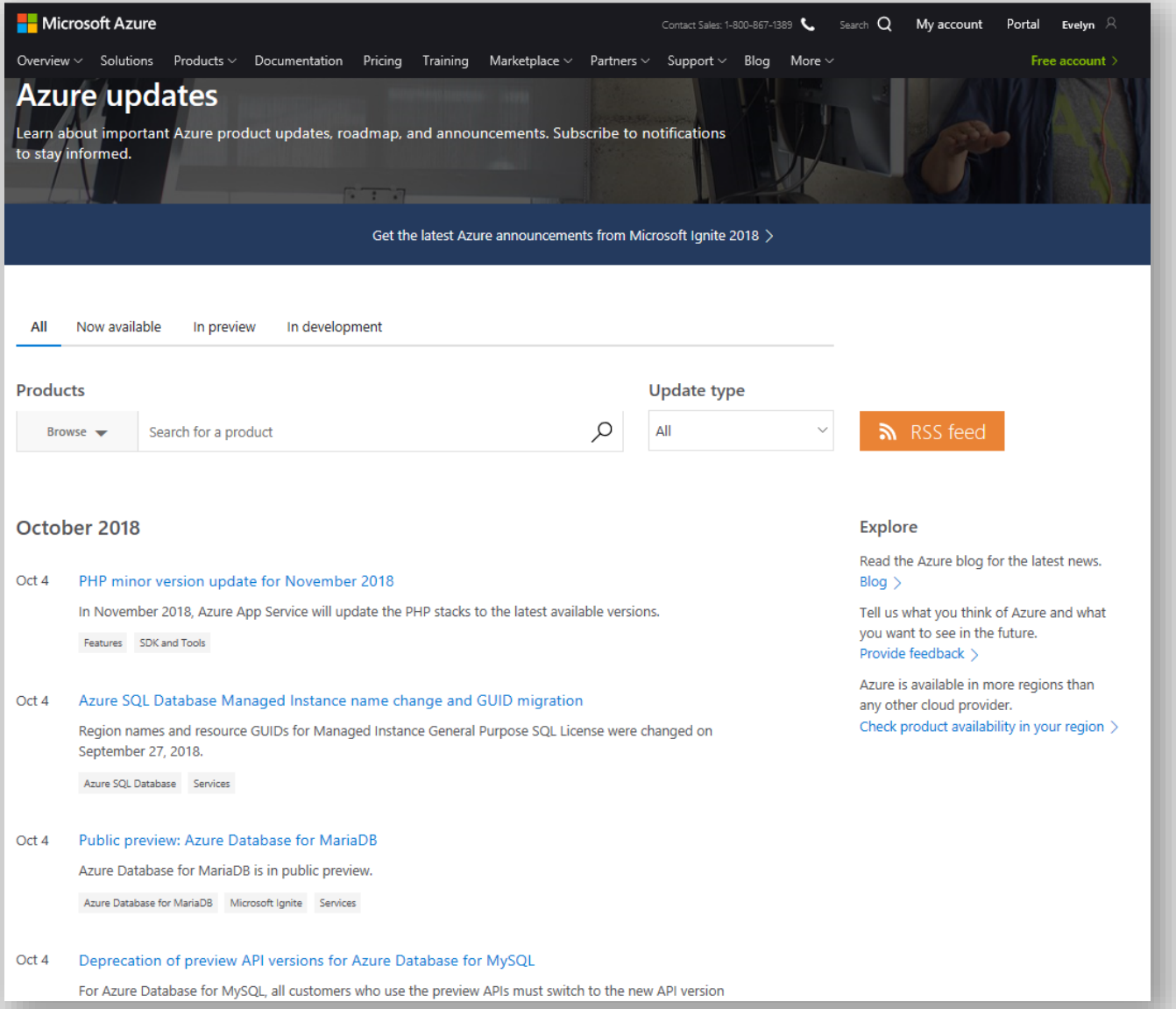
# Stay informed of changes in Azure

[Azure.com/updates](Azure.com/updates)

**Azure updates** is the single source of truth for product updates and roadmap changes

Subscribe to customized RSS Feed to stay informed on updates you care about

Includes packaging, licensing and region availability changes

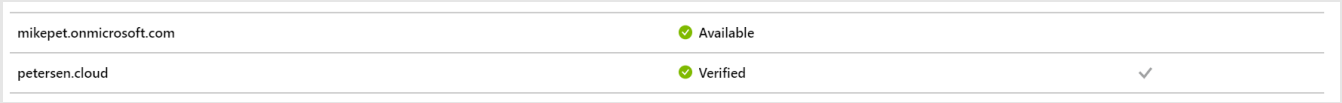


# Azure AD for Azure

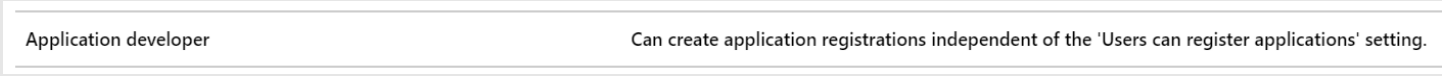
# Azure AD – How To Start

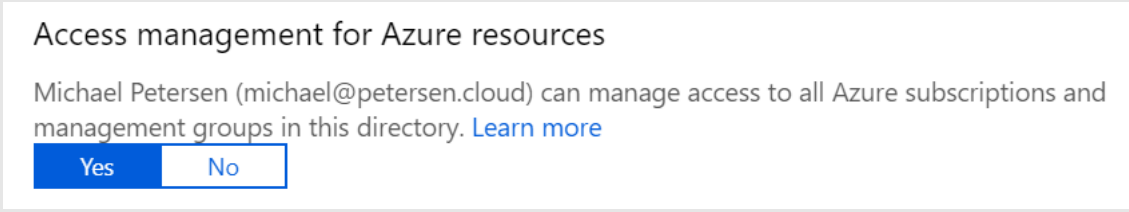
**Single Tenant, Multiple Domains**

1. Create a single tenant which is shared between Azure and Office365
2. Register public resolvable custom DNS domain names for admin and non-admin roles
3. Create AAD groups for end users, governance owners, subscription owners, contributors, and readers
4. Assign subscription owners the AAD Application developer role, so that they can register applications and service principals
5. Elevate access to manage all Azure subscriptions and management groups and configure the Root Management Group: [How To]





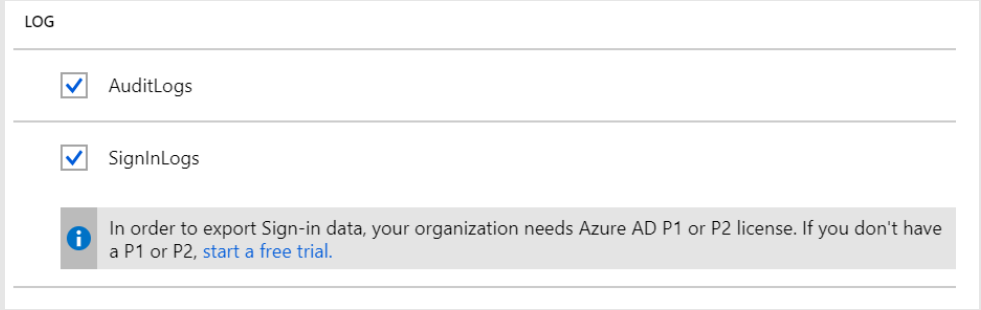


# Azure AD – How To Start

**Auditing and Identities**

6. Configure central Storage Account and Log Analytics workspace to collect Audit/SignIn logs for auditing purposes
7. Understand roles in
   - Azure AD
   - and in Azure RBAC
   - … and assign identities to them
   - ARM Provider Operations
8. Applications and Service Principals
   - Application is a global definition in its home AAD tenant
   - Service Principal is local to an AAD tenant where the application accesses protected resources
   - Background Information and Why
   - Create Subscription Creator App/SP




| | |
|---|---|
| Exchange administrator | Can manage all aspects of the Exchange product. |
| Global administrator | Can manage all aspects of Azure AD and Microsoft services that use Azure AD identities. |
| Guest inviter | Can invite guest users independent of the 'members can invite guests' setting. |

| NAME | TYPE | USERS | GROUPS |
|---|---|---|---|
| Owner | BuiltInRole | 1 | 1 |
| Contributor | BuiltInRole | 1 | 1 |
| Reader | BuiltInRole | 0 | 1 |
| User Access Administrator | BuiltInRole | 1 | 0 |

To access resources that are secured by an Azure AD tenant, the entity that requires access must be represented by a security principal. This is true for both users (user principal) and applications (service principal).

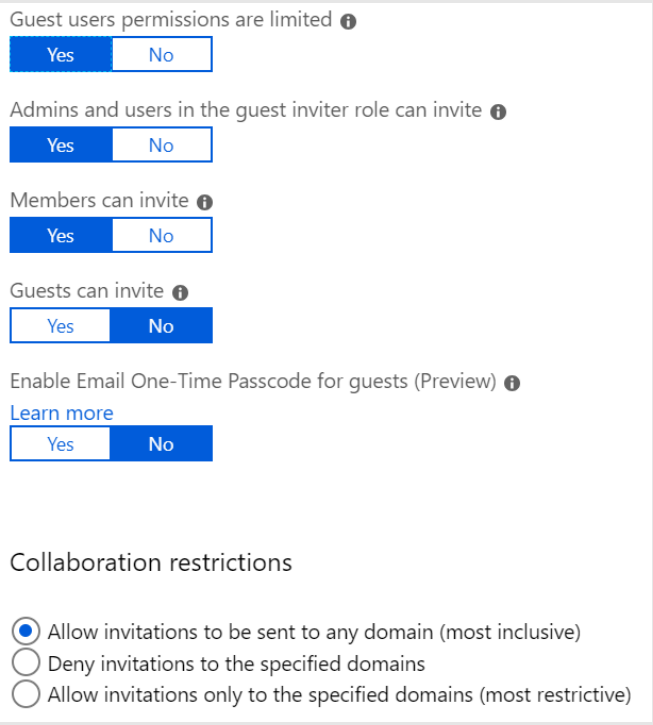
The Managed Identities for Azure feature provides Azure services with an automatically managed identity in Azure AD. You can use the identity to authenticate to any service that supports Azure AD authentication, including Key Vault, without any credentials in your code.

Managed Identities for Azure

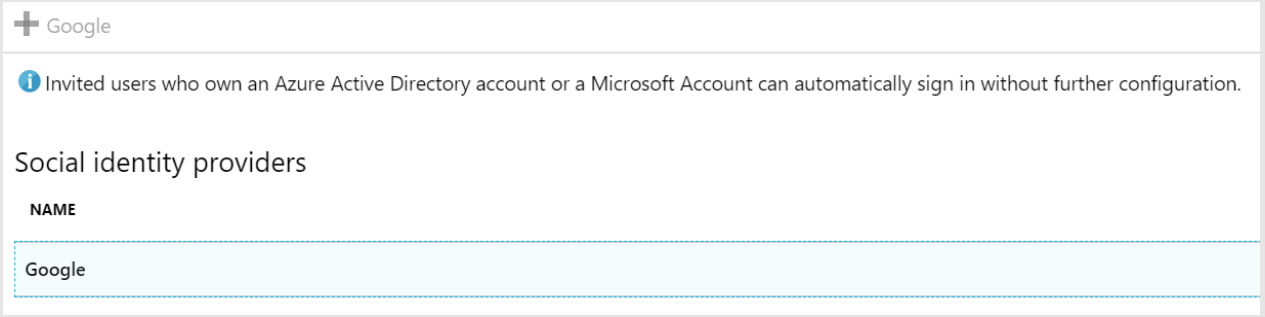
# Azure AD – How To Start

**External Collaboration**

9. Configure organizational relationships
10. Define who can invite external guests



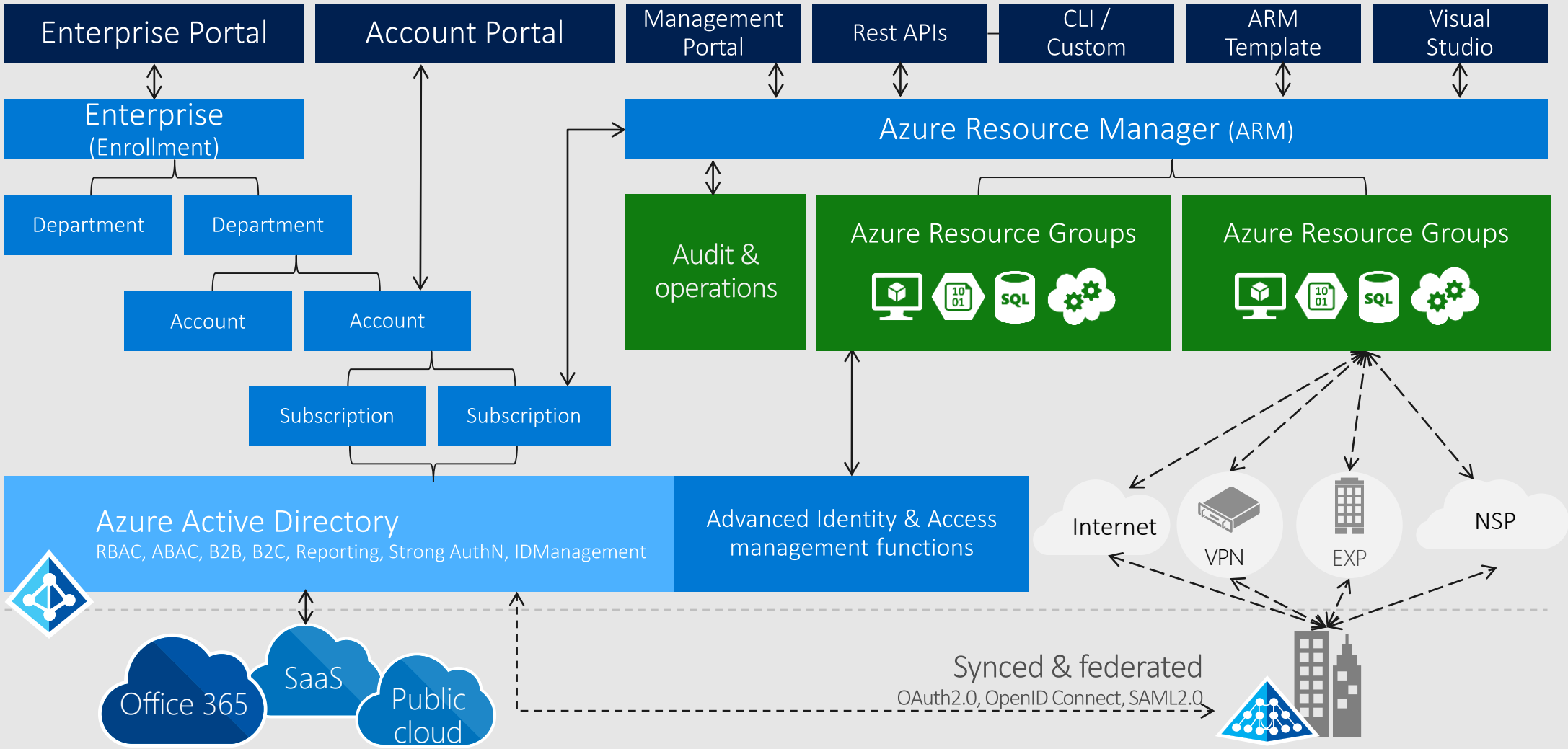

11. Azure AD creates "proxy" accounts for guests that point to external accounts but can be used to authorize access to Azure resources protected by Azure AD
    - Identity provider for Google Accounts available
    - External Azure AD und Microsoft Accounts supported
    - Any other account type mapped to newly created Microsoft Account with a separate password and identical username




| USER TYPE | SOURCE |
|---|---|
| Guest | Microsoft Account |
| Guest | External Azure Active Directory |
| Guest | Google |

# Cloud Security and Governance

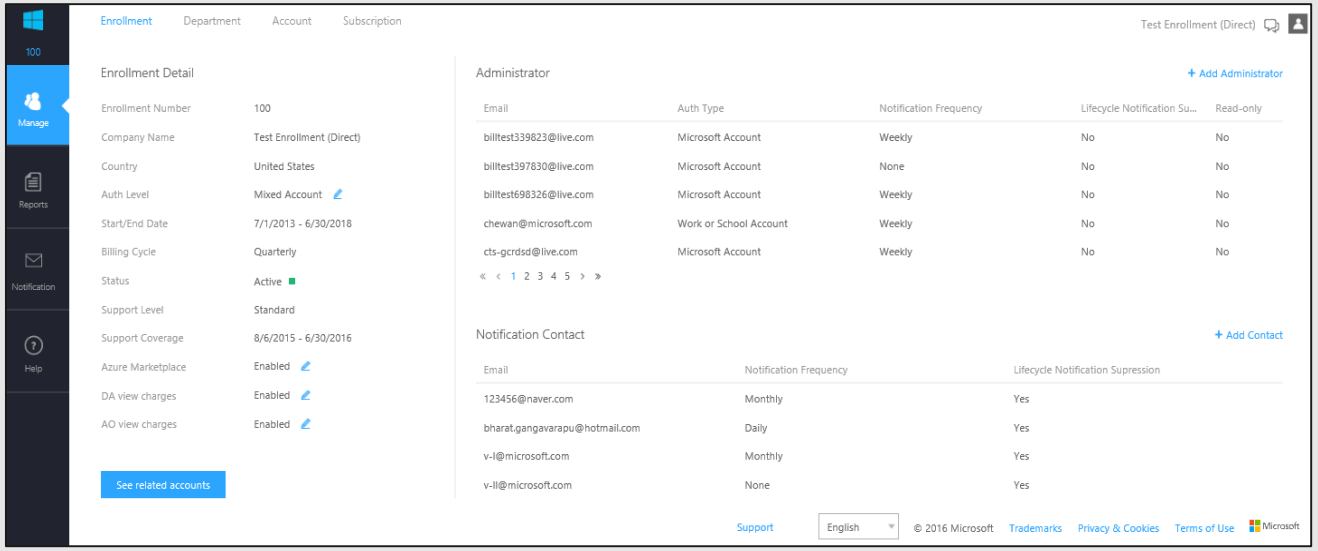
# Azure Enrollment Overview



# Azure – How To Start

**Enterprise Portal**

1. Formula: 1 Azure enrollment -> 1 AAD tenant -> 1-N enrollment accounts -> 50-200 subscriptions
2. Recommendation: please ignore departments and enrollment accounts and use enrollment accounts only as technical container for Azure subscriptions: account-1, account-2, …

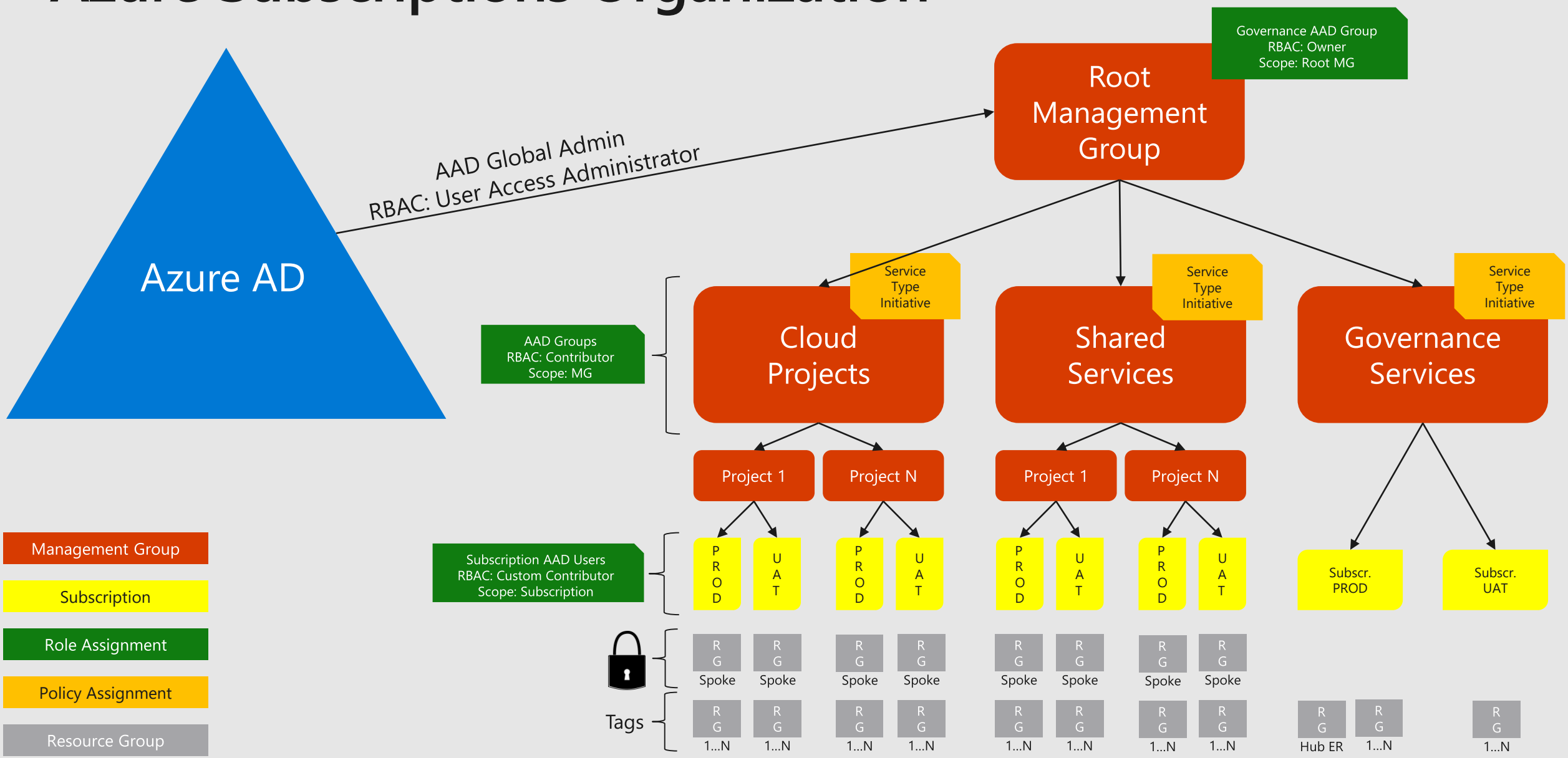



3. Assign account owners to enrollment accounts
   - RBAC assignment of an AAD user to the enrollment account
   - AAD User Object ID
   - Role = ‘Owner’
   - Scope = ‘/providers/Microsoft.Billing/enrollmentAccounts/{guid}’
   - Grant Access and Create Subscription

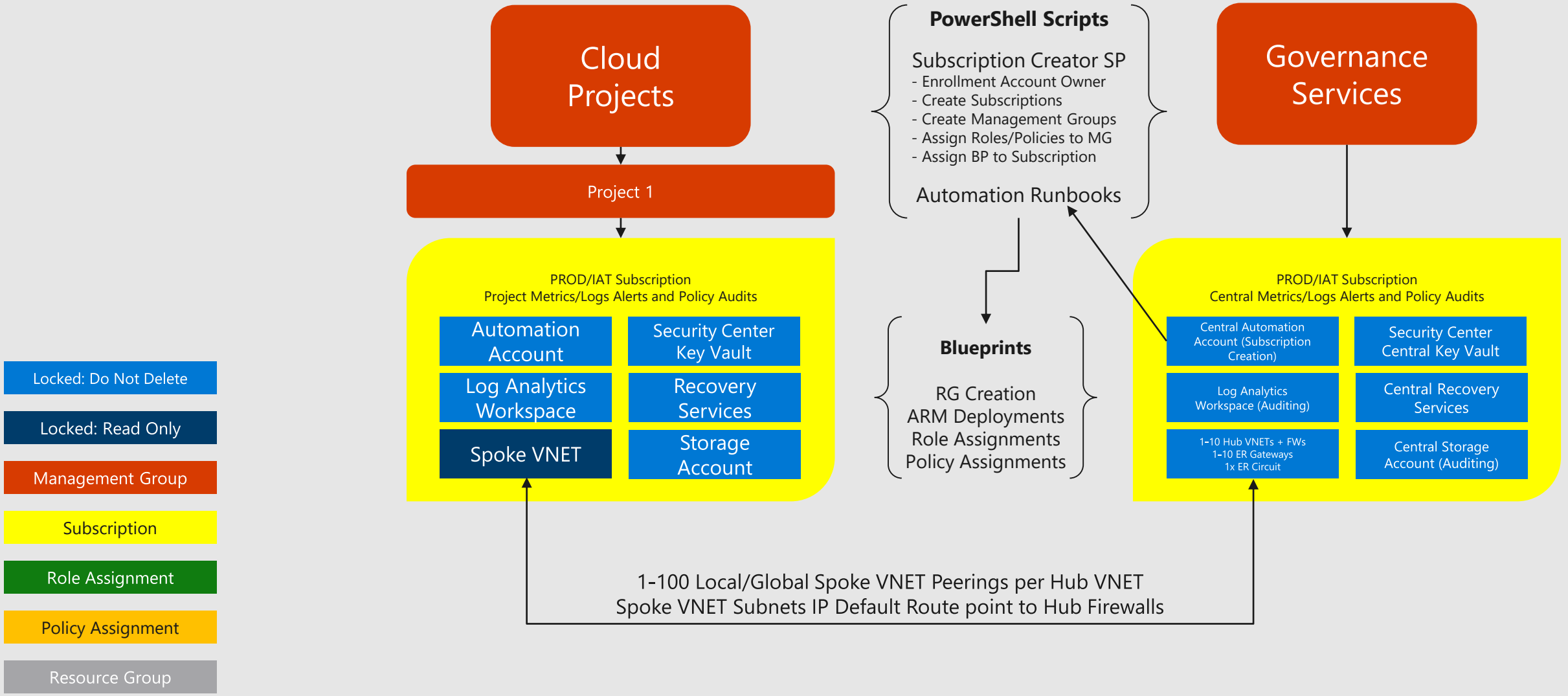
```
Get-AzEnrollmentAccount

New-AzRoleAssignment -RoleDefinitionName Owner
                     -ObjectId <userObjectId>
                     -Scope /providers/Microsoft.Billing/enrollmentAccounts/<GUID>

New-AzSubscription -OfferType MS-AZR-0017P
                   -Name "Subscription Name" -EnrollmentAccountObjectId <GUID>
                   -OwnerObjectId <userObjectId>,<servicePrincipalObjectId>
```

# Azure Subscriptions Organization

Billing and Permission hierarchy is identical in this concept (no EA portal usage)



# Azure Subscriptions Blueprint



# Governance – What To Learn

**Understand Inheritance**

1. Management Groups, Subscriptions, Resource Groups, and Resources build an inheritance hierarchy with respect to permissions and policies
2. Azure Policy is an explicit deny system (everything is allowed by default). If you denied something, you cannot allow it again later.
3. Azure RBAC is an explicit allow system (everything is denied by default). If you allow something, you cannot deny it again later on.
    - This will change in the future: Deny Assignments

**Define core set of Azure Policies**

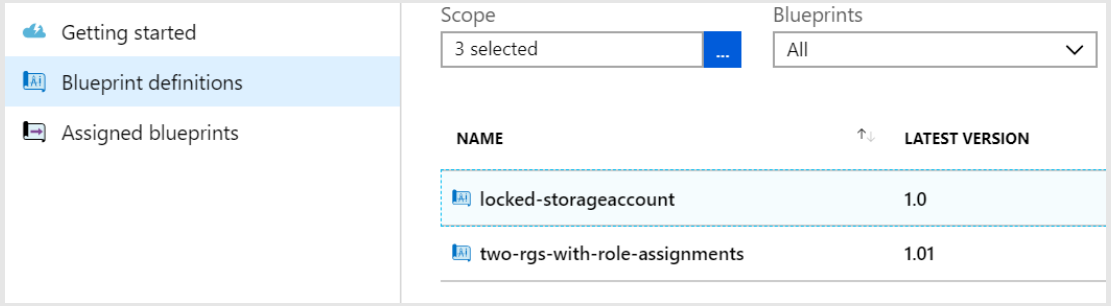
4. Enforce NSG rules, image publishers, locations, managed disks, encryption, resource types, …
5. Look at built-in policies and samples on GitHub: https://github.com/Azure/azure-policy

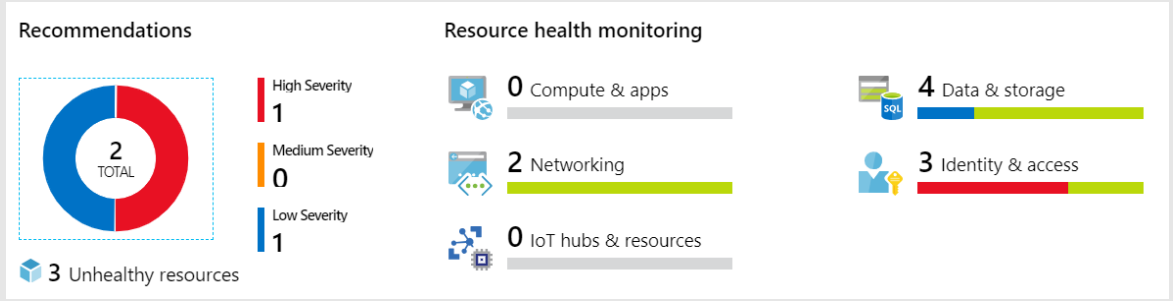
# Subscriptions Organization – Deep Dive

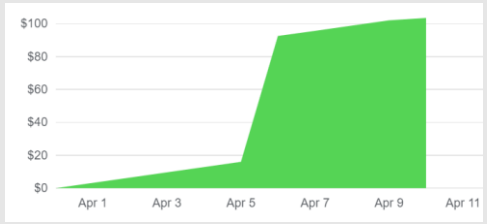
**Walkthroughs**

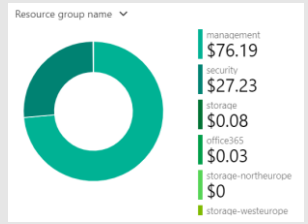
1. PowerShell
   - Management Groups
   - Policies, Custom Roles
2. Blueprints
   - Create and analyze results
   - What is happening in the background
   - What is a Deny Assignment
3. Security Center
   - Enable Security Center (coverage)
   - Understand security policies and settings
   - Recommendations
   - Adaptive Application Controls
   - JIT VM Access
4. Cost Center
   - Create budgets with alerts and exports

```
# Create first level of Management Groups
New-AzManagementGroup -GroupName 'cloud-projects' -DisplayName 'Cloud Projects' -ParentId $parentId
New-AzManagementGroup -GroupName 'shared-services' -DisplayName 'Shared Services' -ParentId $parentId
New-AzManagementGroup -GroupName 'governance-services' -DisplayName 'Governance Services' -ParentId $parentId
```



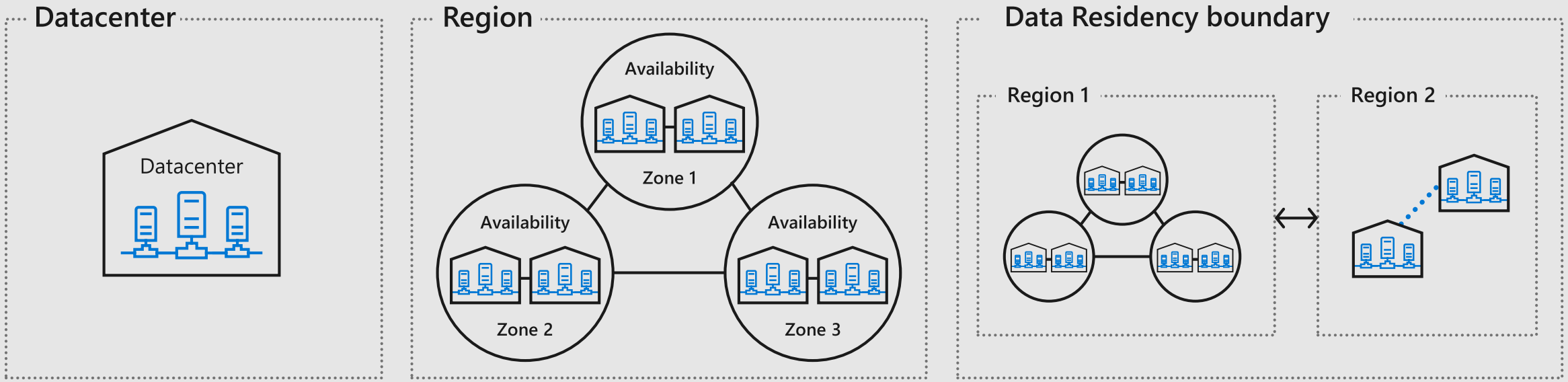




Operations for the Cloud

# Azure Resiliency as a Platform

## Resilient from hardware, datacenter, and regional outages

| Power/facility | Region Pairs, Availability Zones, Availability Set |
|---|---|




### Availability Sets

High availability protection from hardware failures in a datacenter

### Availability Zones

High availability protection against loss of datacenters. Multiple datacenters per physically separated zone. Each zone features independent network, cooling, and power

### Region Pairs

Protection for your data and applications from the loss of an entire region with Geo-redundant storage (GRS) and Azure Site Recovery

# Azure Resiliency as a Platform

## Industry-leading high availability SLA

| Power/facility | Region Pairs, Availability Zones, Availability Set |
|---|---|

Industry-only ····· Industry-leading high availability SLA ····· Industry-leading broadest choice of Data Residency ·····

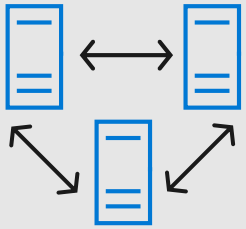
### VM SLA
99.9%

### Single VM
Protection with Premium Storage

### VM SLA
99.95%

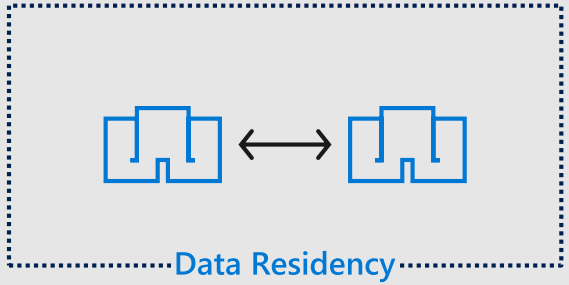
### Availability Sets
Protection against failures within datacenters

### VM SLA
99.99%



### Availability Zones
Protection from entire datacenter failures

### Regions
54




### Region Pairs
Protection from disaster with Data Residency compliance

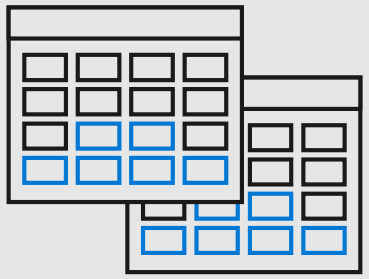
# Azure Storage Resiliency Solutions

## Azure storage provides replication options based on availability needs

| Storage | * Designed to provide durability of objects over a given year |
|---|---|

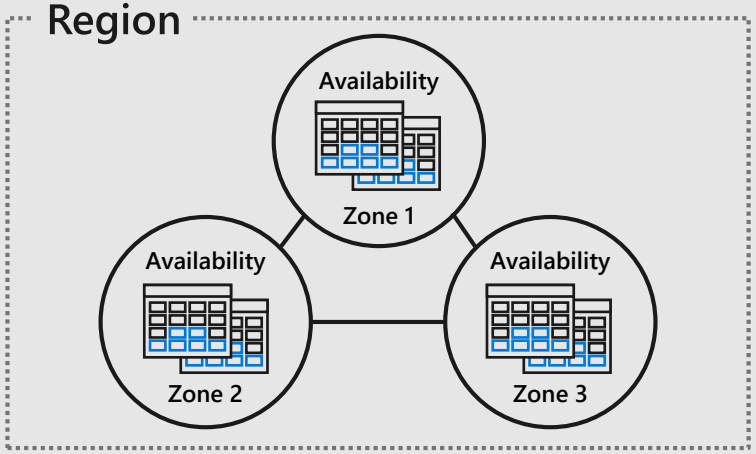
### LRS

99.999999999% (11 9s) *



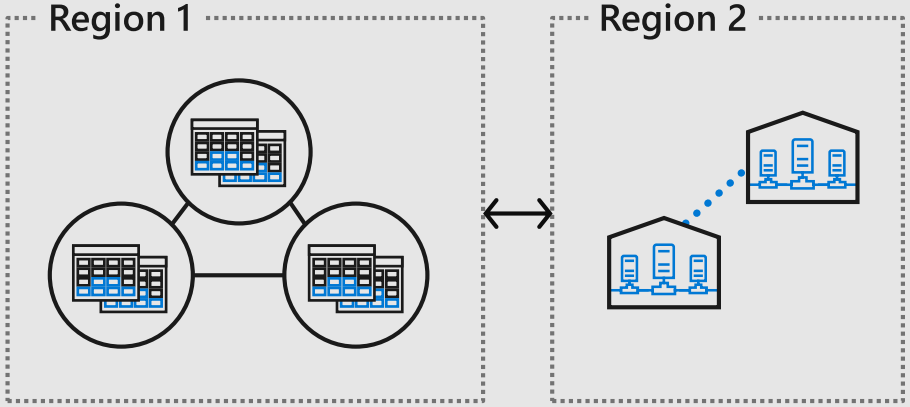
### ZRS

99.9999999999% (12 9s ) *




### GRS

99.99999999999999% (16 9s) *




### Locally redundant storage

The simplest, low-cost replication strategy that Azure Storage offers

### Zone-redundant storage

A simple option for high availability and durability

### Geo-redundant storage

Cross-regional replication to protect against region-wide unavailability

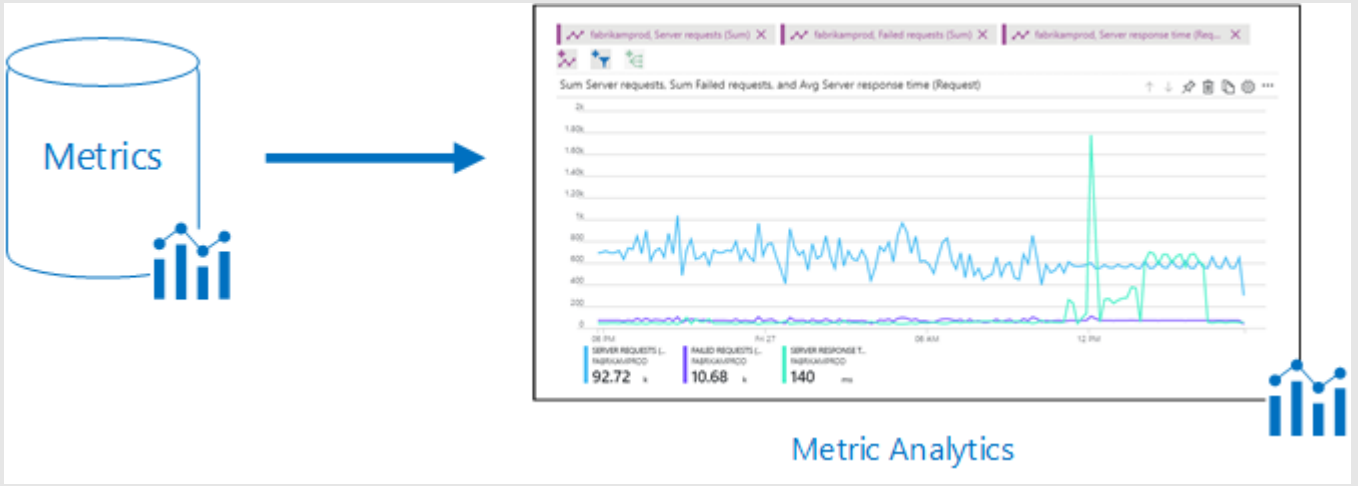
# Azure Monitor

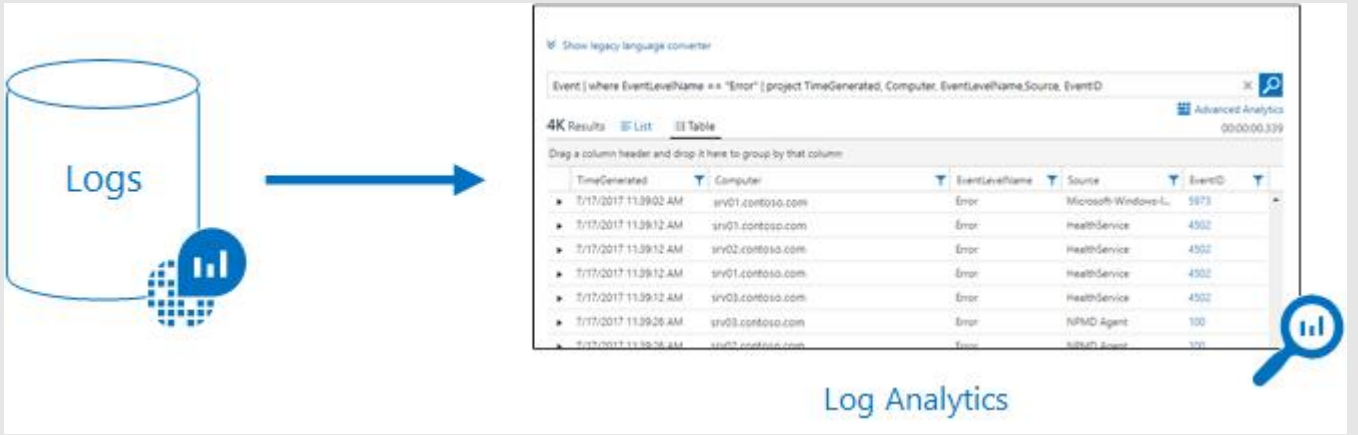
**Metrics and Logs**

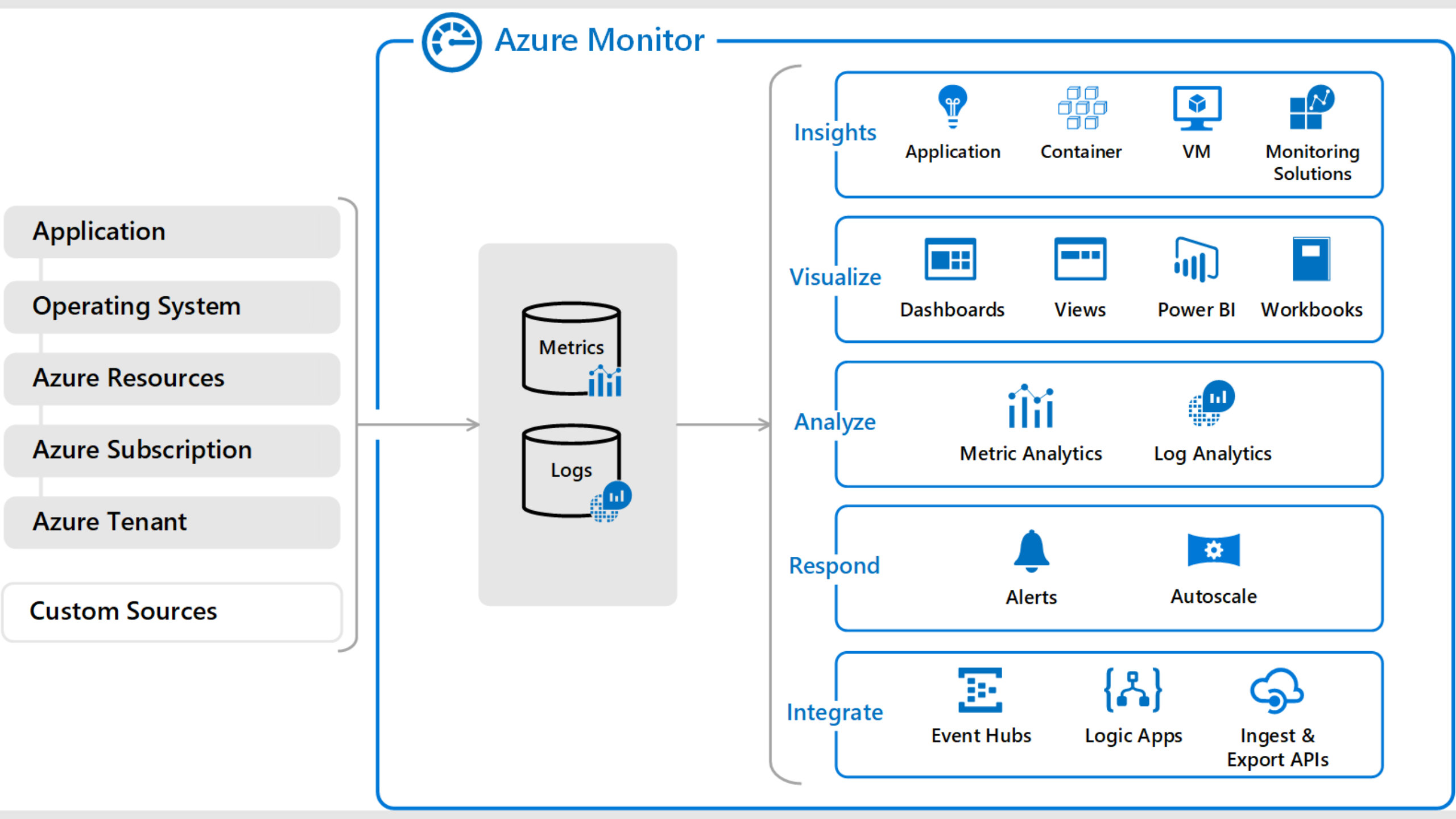
- All data collected by Azure Monitor fits into one of two fundamental types, metrics and logs.

- Metrics are numerical values that describe some aspect of a system at a particular point in time.

- Logs contain different kinds of data organized into records with different sets of properties for each type. Telemetry such as events and traces are stored as logs.



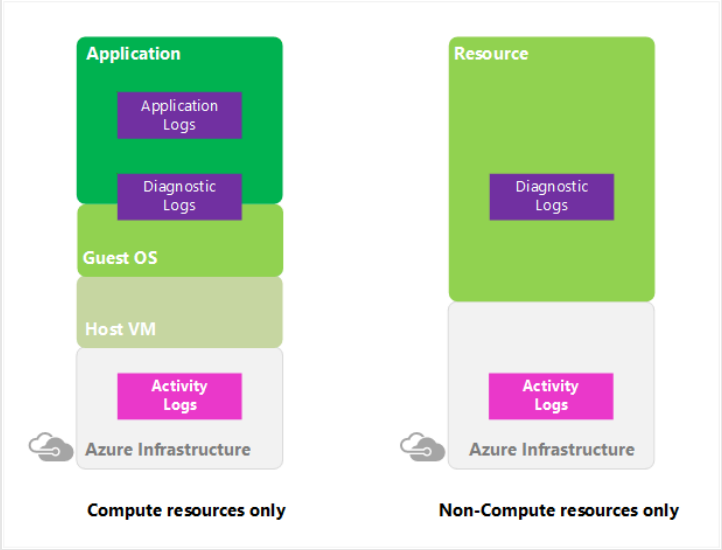



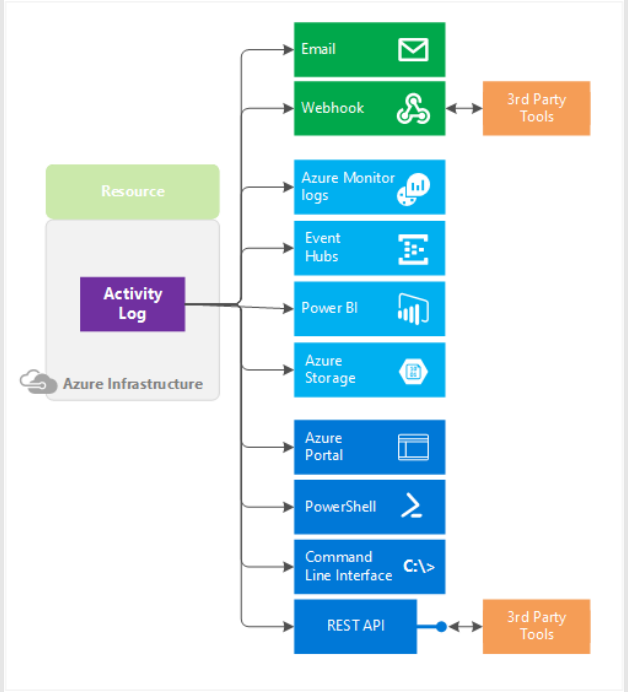

Azure Monitor
Application
Operating System
Azure Resources
Azure Subscription
Azure Tenant
Custom Sources
Metrics
Logs
Insights
Application
Container
VM
Monitoring Solutions
Visualize
Dashboards
Views
Power BI
Workbooks
Analyze
Metric Analytics
Log Analytics
Respond
Alerts
Autoscale
Integrate
Event Hubs
Logic Apps
Ingest & Export APIs

# Monitor – Deep Dive

**Walkthroughs**

1. Activity Logs
   - PUT, POST, DELETE on any subscription resource
   - Stored for 90 days, read only
   - Log Profiles for central auditing
   - Activity Logs Overview
   - Export Activity Log with Log Profiles
2. Alerts, Alert Rules, Action Groups
   - Create CPU alert for VM
3. Metrics
   - Create CPU and IOPS/s chart for VM
4. Service Health
   - Service Issues, Planned Maintenance, Health Advisories, Health History, Resource Health, Health Alerts
5. Diagnostics Settings
   - Collect diagnostics logs from any resource

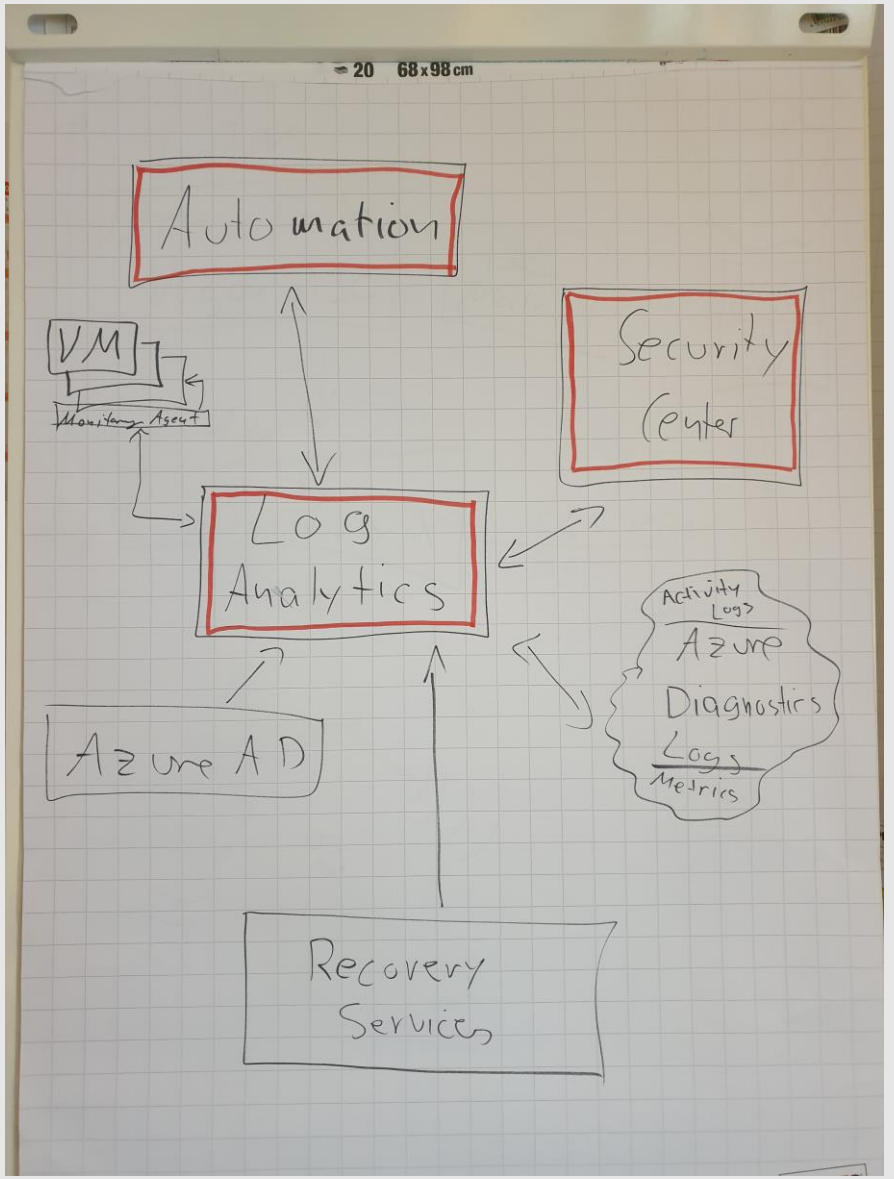


# Automate Operations – Deep Dive

**Walkthroughs**

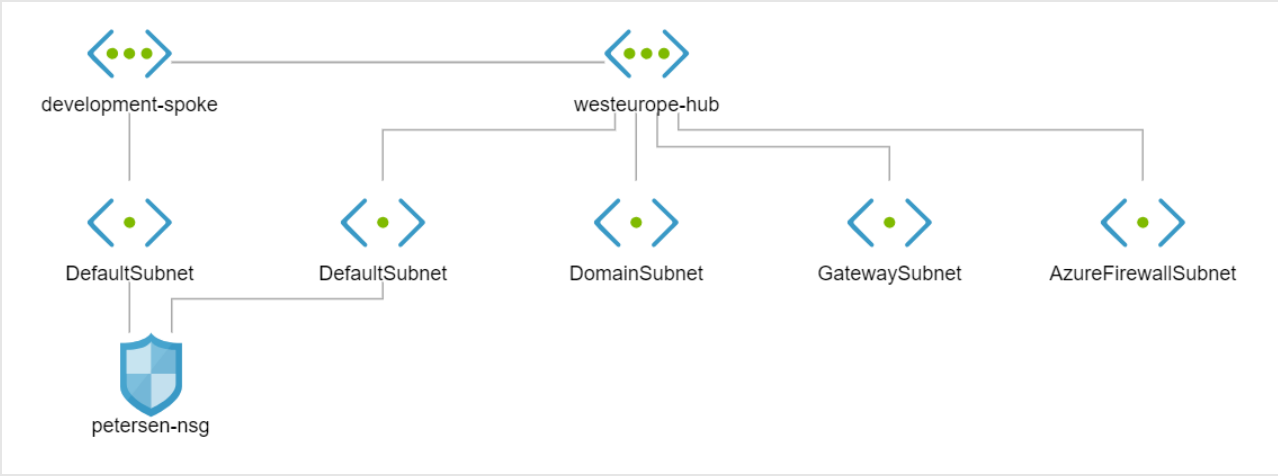
1. Log Analytics
   - Workspace Data Sources
   - Advanced Settings
   - Automation Account
2. Enable VM Insights based on Log Analytics on Virtual Machine Blade (Monitoring/Insights)
   - VM Insights At Scale with Policies
3. Automation
   - Configuration Management
   - Update Management
   - Hybrid Worker Groups
   - Process Automation (Runbooks/Jobs)
4. Recovery Services Vault
   - Azure Backup & Restore



# Network Watcher – Deep Dive

**Walkthroughs**

1. Network Watcher
   - Topology
   - Connection Monitor (e.g. Web -> SQL)
   - IP Flow Verify
   - Next Hop
   - Effective Security Rules
   - Packet Capture




| SOURCE | SOURCE PORTS | DESTINATION | DESTINATION PORTS | PROTOCOL | ACCESS |
|---|---|---|---|---|---|
| [redacted]/16 | 0-65535 | Virtual network (2 prefixes) | 22-22,3389-3389,5985-5... | TCP | Allow |
| Virtual network (2 prefixes) | 0-65535 | Virtual network (2 prefixes) | 0-65535 | All | Allow |
| Azure load balancer (1 prefixes) | 0-65535 | 0.0.0.0/0 | 0-65535 | All | Allow |
| 0.0.0.0/0 | 0-65535 | 0.0.0.0/0 | 0-65535 | All | Deny |

| SOURCE | SOURCE PORTS | DESTINATION | DESTINATION PORTS | PROTOCOL | ACCESS |
|---|---|---|---|---|---|
| Virtual network (2 prefixes) | 0-65535 | Virtual network (2 prefixes) | 0-65535 | All | Allow |
| 0.0.0.0/0 | 0-65535 | Internet (122 prefixes) | 0-65535 | All | Allow |
| 0.0.0.0/0 | 0-65535 | 0.0.0.0/0 | 0-65535 | All | Deny |

# Terraform Support in Azure

**Strong support for Terraform in the Azure Cloud**

1. The Azure Provider can be used to configure infrastructure in Microsoft Azure using the Azure Resource Manager API's: https://www.terraform.io/docs/providers/azurerm/index.html
2. Azure Documentation Hub for Terraform: https://docs.microsoft.com/en-us/azure/terraform/
3. Large amount of examples for the Terraform Azure Provider: https://github.com/terraform-providers/terraform-provider-azurerm/tree/master/examples

**Tools for Terraform related to Azure**

4. Azure Cloud Shell preconfigured for Terraform: https://docs.microsoft.com/en-us/azure/terraform/terraform-cloud-shell
5. Azure Storage as Terraform State Backend: https://docs.microsoft.com/en-us/azure/terraform/terraform-backend
6. Azure Marketplace provides preconfigured Linux VM with Managed Identity: https://docs.microsoft.com/en-us/azure/terraform/terraform-vm-msi
7. Azure Terraform VS Code Extensions: https://docs.microsoft.com/en-us/azure/terraform/terraform-vscode-extension
8. Terraform Build and Release Tasks for Azure DevOps: https://marketplace.visualstudio.com/items?itemName=charleszipp.azure-pipelines-tasks-terraform

# Automate Builds and Deployments – Deep Dive

**Visual Studio Community Edition – ARM Automation**

1. Create empty project and understand ARM fundamentals
2. Quickstart Templates for Azure and Blueprint ARM Templates
3. Create Virtual Machine with Key Vault Integration and Custom Script Extension

**Visual Studio Code – Terraform Automation**

4. Understand Terraform extensions for Azure
5. Deploy Getting Started and optionally Kubernetes Cluster or Virtual Machine

**Azure DevOps – Automate Everything with Pipelines**

4. Understand Pipelines to automate CI (build) and CD (deploy)
5. Deploy Azure resources with ARM Templates
6. Infrastructure deployments in the Azure Cloud with Terraform, see also https://azuredevopslabs.com/labs/vstsextend/terraform/
7. Custom Build Servers and Deployment Groups
8. How to integrate Git Lab with Azure DevOps Pipelines, see also https://marketplace.visualstudio.com/items?itemName=onlyutkarsh.gitlab-integration

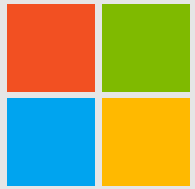
# Cryptographic Security – What To Learn

**Data At Rest, Data In Transit**

1. For any application and storage system it is mandatory to understand the encryption technologies in use while data is stored (at rest) and transferred (in transit)
2. Two examples: Azure Storage, Azure SQL Database
   - Storage: Storage Service Encryption (at rest) and HTTPS (in transit), Storage Security Guide
   - SQL: Transparent Data Encryption (at rest) and TDS+TLS (in transit), SQL Security

**Key Management, Secret Management, Certificate Management**

4. Azure Key Vault: a FIPS 140-2 Level 2 validated HSM (in premium edition), Key Vault Overview
5. To manage:
   - application secrets, store secrets and access them via Managed Identities (e.g. a Web App instance)
   - encryption keys, generate/import them; cannot be exported but used to encrypt data/keys or sign hashes; access them via Key Vault access policies (VMs, ARM, Disk Encryption) or Managed Identities
   - certificates, create/import them and let you notify at a given percentage lifetime; connect GlobalSign or DigiCert; stored as secrets and accessed via Managed Identities or access policies (VMs)
6. ARM Templates can reference Key Vault secrets and certificates
7. Azure DevOps Pipelines, Azure Storage, Azure SQL Database, … are integrated with Azure Key Vault



# Microsoft Azure

Productive + Hybrid + Intelligent + Trusted