### Microsoft Azure Architect Technologies & Design Study Group

Session 1: Kickoff and Requirements

Jaswant Singh (Jas), Chief Enterprise Architect
NA GTS CTO Office - Cloud and Integration

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### Agenda

- Introductions
- Course Objectives
- Course Outline
- Azure Trial Account
- Study Groups
- Workload Requirements
- □ Q&A





### About Me

Jaswant Singh (Jas), Chief Enterprise Architect

- https://www.linkedin.com/in/jaswantsingh/
- http://techblog.baghel.com

#### Technical Eminence:

- Recognized Teacher and Mentor
- Industry Thought Leader, and
- Published Author

#### Education:

- MS Technology Management, GMU
- MS Mathematics, IIT Bombay

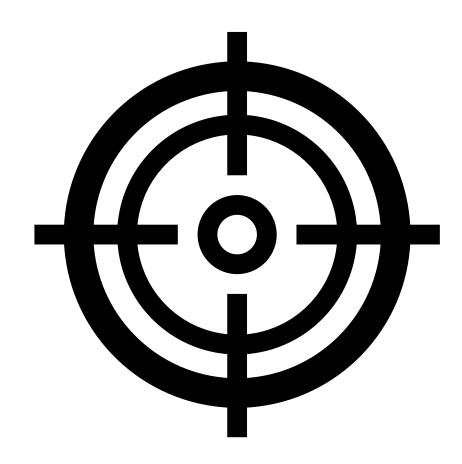
### Course Objectives

### Objectives:

- You will network with like minded professionals and develop understanding of core concepts in Infrastructure Services
- You will learn IaaS/PaaS solution design with Azure Cloud
- Participants will accelerate self study to prepare for the Azure Solutions Architect Certification

### Prerequisites:

- Curious to learn, and/or
- You have background in Infrastructure,
   System, and/or Software Architecture
   Design, Deployment and Operations



### **Course Outline**



Course Outline
Session 1:
Kickoff
and
Requirements

- Introductions
- Course Objectives
- Course Outline
- Azure Trial Account
- Study Groups
- Workload Requirements
- □ Q&A

# Course Outline Session 2: Infrastructure Design

- Q&A Follow Up
- Network Design
- Storage Design
- Compute Design
- Monitoring Design
- □ Q&A

Session 3:
Identity
and
Security Design

- Q&A Follow Up
- Active Directory & Integration
- Hybrid Identity & MFA
- Single Sign On
- Data Protection
- ABQ =

Session 4:
Migration and Resiliency

- Q&A Follow Up
- Backup and Archives
- Azure Site Recovery
- Database Migration Service
- Azure Migrate
- ABQ =

# Course Outline Session 5: Cloud Native Design

- Q&A Follow Up
- Database, Middleware & PaaS
- Containers and Serverless
- Developer Tools and DevOps
- Mobile
- Q&A

# Course Outline Session 6: Cloud Native Design

- Q&A Follow Up
- Integration Services
- □ AI + Machine Learning
- Analytics
- □ IOT and Media
- □ Q&A

## Azure Trial Account

- Account Setup
- Syllabus and Labs Downloads
- Microsoft Learning Resource

## Study Groups

#microsoft-azure-study-group

- Join Slack Channel
- Suggested to Network and Create Lab
   Team with up to 3 Members
- Hands on Labs Self Study

# Workload Requirements

- Industry Leading Buzzwords
- Shared Responsibility Model
- Optimization Strategy
- Auditing & Monitoring Strategy
- Azure Architecture Pillars

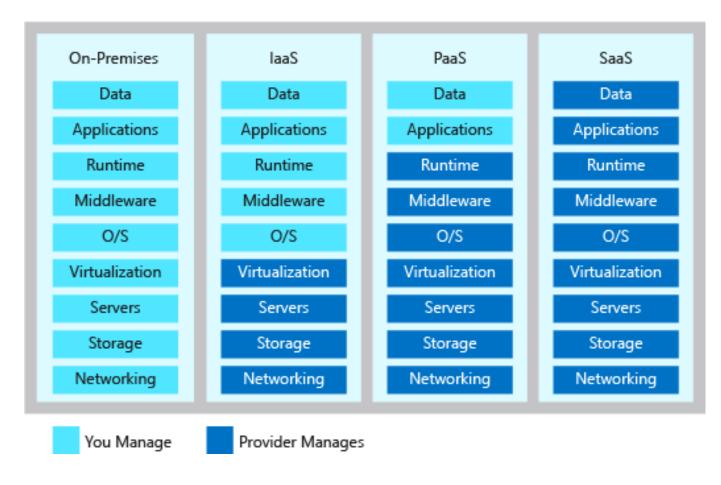
### Workload Requirements

### Industry Leading Buzzwords

Security Compliance Accessibility Governance Scalability Availability Recoverability Sizing Planning Deployability Capacity Configurability Maintainability Testing Scenarios Product and Evaluate Services Identity and Access Management Infrastructure Services Architecture

### Workload Requirements

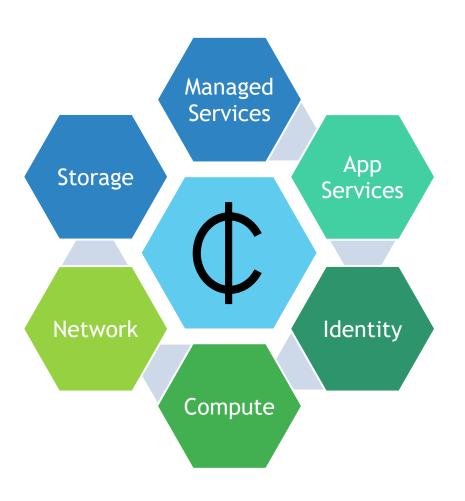
### Cloud Responsibility Model



Source: http://techblog.baghel.com/index.php?itemid=157

### **Workload Requirements**

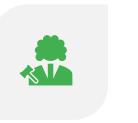
### **Optimization Strategy**













LOGS LEVELS
AND
STORAGE LOCATIONS

RESOURCE TAGGING AND GROUPS MONITORING TOOLS INTEGRATION AUDITING
COMPLIANCE, POLICIES
AND TRACEIBILITY

AND ESCALATIONS

Workload Requirements

Auditing & Monitoring Strategy

### Workload Requirements Azure Architecture Pillars



Security

Access Control

Data Integrity

and

Regulatory Compliance



Performance and Scalability

Economically
Deliver User Demands
in
all Use Cases



Availability and Recoverability

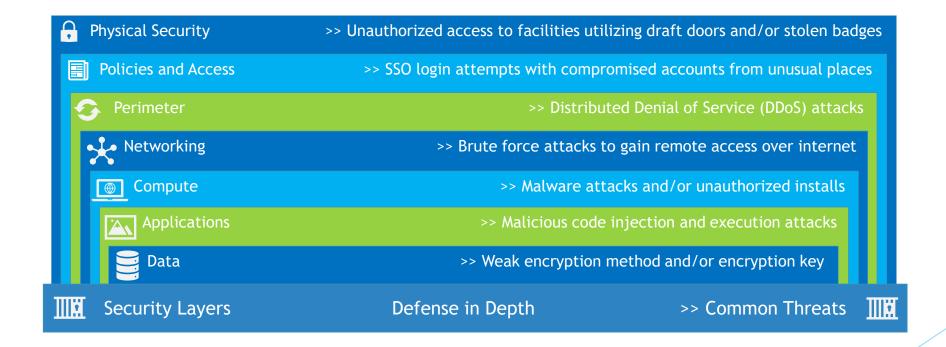
Minimize Downtime and Avoid Permanent System and Data Loss



and Operations

Maximize Maintainability and Ensure Completeness of Monitoring

# Workload Requirements Azure Architecture Pillars Security



Source: http://techblog.baghel.com/index.php?itemid=152

# Workload Requirements Azure Architecture Pillars Performance and Scalability

- Scaling
  - Scale Up-Down / Vertical Scaling
  - Scale Out-In / Horizontal Scaling
- Performance Optimization
  - Understanding the need and use of Network, Storage, Compute and Dependent Services by an application for the desired performance level.
  - Design and configure at the minimum cost.
- Leading Patterns and Practices
  - Caching and Data Partitioning
  - Scale Units and Auto Scaling
  - Decouple Resource Intensive Tasks and Services Integration
  - Performance Monitoring

# Workload Requirements Azure Architecture Pillars Availability and Recoverability

### Availability

- Maintaining up time through conditions such as network and system outages
- Establish the Service Level Agreement (SLA)
- Leading practice is to handle the localized failures by integrating high availability and eliminating single points of failure by clustering and load balancing solutions.

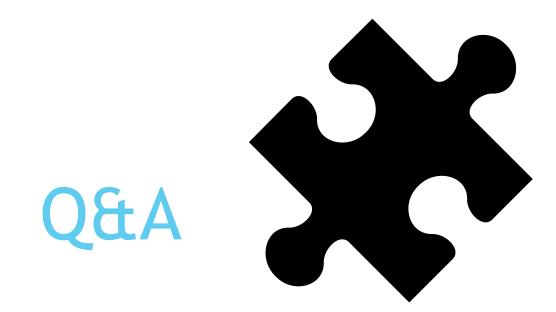
### Recoverability

- System and data recovery after a disaster
- Leading practice is to establish RPO and RTO for an application and design backup, restore, replication, and recovery capabilities.
  - Recovery Point Objectives (RPO) The time units data loss is acceptable to business owners
  - Recovery Time Objectives (RTO) The time units available for system and data recovery

# Workload Requirements Azure Architecture Pillars Efficiency and Operations

#### Leading Patterns and Practices

- Maximize use of automation for build, testing and deployment through DevOps and Continuous Integration
- Minimize operations cost by the use of automation and utilizing SaaS over PaaS, and PaaS over IaaS.
- Design thorough monitoring, logging, and instrumentation system to
  - Proactively resolve availability and performance issues
  - Identify areas of waste of resources and eliminate them
  - Proactively tune and optimize deployed resources

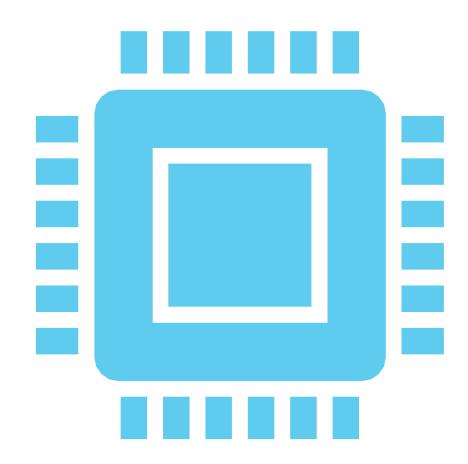


# Microsoft Azure Architect Technologies & Design Study Group Session 2: Infrastructure Design

Jaswant Singh (Jas), Chief Enterprise Architect
NA GTS CTO Office - Cloud and Integration

### Agenda

- Q&A Follow Up
- Network Design
- Storage Design
- Compute Design
- Monitoring Design
- **♦** Q&A





- Cloud Deployment Model
- Recoverability Solution
- Commonly Assumed Risk

### Q1: Cloud Deployment Model

- You are developing Cloud Deployment Model strategy for a company ABC. You are asked to recommend a solution that needs to provide competitive advantage for their business
- The Line of Business wants to align with industry leading platform and tools to develop and deploy the business application to balance between cost and flexibility for the needs
- The solution must deliver Auto Scaling, DevOps and Continuous Integration for optimized Deployability and Scalability.

Select the best primary Cloud Deployment Model you will recommend to the Scenario:

- Software as a Service (SaaS)
- Platform as a Service (PaaS)
- Infrastructure as a Service (laaS)
- None of the Above

### Q2 Recoverability

What's not Covered under the Recoverability Solution Design Pillar? Select all the possible choices:

- ☐ Time to Restore the Application Services for End Users
- Volume of the Data Loss
- Application Architecture Component Redundancy
- Application Architecture Component Performance
- Application Architecture Component Restore Location
- □ Scope of Application Services and/or Functionality
- ☐ Time units of the Data Loss
- None of the Above

### Q3: Commonly Assumed Security Risk

- You are designing security solution for the ABC Corp business application that is consumed by their employee over the private network only.
- The application end points are not published to internet.
- The company has invested in through background checks for their employee to be considered trusted users of the application.
- You are working on very tight budgets and this needs to be quick to launch that must have lowest Operations and Maintenance (O&M) Cost.

Select the common threat and/or threats from Defense in Depth Security Model that can be assumed for the Scenario:

- Distributed Denial of Service (DDoS) Attacks
- Application Layer Security Malicious code injection and execution Attacks
- Login Attempts from Unusual Places
- None of them
- □ A & C Only
- B & C Only
- □ A & B Only
- All of them

## Network Design

- VNets & SubNets
- Azure DNS Resolving
- Load Balancers
- Network Integration
- □ Network Security
- Network Tools

### Network Design VNets and SubNets

- Networking Topology:
  - Define 1 or more VNets within an Azure Region, and configure an address space for each
  - Define 1 or more SubNets within a VNet, and configure address space within the VNet range
  - VNets and SubNets are using CIDR notation (x.x.x.x/16, x.x.x.x/24,...)
  - Configure Network Security Group settings on VNet level
  - Attach a NIC to a SubNet
- SubNet IP Addressing:
  - IP-address gets allocated to a NIC during provisioning of the NIC
  - ☐ First available IP-address in a SubNet range is x.x.x.4
  - Azure SubNets support dynamic (=default) and static IP addressing

CIDR Notation	Size	Configurable IP Address
x.x.x.x/29	8	4
x.x.x.x/28	16	12
x.x.x.x/27	32	28
x.x.x.x/26	64	60
x.x.x.x/25	128	124
x.x.x.x/24	256	252
x.x.x.x/20	4,096	4,092
x.x.x.x/16	65,536	65,532
x.x.x.x/12	1,048,576	1,048,572
x.x.x.x/8	16,777,216	16,777,212

- Public IP Addressing:
  - Used for all public internetfacing communication
  - Required parameter when creating a VM from the portal
- Private IP Addressing:
  - Used for all inter-VNet communication
  - Used for all communication between an Azure VNet and an on-premises VNet
  - Class A: 10.0.0.0 to 10.255.255.255
  - Class B: 172.16.0.0 to 172.31.255.255
  - Class C: 192.168.0.0 to 192.168.255.255

### Network Design Azure DNS Resolving

- Buzzwords: Root DNS, Domain Registrar
   Authoritative DNS, Recursive DNS, Public DNS
   DNS Zone, and Private DNS Zone
- DNS Server settings are configured on VNET level
  - Use Azure DNS (Default), or
  - Use your custom DNS configuration:
    - Azure DNS Appliance (from Azure Marketplace)
    - □ Azure VM (e.g. Windows ADDS with DNS)
    - On-premises DNS solution (requires connectivity)
- Public DNS names (available for VMs and App Services) must be unique across Azure regions: <host.region.cloudapp.azure.com>

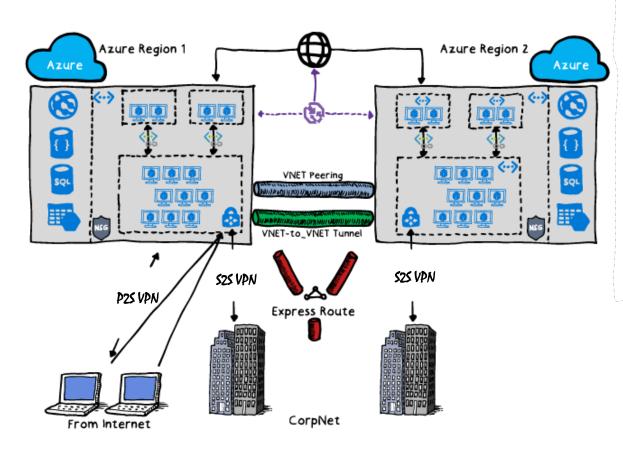
- Commonly Used DNS Records
  - A (Host Address)
  - CNAME (Canonical Name for Alias)
  - Mail eXchange (MX)
  - Reverse DNS (PTR)
  - TXT (Descriptive Text)
    - Sender Policy Framework (SPF)
    - DomainKeys Identified Mail (DKIM)
    - Ownership Validation
  - □ NS (Name Server)
  - □ SOA (Start of Authority)
  - AAAA (IPv6 Host Address)

## Network Design Load Balancers

	Туре	Use Cases
Azure Load Balancer Basic	L4 LB + NAT up to <= 100 instances	<ul> <li>Single Availability Sets</li> <li>Network Security Group (NSG) Optional</li> <li>Basic NAT and Probe Health Status</li> </ul>
Azure Load Balancer Standard	L4 LB + NAT up to <= 1000 instances	<ul> <li>Availability Zones, Zone-redundant fronted Zonal frontend</li> <li>NSG Required and HA Ports</li> <li>Integrated Frontend and Backend Health Metrics</li> </ul>
Azure Application Gateway	L7 LB	<ul> <li>SSL Termination, and Application Layer Security (WAF)</li> <li>URL Based Routing</li> </ul>
Azure Traffic Manager	Smart DNS	<ul><li>Global Resiliency and Performance</li><li>Distribute and Failover Users Across Azure Regions</li></ul>
Azure Front Door	Application Delivery Network	<ul> <li>SSL Termination, DDoS, Application Layer Security and Caching</li> <li>Global Resiliency and Performance Based</li> </ul>
Azure Marketplace Appliance	L7 LB	<ul> <li>Porting proprietary implementation such as f5 iRules</li> <li>Security and Regulatory Compliance and Governance</li> </ul>

### **Network Design**

# **Network Integration**



- ExpressRoute
- Site-to-Site (S2S) VPN
- Point-to-Site (P2S) VPN
- VNeT Peering
- Network Address Translation (NAT)
- VPN Gateway
- Transit VNeT
- Virtual Network Traffic Routing
  - User Defined
  - Border Gateway Protocol (BGP)
  - System Defined

# Network Design Network Security

Network Security Groups (NSG) is a toplevel object that is associated to your subscription:

- NSG controls traffic to one or more virtual machine (VM) instances in your virtual network
- NSG contains access control rules that allow or deny traffic to VM instances
- NSG rules can be changed at any time, and changes are applied to all associated instances

Application Security Groups (ASG) enable us to configure network security as a natural extension of an application architectures' function-based resource groups:

- Define network security policies based on resource groups that enables reuse of the security policy at scale without manual maintenance of the explicit IP addresses
- Just map the VM instances to appropriate resource groups. The platform handles the complexity of explicit IP addresses and multiple rule sets, allowing us to focus on the business logic



### Network Design

### Network Tools - Azure Network Watcher

### Monitoring



🚠 Topology



Connection monitor



Network Performance Monitor

### Network diagnostic tools



IP flow verify



Next hop



# Effective security rules



VPN troubleshoot



Packet capture



Connection troubleshoot

### Metrics



Usage + quotas

### Logs



NSG flow logs



Diagnostic logs



Traffic Analytics

# Storage Design

- Azure Storage by Usage
- Azure Storage Solutions
- Replication Options
- □ Access Control & Encryption
- Management and Tools

# Storage Design Azure Solutions by Usage

# Azure Virtual Machines

- Operating System and Data Disks
- File Storage



- Blobs
- Queues
- Data Lake Store



- Tables
- Cosmos DB
- Azure SQL Database

### Storage Design

### Azure Storage Solutions

Highly Available, Secure, Durable, Scalable, and Redundant

### **Discrete Storage Services**

- Blob >> REST based Object Storage for Unstructured Data
- File >> Industry Standard SMB 3.0 Protocol based Cloud File Shares
- Queue >> Durable Queues for Cloud Services
- Table >> NoSQL Key Value Store
- Disk >> Persistent and High Performing Disks for Azure Virtual Machines

### Account Kind:

- ☐ General Purpose v2 (GPv2)
- ☐ General Purpose v1 (GPv1)
- BlobStorage (Blob)

#### Performance Tiers:

- Standard
- Premium

#### **Access Tiers:**

- □ Hot (Default Option)
- Cold
- Archive

# Storage Design Azure Replication Options

	Locally Redundant Storage (LRS)	Zone Redundant Storage (ZRS)	Geo Redundant Storage (GRS)	Geo Zone Redundant Storage (GZRS)
Localized Hardware Failure	Yes	Yes	Yes	Yes
Data Center Outage	No	Yes	Yes	Yes
Region Outage	No	No	Yes	Yes
Remote Read Access	No	No	RA-GRS	RA-GZRS
Number of Copies of Data	3	3	3+3	3+3
Account Type Requirements	GPv1, GPv2, Blob	GPv2	GPv1, GPv2, Blob	GPv2
Performance Tiers	Premium	Standard	Standard	Standard
Type of Replication	Synchronously	Synchronously	Synchronously & Asynchronously	Synchronously & Asynchronously

### Storage Design

# **Access Control and Encryption**



#### **Access Control**

- Azure Active Directory: Azure AD credentials to authenticate a user, group, or other identity
- Shared Key Authorization:
   Applications can use Shared Access
   Key at the Runtime to Access Azure
   Storage
- Shared Access Signature (SAS):
   Delegate Access to Resources using
   SAS when Azure AD is not in Use



### Data Encryption at Wire\*

Storage Account End Points = Unique Account Name + Storage Service End Points

- Blob storage: Configurable to Custom Domain https://\*mystorageaccount\*.blob.core.windows.net
- □ Table storage:
  https://\*mystorageaccount\*.table.core.windows.net
- Queue storage: https://\*mystorageaccount\*.queue.core.windows.net
- Azure Files: https://\*mystorageaccount\*.file.core.windows.net



### Data Encryption at Rest

- Azure Storage Service
   Encryption (SSE) by default
   Encrypts Data at Rest for all
   the Azure Storage Services
   using Azure SSE Managed
   Encryption Keys
- Azure SSE can Encrypt Data at Rest using the User Provided and Managed Encryption Keys via the Azure Key Vault



#### AZURE STORAGE EXPLORER

FREE DESKTOP APP
FOR MANAGING
AZURE CLOUD STORAGE
RESOURCES



#### **AZCOPY**

WINDOWS COMMAND-LINE
UTILITY FOR
HIGH-PERFORMANCE
COPYING OF DATA
TO AND FROM
AZURE STORAGE



#### **AZURE ADVISOR**

FREE AZURE SERVICE THAT
ANALYZES AZURE USAGE AND
PROVIDES RECOMMENDATIONS
TO REDUCE COSTS, BOOST
PERFORMANCE, STRENGTHEN
SECURITY, AND IMPROVE
RELIABILITY



#### **AZURE MONITOR**

APPLICATIONS AND INFRASTRUCTURE MONITORING



#### IMPORT & EXPORT SERVICE

TRANSFERS VERY LARGE
AMOUNTS OF DATA
BETWEEN
ON-PREMISES
AND AZURE

Storage Design

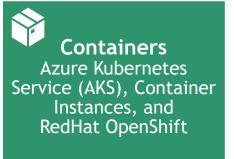
Management and Tools

- Solution Options
- □ Availability Sets & Zones
- □ Deployment Options & Strategy
- Management and Tools

# **Solution Options**















# Availability Sets & Zones

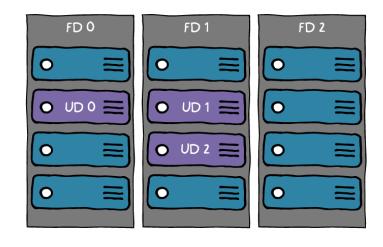
Azure provides money-backed Availability SLAs for IaaS Services\*

### Standalone VM

- Any single instance VM without Premium storage receives no SLA
- Single instance
  VM would gain
  99.9% SLA if
  deployed with
  Premium Storage
  for all Operating
  System Disks and
  Data Disks

### VM in Availability Sets

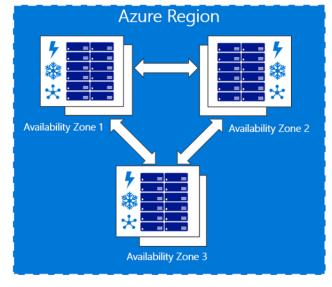
Availability Sets provide assurance that any multiple instance (≥2) VM will be available 99.95% of the time



Availability Sets
delivers High
Availability (HA)
protection from
planned and
unplanned
maintenances using
Update Domains
(UD) and Fault
Domains (FD)

### Availability Zones

Service helps to protect resources from datacenter level failures but not from a Region wide failure



### Deployment Options & Strategy

**Leading Practices and Patterns** 

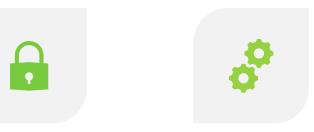
- Evaluate in the order and use Business Justification to pick compute on the Right Side for deploying compute in the Cloud: Serverless >> PaaS >> Containers >> Virtual Machines >> Bare Metal
- Open Source Operating Systems and Middleware as default choice for ease and economical deployment, portability, and scalability of compute resources.
   Consider Availability Sets for Each Application Tier for High Availability and Scalability.
- Leverage Build Automation and Templates for Consistent User Experience
- Monitor Usage and Usage Pattern to optimize deployed resources to Right Size, Schedule Stop/Start and Remove unused Compute Resources.
- Minimize the Exposure of Compute Resources for remote access. Consider Jump Servers and/or Private Network Connectivity for Accessing and Managing the Compute Resources.

- Image Options:
  - Green field Azure Native and Marketplace VMs
  - Azure Resource Manager Templates
  - Virtual Hard Disk (VHD) Images
- Deployment Tools:
  - Azure Portal
  - Power Shell and CLI
  - REST API
- Backup Options:
  - Managed Snapshots
  - Azure Site Recovery
  - Azure Backup









CONNECTING OPTIONS

RDP, SSH

AND

BASTION

USER CREDENTIALS
USERNAME & PASSWORD
AND
SSH KEY

PERFORMANCE & OPTIMIZATION
AZURE MONITORING SERVICES
AND
AZURE ADVISOR

SECURITY STRATEGY

NSG, ASG

AND

NETWORK SEGMENTATION

OS MANAGEMENT AZURE AUTOMATION

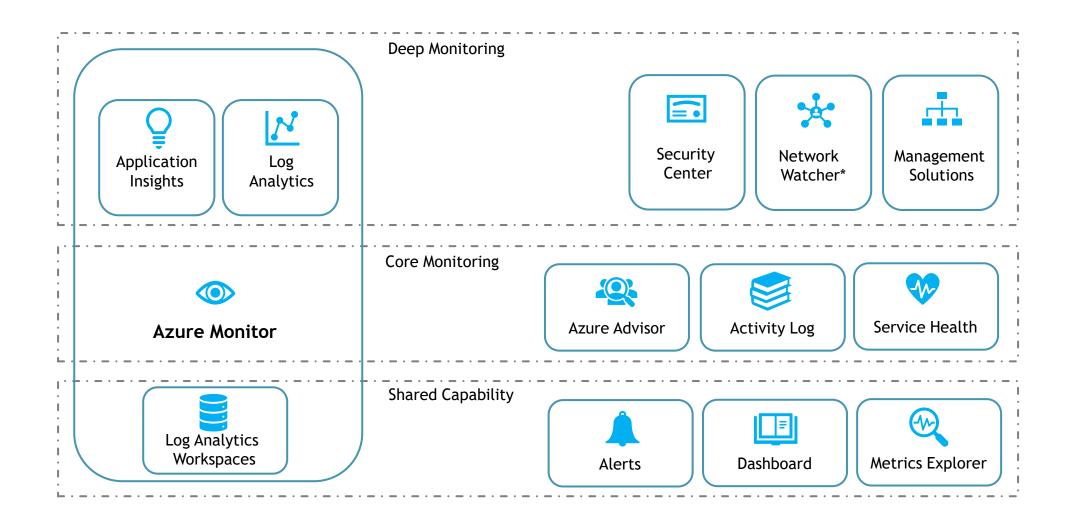
Compute Design

Management and Tools

# Monitoring Design

- Azure Solutions
- Monitoring Strategy

# Monitoring Design Azure Solutions



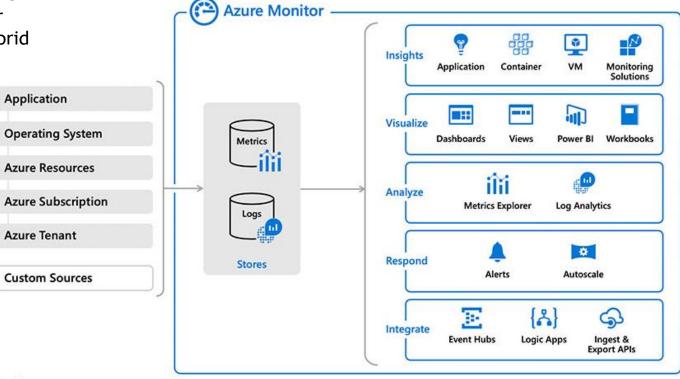
# Monitoring Design Azure Solutions

### **Azure Monitor**

Full observability into your applications, infrastructure, and network

Maximizes the availability & performance of applications and services by delivering a comprehensive solution for collecting, analyzing, and acting on telemetry from hybrid environments. The leading use cases are

- Detect and diagnose issues across applications and dependencies with Application Insights.
- Correlate infrastructure issues with Azure Monitor for VMs and Containers.
- Drill into monitoring data with Log Analytics for troubleshooting and deep diagnostics.
- Support operations at scale with smart alerts and automated actions.
- Create visualizations with Azure dashboards and workbooks.



Source: https://azure.microsoft.com/en-us/services/monitor/

# Monitoring Design Azure Solutions Deep Monitoring



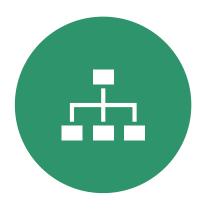
#### **SECURITY CENTER**

UNIFIED SECURITY MANAGEMENT
AND ADVANCED THREAT
PROTECTION ACROSS HYBRID
CLOUD WORKLOADS



#### NETWORK WATCHER

NETWORK MONITORING, METRICS, LOGS AND DIAGNOSTIC TOOLS

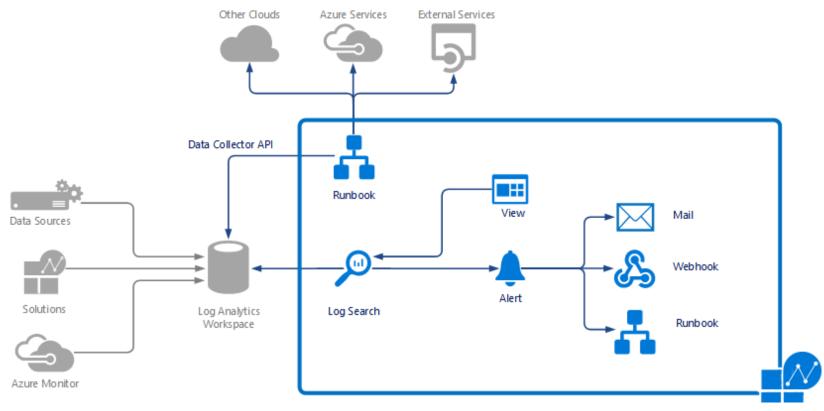


#### MANAGEMENT SOLUTIONS

MANAGEMENT SOLUTIONS CONTAIN
AZURE RESOURCES THAT WORK
TOGETHER TO ACHIEVE A
PARTICULAR MANAGEMENT
SCENARIO

# Monitoring Design Azure Solutions Management Solutions - Common Pattern

- Enables one click deployment of all the resources needed to create run time of an applications and/or services.
- The basic strategy is to start your management solution by building the individual components in your Azure environment. Once you have the functionality working properly, then you can start packaging them into a management solution file.
- Implemented as Azure Resource Manager (ARM) Templates



Source: https://docs.microsoft.com/en-us/azure/azure-monitor/insights/solutions-creating

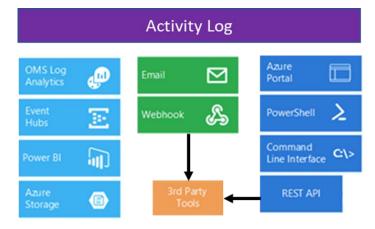
# Monitoring Design Azure Solutions Core Monitoring

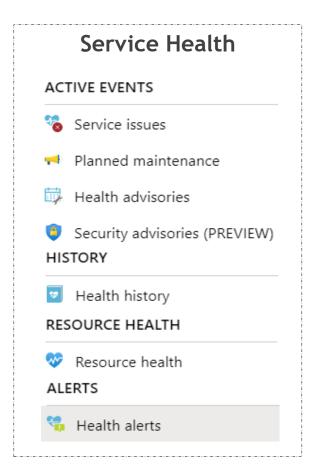
#### **Azure Advisor**

- Personalized cloud service for optimizing Azure deployments
- Analyzes resource configuration and usage telemetry.
- Recommendations
  - High Availability
  - Security
  - M Performance
  - ↑ Operational Excellence
  - Cost

### **Activity Logs**

- Azure Resource Manager operational data (control plane) includes Audit Trail of all the write and change operations and Service Health events
- Integration Options

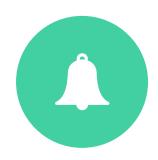




# Monitoring Design Azure Solutions Shared Capability



Log Analytics Workspaces - Enables to create central logs repository to collect logs across hybrid deployments



Alerts - Proactively notify when important conditions are found in monitoring data. They allow us to identify and address issues before the users of system notice them



Dashboards - Build custom pages using Tile Gallery Visualizing Data from multiple Azure resources across different resource groups and subscriptions



Metrics Explorer - Corelate, Aggregate, Compare and Visualize Standard and Custom Metrics

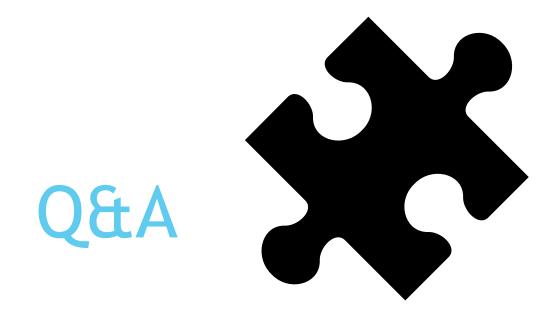
### Monitoring Design

### **Monitoring Strategy**

**Leading Practices and Patterns** 

- Monitoring strategy and solution pillars are automation, integration, self service, and API economy.
- One must consider implementing logs repository with appropriate accessibility and retention policy.
- Identify and implement Service Desk Integration.
- Usage, usage pattern and performance monitoring for deployed resources is mission critical to right size, scheduling stop/start and removing unused resources.
- Implementation of AIOps is a leading practice for efficient operations and data driven innovation.





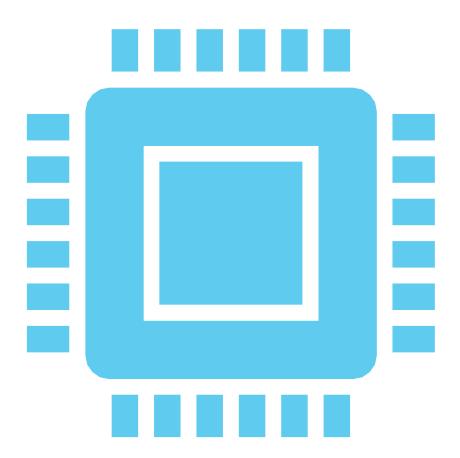
### Microsoft Azure Architect Technologies & Design Study Group

Session 3: Identity and Security Design

Jaswant Singh (Jas), Chief Enterprise Architect
NA GTS CTO Office - Cloud and Integration

# Agenda

- Q&A Follow Up
- Active Directory & Integration
- Single Sign On
- Security Design
- ◆ Q&A





- Q1: Storage Replication
- Q2: Availability Set
- Q3: VNets and SubNets
- Q4: Network Connectivity
- Q5: Load Balancer

# Q1: Storage Replication

The solution must minimize costs. What should you include in the recommendation?

You have an Azure subscription used for testing and development purposes only. The subscription contains Azure Virtual Machines that is unmanaged, Standard Hard Disk Drives (HDD). You need to recommend a Storage Replication Strategy for the Virtual Machines if an Azure region fails for a sustained period. The recovery time objective (RTO) can be up to seven days.

- ☐ A:: Store the disks in a Standard LRS storage account
- B:: Store the disks in a Standard ZRS storage account
- C:: Store the disks in a Standard GRS storage account
- □ D:: Store the disks in a Standard RA-GRS storage account
- E:: Store the disks in a Standard GZRS storage account
- ☐ F:: Store the disks in a Standard RA-GZRS storage account

# Q2: Availability Set

Which three options should you recommend?

You manage a solution in Azure that consists of a single application which runs on a virtual machine (VM). Traffic to the application has increased dramatically. The application must not experience any downtime and scaling must be dynamically defined.

You need to define an auto-scale strategy to ensure that the VM can handle the workload.

- A:: Deploy application automatic vertical scaling
- B:: Create a VM availability set
- □ C:: Create a VM scale set
- D:: Deploy application automatic horizontal scaling
- E:: Deploy a custom auto-scale implementation

### Q3: VNets and SubNets

You need to recommend an Azure Subnet Design that meets the technical requirements.

### Requirements:

- You have an on-premises network that uses on IP address space of 172.16.0.0/16. You plan to deploy 29 virtual machines to a new azure subscription. All Azure virtual machines must be placed on the same SubNet subnet1.
- All the Azure virtual machines must be able to communicate with all on- premises servers. The servers must be able to communicate between the on-premises network and Azure by using a site to site VPN.

**SubNets Options:** What should you include in the recommendation?

- A:: Subnet1 = 172.16.0.0/16 and Gateway Subnet = 172.16.1.0/28
- B:: Subnet1 = 192.168.0.0/24 and Gateway Subnet = 192.168.1.0/28
- C:: Subnet1 = 192.168.0.0/27 and Gateway Subnet = 192.168.1.0/28
- D:: Subnet1 = 10.10.0.0/16 and Gateway Subnet = 10.10.1.0/28

### Q4:: Network Connectivity

You are designing a network connectivity strategy for a new Azure subscription. For each Use Case map a network component. Each component may be used once, more than once not at all. The overall solution cost must be minimized.

**Use Case 1:** The Azure Virtual Machines on Subnet1 must be accessible only from the computers in the London Office

**Use Case 2:** Engineers require access to the Azure Virtual Machines on Subnet2 over the internet on a specific TCP/IP Management Port

**Use Case 3:** The Azure Virtual Machines in the West Europe Region must be able to communicate on all the ports to the Azure Virtual Machines in the North Europe Region

### Components:

- ☐ A:: A Network Security Group (NSG)
- □ B:: A New Virtual Network (VNet)
- C:: An Azure Express Route Connection
- D:: A Site to Site VPN
- □ E:: A VNeT Peering
- ☐ F: A VPN Gateway

### Q5:: Load Balancer

A company has an existing web application that runs on virtual machines (VMs) in Azure. You need to ensure that the application is protected from SQL injection attempts and uses a layer-7 load balancer. The solution must minimize disruption to the code for the existing web application. What should you recommend? Each value may be used once, more than once, or not at all.

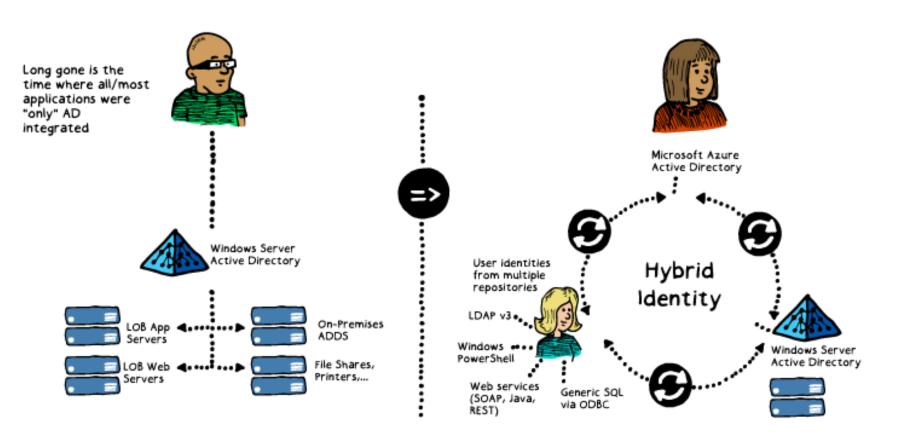
### Azure Services and/or Features:

- ☐ A:: Web Application Firewall (WAF)
- B:: Azure Application Gateway
- C:: Azure Load Balancer
- D:: Azure Traffic Manager
- □ E:: SSL Offloading
- ☐ F:: URL Based Content Routing

- Azure AD
- Azure AD Features
- Multi Factor Authentication
- Azure AD Connect
- Windows Server AD Integration

### Microsoft Azure Active Directory aka Azure AD

Universal Identity Platform



Cloud based directory services, identity governance, and application access management

**Subscription Options:** 

- ☐ Free\*
- ☐ Office 365 Apps\*\*
- ☐ Premium P1\*\*\*
- ☐ Premium P2\*\*\*\*

Deployment Options:

- ☐ Single Tenant
- Multi Tenant

### Azure AD Features

- Directory Objects\*
- Seamless Single Sign-On (SSO)\*
- User Provisioning
- Federated (ADFS or 3rd party IDP)
- User & Group Management
- Device Registration, Writeback\*\*
- Cloud Authentication
- Azure AD Connect Sync
- Self-Service Password Change,
   Reset\*\*, unlock with writeback\*\*\*
- Password Protection Global, Custom\*\*\*, Windows AD\*\*\*
- Multi-Factor Authentication
- Basic Security & Usage Reports

- Advanced Security & Usage Reports\*\*\*
- Azure AD Join: Desktop SSO, admin bitlocker recovery, Self service bitlocker recovery\*\*\*, MDM auto enrollment\*\*\*, local admin policy customization\*\*\*, enterprise state roaming\*\*\*
- Azure AD B2B\*\*
- Azure AD B2C\*
- Company Branding\*\*
- □ SLA\*\*
- Group Access Management\*\*\*
- Microsoft Cloud App Discovery\*\*\*
- Connect Health\*\*\*

- Application Proxy (Service & Connector)\*\*\*
- Microsoft Identity Manager User CAL\*\*\*
- Advanced Group Access Management\*\*\*
- Conditional Access\*\*\*
- Identity Protection (Risk based Conditional Access Policies, Risk Event Investigation, Vulnerability and Risky Accounts Detection)\*\*\*\*
- Identity Governance (Privileged Identity Management(PIM), Access Reviews, EM)\*\*\*\*
- Azure AD DS

### **Azure AD Features**

### Multi Factor Authentication aka MFA

Enforces two or more factors when authenticating users

Possession Inherence Badge **Fingerprint** Mobile Device Face, Voice, Iris Security Token Knowledge Password, PIN **Security Question** 

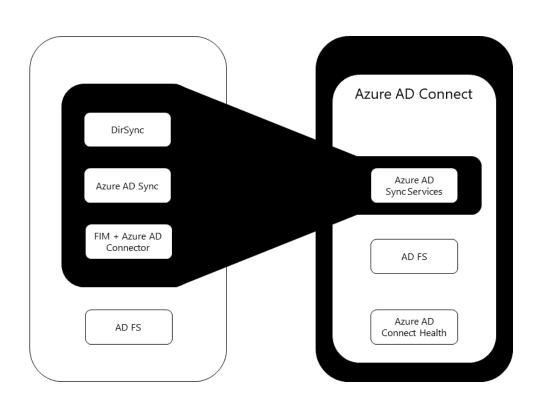
### MFA Triggers:

- Supports exceptions such as sign-ins from a trusted IP addresses or using the remembered devices feature.
- Risk based conditional access with Azure AD Identity Protection
- Authentication Methods:
  - Call to phone or Text message to phone
  - Verification code from mobile app (Microsoft Authenticator)
  - Notification through mobile app
- Azure AD MFA SDK: Allows building MFA into any transaction not just sign-in. Supports C#, Visual Basic (.NET), Java, Perl, PHP, and Ruby

## Active Directory and Integration

## **Azure AD Connect**

Integrates AD DS with Azure AD to deliver Hybrid Identity



- Sync Services: Synchronize AD DS objects, such as users & groups
- Provides Centralized Health Monitoring
- Simplifies Federation configuration of AD FS and Automatic Upgrades
- Filtering of synchronization scope
- Password hash synchronization
- Protection against accidental deletes
- Password and Device writeback

## Active Directory and Integration Windows Server AD Integration

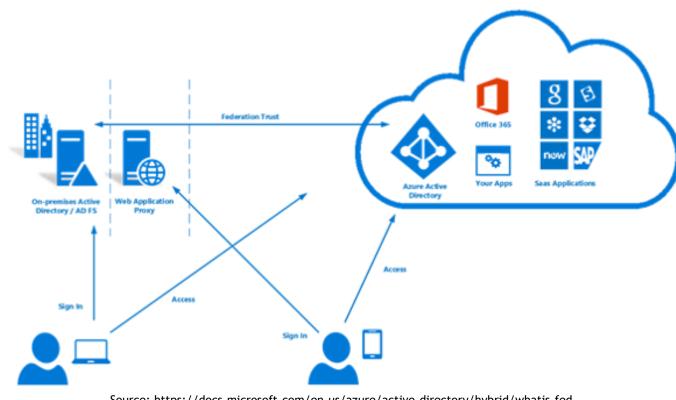
## Azure AD Connect - Federation AD FS

Federation is a collection of domains that have established trust.

The level of trust may vary, but typically includes authentication and almost always includes authorization.

A typical federation might include a number of organizations that have established trust for shared access to a set of resources.

All user authentication occurs onpremises.



Source: https://docs.microsoft.com/en-us/azure/active-directory/hybrid/whatis-fed

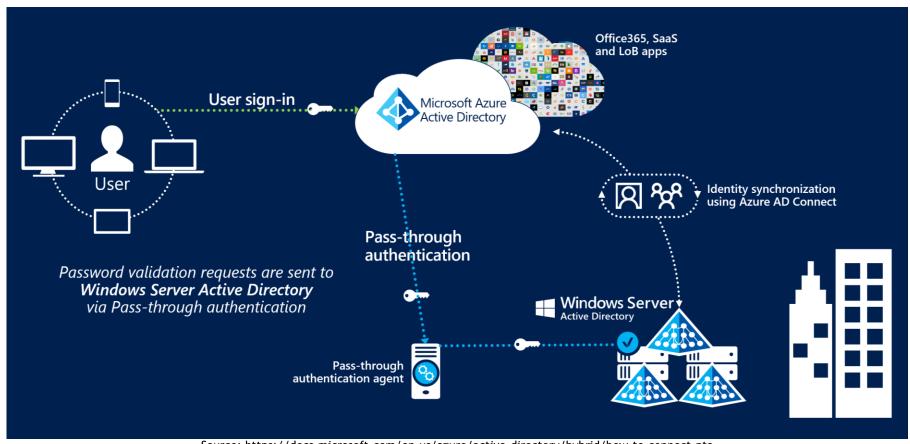
# Active Directory and Integration Windows Server AD Integration

# Azure AD Connect - Pass-through Authentication

Users use the same passwords to sign into both on-premises and Cloud-based applications.

Users can complete self-service password management tasks in the Cloud.

Passwords are validated against on-premises Active Directory.



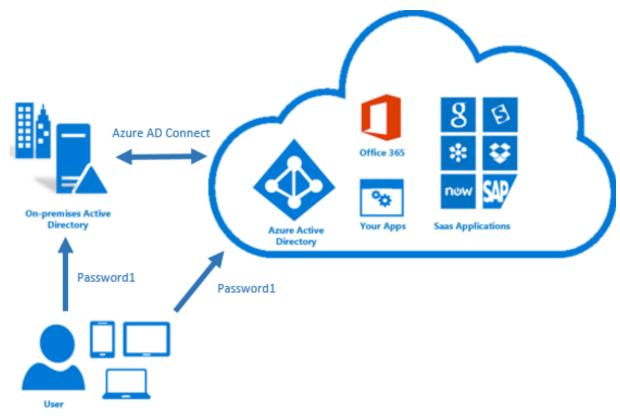
Source: https://docs.microsoft.com/en-us/azure/active-directory/hybrid/how-to-connect-pta

# Active Directory and Integration Windows Server AD Integration

# Azure AD Connect - Password Hash Synchronization

Azure AD Connect synchronizes a hash, of the hash, of a users' password from an onpremises Active Directory instance to a cloud-based Azure AD instance.

User authentication occurs at both on-premises and Azure AD using same password.



Source: https://docs.microsoft.com/en-us/azure/active-directory/hybrid/whatis-phs

# Single Sign On

- □ SSO Methods
- Decision Guide
- Linux & SaaS Applications

# Single Sign On SSO Methods

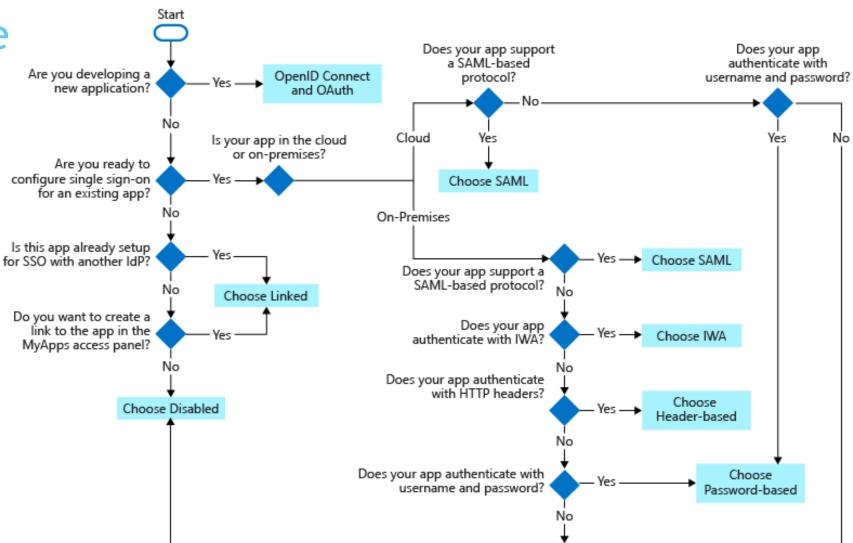
SSO Method	Applications	Use Cases
OpenID Connect & OAuth	Cloud	New Application Development - Easy to Use SDK and MS Graph
Security Assertion Markup Language (SAML)	Cloud & On-Prem	Existing Applications that do not use OpenID Connect & OAuth
Password Based	Cloud & On-Prem	Password-based single sign-on enables secure application password storage and replay using a web browser extension or mobile app
Linked	Cloud & On-Prem	Choose linked sign-on when the application is configured for single sign-on in another identity provider service such as ADFS
Disabled	Cloud & On-Prem	Application is not ready for SSO. Users must use credentials to login every time they launch the application.
Integrated Windows Authentication (IWA)	On-Prem Only	SSO for Applications that uses IWA for authentication. The Application Proxy connector uses Kerberos Constraints Delegation to authenticate users.
Header-based	On-Prem Only	Applications that uses header for Authentication.

 $Suggested\ Reading:\ https://docs.microsoft.com/en-us/azure/active-directory/manage-apps/what-is-single-sign-on-like the properties of t$ 

#### Single Sign On

## **Decision Guide**

- Cloud applications can use OpenID Connect, OAuth, SAML, passwordbased, linked, or disabled methods for single sign-on.
- On-premises
  applications can use
  password-based,
  Integrated Windows
  Authentication, headerbased, linked, or
  disabled methods for
  single sign-on. The onpremises choices work
  when applications are
  configured for
  Application Proxy.



Source: https://docs.microsoft.com/en-us/azure/active-directory/manage-apps/what-is-single-sign-on

Single Sign On

Linux & SaaS Applications

- Azure AD login VM extension\*
- Azure AD supports
   more than 2,800
   pre-integrated
   Software as a Service (SaaS)
   applications



Source: https://azure.microsoft.com/en-us/services/active-directory/

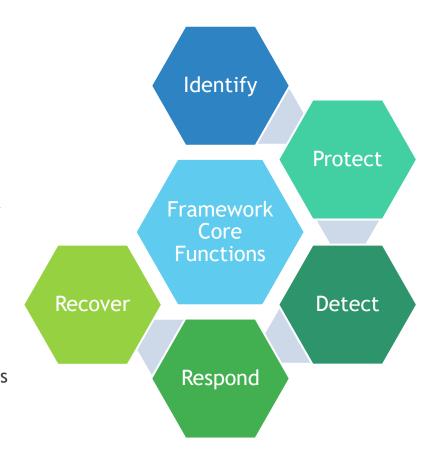
# Security Design

- Cyber Security Framework
- ☐ HSM and Key Vault
- Security Center
- Azure Information Protection
- Azure Sentinel

# Security Design Cyber Security Framework

National Institute of Science and Technology (NIST)

- Core: Cyber Security Activities, Desired Outcomes and Applicable References
  - Provides Industry Standards, guidelines and practices for effective communications among stake holders and industry regulators.
  - ☐ The Framework Core Functions then identifies underlying key Categories & Subcategories which are discrete outcomes for each Function.
- Tiers: Organization Views of Cyber Security Risk and Processes to manage that risk
  - □ From Partial Tier1, Risk & Threat Aware Tier2, Repeatable Tier3 to Adaptive Tier4.
  - ☐ Tier selection is driven by current risk management practices, threat environment, legal and regulatory requirements, business & mission objectives, and organizational constraints.
- Profiles: Organization implementation of core functions categories & subcategories
  - Used to identify opportunities for improving cybersecurity posture by comparing a Current Profile with a Target Profile.



# Security Design HSM and Key Vault



- Centrally Manage Keys, Secrets, and Policies
- Automatically Renew Digital Certificates with supported Public Certificate Authorities (CAs)
- Audit & Monitor Key Usage with Azure Logs and Security Information & Event Management (SIEM) Solutions

#### Azure Key Vault

- Multi Tenant SaaS
- Green field Cloud Deployments
- FIPS 140-2 Level 2 Validated
- Integrations
  - Seamlessly works with Azure Storage Service Encryption (SSE)
  - User deployed cloud applications

#### **Azure Dedicated HSM\***

- Dedicated Hardware Appliance
- Migrate on-prem HSM Solutions
- FIPS 140-2 Level 3 Validated
- Integrations
  - Doesn't integrate with Azure SSE
  - User deployed on prem and cloud applications

#### POLICY & COMPLIANCE

- 1 Coverage
- Secure Score
- Security policy
- Regulatory compliance

#### RESOURCE SECURITY HYGIENE

- Recommendations
- Compute & apps
- Networking
- loT Hubs & resources
- ata & storage
- ldentity & access
- Security solutions

#### ADVANCED CLOUD DEFENSE

- Adaptive application controls
- Just in time VM access
- 🚺 Adaptive network hardening
- File Integrity Monitoring

#### THREAT PROTECTION

Security alerts



# Security Design Security Center

Unified Security Management System

- Top Security Challenges Addressed
  - Rapidly Changing Workloads
  - Increasingly Sophisticated Attached
  - Security Skills
- Provides Tools For
  - Strengthen Security Posture
  - Protect Against Threats
  - Get Secure at Cloud Speed

# Security Design Information Security Protection

Secure email, documents, and sensitive data - anywhere, anytime







# Security Design Azure Sentinel



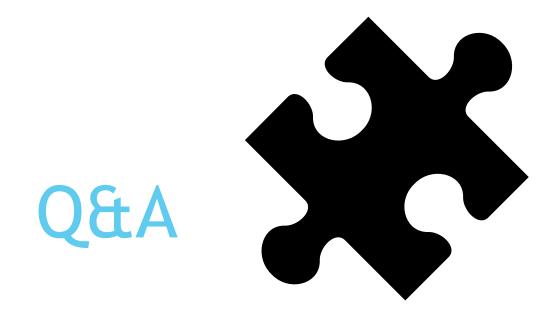






- One Solution
  - Security Information Event Management (SIEM)
  - Security Orchestration Automated Response (SOAR)
- **Hybrid Deployments** Capability
- **Integration Options** 
  - Azure Service to Service
  - External Solutions via Agent and API

Source: https://docs.microsoft.com/en-us/azure/sentinel/overview

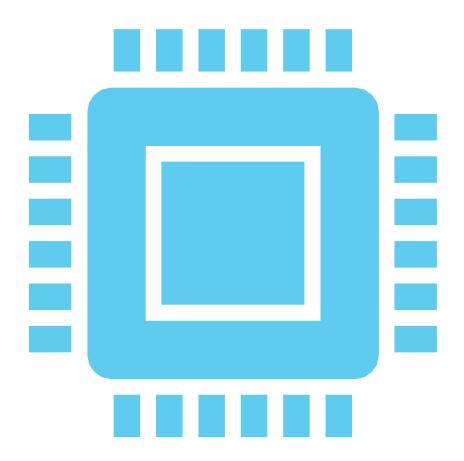


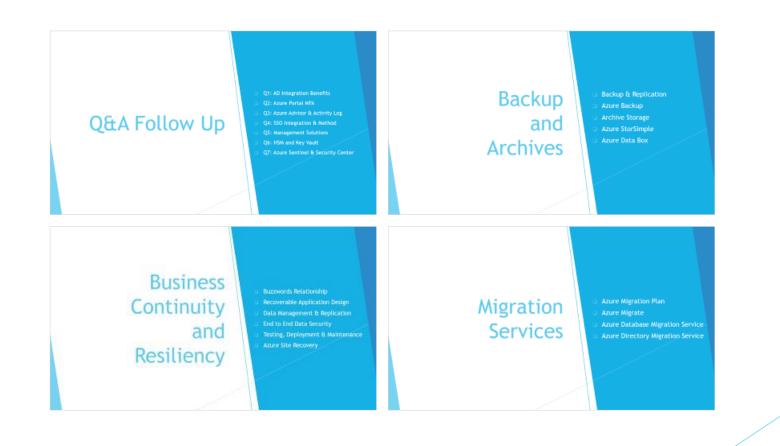
# Architect Technologies & Design Study Group Session 4: Migration and Resiliency

Jaswant Singh (Jas), Chief Enterprise Architect
NA GTS CTO Office - Cloud and Integration

# Agenda

- Q&A Follow Up
- Backup & Archives
- Business Continuity & Resiliency
- Migration Services
- ◆ Q&A





- □ Q1: AD Integration Benefits
- Q2: Azure Portal MFA
- □ Q3: Azure Advisor & Activity Log
- Q4: SSO Integration & Method
- Q5: Management Solutions
- □ Q6: HSM and Key Vault
- □ Q7: Azure Sentinel & Security Center

# Q1: AD Integration Benefits

You have an on-premises Active Directory forest and an Azure Active Directory (Azure AD) tenant. All Azure AD users are assigned a Premium P1 Subscription License. You deploy Azure AD Connect. Which two features are available in this environment that can reduce operational overhead for your company's help desk?

- □ A:: Azure AD Privileged Identity Management Policies
- B:: Access reviews
- □ C:: Self-service password reset
- D:: Microsoft Cloud App Security Conditional Access App Control
- □ E:: Password writeback

## Q2: Azure Portal MFA

You set the multi-factor authentication status for a user named admin1@contoso.com to Enabled. Admin1 accesses the Azure portal by using a web browser. Which additional security verifications can Admin1 use when accessing the Azure portal?

- A:: an app password, a text message that contains a verification code, and a verification code sent from the Microsoft Authenticator app
- B:: a phone call, a text message that contains a verification code, and a notification or a verification code sent from the Microsoft Authenticator app
- C:: a phone call, an email message that contains a verification code, and a text message that contains an app password
- □ D:: an app password, a text message that contains a verification code, and a notification sent from the Microsoft Authenticator app

# Q3: Azure Advisor & Activity Log

**Identify True Statements** 

Select all the True Statement(s) from the following:

- □ A:: Azure Users needs to Configure Azure Advisor and Activity Log
- B:: Activity Log can be Used for Audit Trail for an Azure Subscription to Identify When and Who Deployed Azure Resources.
- C:: Azure Advisor can Analyze User provided Resource Usage Telemetry Logs
- □ D:: Users can Send Activity Log to User Provided Log Repository
- E:: Azure Advisor provides Personalized Recommendations for Cost Optimization

# Q4: SSO Integration and Method

**Identify False Statements** 

Select all the False Statement(s) from the following:

- □ A:: Windows AD Password Hash Synchronization Method sends the same Password Hash to Azure AD
- B:: Federation AD FS Integration to Azure AD Users Authentication occurs at the On Prem Windows AD Severs
- C:: Azure AD Passthrough Authentication users can Authenticate at Azure AD and On Prem Windows AD Servers
- D:: SAML is a leading authentication and authorization SSO method that should be our default choice for developing new application
- E:: The Application Proxy connector uses Kerberos Constraints Delegation to authenticate users in Integrated Windows Authentication (IWA)

## Q5: Management Solutions

**Identify True Statements** 

#### Select all that is True for Management Solutions:

- A:: Management Solutions contain Azure Resources that work together to achieve a Particular Management Scenario
- B:: Manually deployed solution can't be used as one click deployment via Management Solutions
- C:: One could earn money to offer management solutions at the Azure Market Place as one click deployment services
- □ D:: Management solutions are independent of the Azure of Resource Manager

# Q6: HSM and Key Vault

**Identify False Statements** 

Select all the False Statement(s) from the following:

- □ A:: Azure Key Vault is FIPS 140-2 Level 3 Validated Solution
- B:: Azure Key Vault is a required for Azure Storage Service Encryption (SSE)
- □ C:: Azure HSM Solutions Dedicated HSM and Key Vault Automatically Renew Digital Certificated with leading public Certificate Authorities.
- D:: Dedicated HSM is a software appliance to centrally manage Keys, Secrets and Policies
- □ E:: Azure Key Vault doesn't support User Created and Managed Keys

# Q7: Azure Sentinel & Security Center

**Identify True Statements** 

Select all the True Statement(s) from the following:

- A:: Organization Security Strategy and Solution either needs Azure Sentinel or Security Center not both.
- B:: Security Center Provides Tools for Strengthen Security Posture,
   Protect Against Threats and Get Secure at Cloud Speed
- C:: Organizations can monitor and work on the Security of their Identities, Data, Apps, Devices, and Infrastructure using Security Center
- D:: Azure Sentinel is a Security Information and Event Management (SIEM) Solution Only
- E:: One can implement Just in Time VM Access using Azure Sentinel

- □ Backup & Replication
- Azure Backup
- Archive Storage
- Azure StorSimple
- Azure Data Box

# Backup & Replication

Backup is distinct from data replication

#### **Backup Use Cases**

- Ransomware Protection
- Audit and Compliance
- Recovery from Accidental Deletes

#### Replication Use Cases

- Copying data near real time to another system over wire synchronously or asynchronously
- Enables shorter RTOs in a disaster scenarios and remote site backups



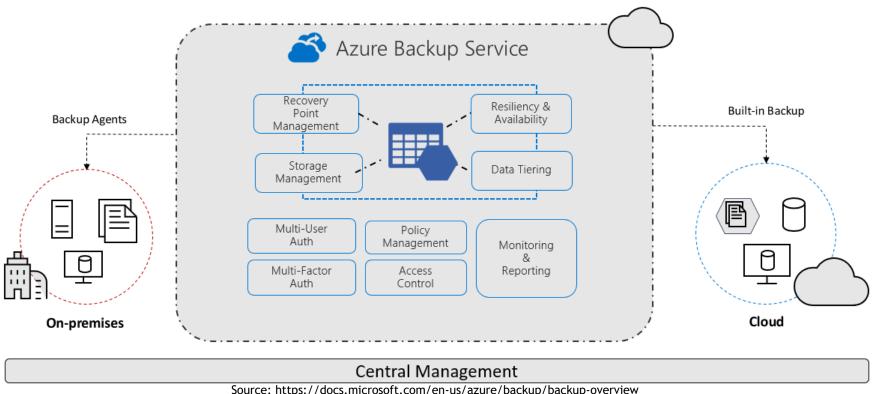
Data replication should not be considered as a substitute to backups

Recovery Services Vault is a storage entity in Azure that houses data. The data is typically copies of data or configuration information for workloads. Azure Site Recovery and Azure Backup both houses data in Recovery Services Vault.

## Azure Backup

Azure VMs, Azure Stack and On-Premises Servers Backup Solution

- Backup Sources Available: On-Premises, Azure Stack and Microsoft Azure
- Azure Backup uses Block Blob Storage. Users can pick from LRS, GRS and RA-GRS\*.
- Backup Size are Calculated before compression and encryption
- Backup TCO = Backup Fee by Type and Size + Storage Cost + Network Charges\*



Source: https://docs.microsoft.com/en-us/azure/backup/backup-overview

# **Archive Storage**

Rarely accessed data storage solution

#### Benefits:

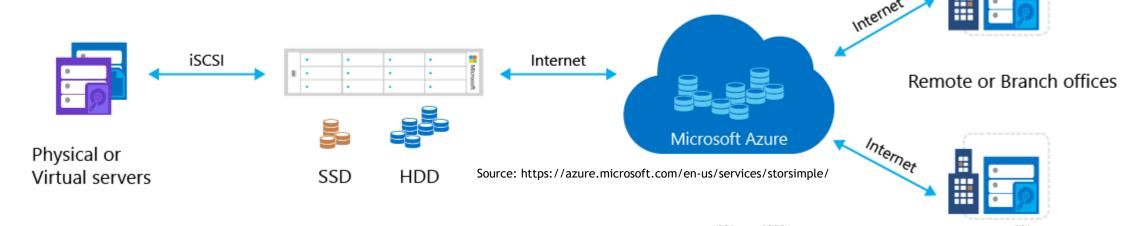
- Low cost High Value Azure Archive Storage offers low-cost, durable, and highly available secure cloud storage for rarely accessed data with flexible latency requirements
- Secure from Start Encrypt Data at Rest using 256-bit AES keys
- Easier management and blob-level tiering - Hot, Cool and Archive. Manage from Azure Portal, REST API and/or SDK driven application.

#### Use Cases:

- Long term Backup Retention
- Business Policy Mandated Data Archiving
- Healthcare Data Archiving
- Magnetic Tape Replacement
- Digital Media Content Retention
- Security Public Safety Data Retention

## **Azure StorSimple**

Enterprise Hybrid Cloud Storage - One Solution to Primary Storage, Backup, Archives, Integrated Data Protection and Location Independent Disaster Recovery when paired with Azure



#### Features and Benefits:

- Consolidate Storage Infrastructure
- Automate Data Management
- Accelerate Disaster Recovery, Improve Compliance
- Enhance IT Agility, Drive your business

#### Deployment Options:

- StorSimple 8000 Series SSDs, HDDs with Cloud Storage
- StorSimple Cloud Appliance 8010/8020 Software Version available in Azure
- StorSimple Virtual Array NAS(using SMB)& SAN (using iSCSI) Device

## Azure Data Box

Up to Peta Byte (PB) Scale Storage devices that enable offline or over the network data transfer to Azure

1. Order

2. Receive

3. Copy Data

4. Return

5. Upload

0

Data Box Disk - Transfer up to 40 TB Data to Azure using 1-5 SSD disks with no to limited network Use Cases: One Time Migration, Initial Bulk Transfer, and Periodic Uploads



Data Box - Transfer 40-80 TB Data to Azure with no to limited network Use Cases: One Time Migration, Initial Bulk Transfer, and Periodic Uploads



Data Box Heavy - PB Scale Rugged Device to Send Data to Azure in a quick, inexpensive, and reliable way Use Cases: One Time Migration, Initial Bulk Transfer, and Periodic Uploads

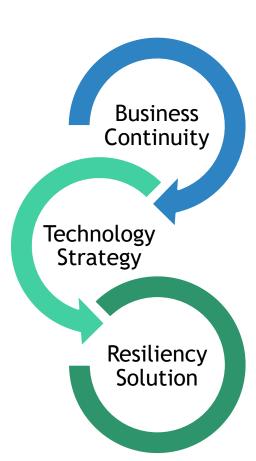


Data Box Gateway - Virtual Appliance to Send Data over Wire to Azure Block and Files Use Cases: Cloud Archival, Continuous Data Integration, and Initial Bulk Transfer with Incremental Data Transfer

# Business Continuity and Resiliency

- Buzzwords Relationship
- Recoverable Application Design
- □ Data Management & Replication
- End to End Data Security
- □ Testing, Deployment & Maintenance
- Azure Site Recovery

# Business Continuity and Resiliency Buzzwords Relationship

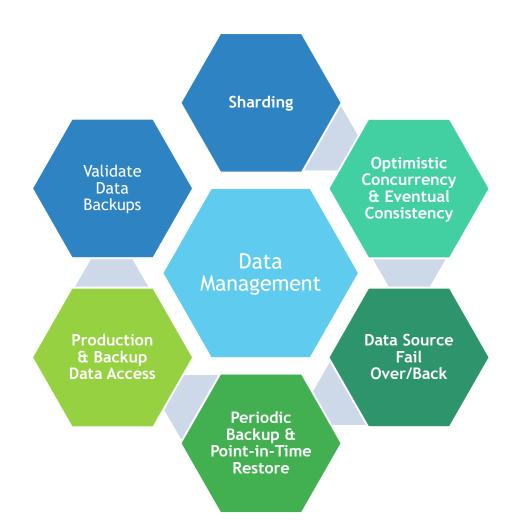


Business Continuity: Ability to perform essential business functions during and after adverse conditions such as a natural disaster or a failure of a service.

Technical Strategy: Ensures that internal and external applications workloads, and services are operational during planned downtime and unplanned outages to support Business Continuity.

Resiliency Solution aka Disaster Recovery Solution: Focuses on recovery from a failure, rather avoiding failures. Solution must respond to failures in a way that delivers applications to functioning state following a failure that meets the Recovery Time Objective (RTO) & Recovery Point Objective (RPO).

# Business Continuity and Resiliency Data Management



## Data Replication:



- Geo-replicate databases: Azure SQL Database and Azure Cosmos DB supports geo-replication. Azure SQL Database auto failover group facilitates automatic failover.
- ☐ Geo-replicate data in Azure Storage: For HA use RA-GRS or RA-GZRS that replicates your data to secondary region.
- VMs: Use Azure Backup and Consider using managed disks for HA needs that avoids single point of failure for VMs deployed in Availability Set.

# Business Continuity and Resiliency End-to-End Data Security

- Encryption at Rest: Encryption of data when it is persisted that protects against physical access to hardware on which data is stored.
  - Transparent Data Encryption: Encryption at rest for data and log files SQL Server, Azure SQL Database and Azure SQL Data Warehouse. Implemented using Database Encryption Key (DEK) that does real time I/O encryption and decryption.
  - Encrypted Database Platform: Always Encrypted available for Azure SQL Database and SQL Server that provides additional security that provides separation between who can mange data (but should have no access) and who own the data (can view the data).
- Trusted Execution Environment: Azure Confidential Computing ensures that there is no way to view data or operations from the outside, even with a debugger, ensures that only authorized code is permitted access, and automatically disables the environment if it detects signs of tampering.
- Encryption at Wire: Transport Layer Security (TLS) aka Secure Socket Layers (SSL) provides communications security over a computer network.

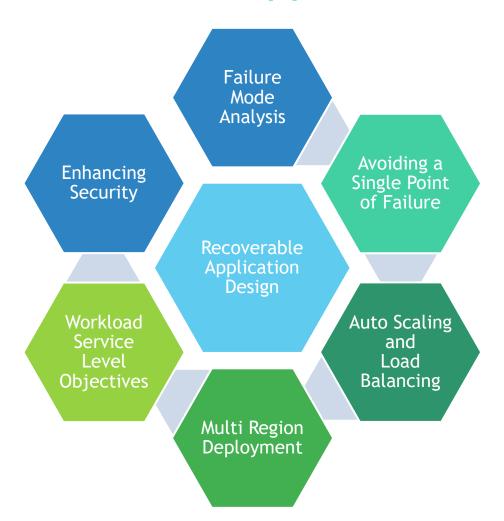
**Encryption:** Process of translating plain text into ciphertext. Uses an encryption algorithm and one or two keys:

One key is used for encryption and decryption. Use Cases: Encryption of large amounts of data



Asymmetric Encryption:
 Different key for encryption (public) and decryption (private).
 Use Cases: Encryption of small amounts of data and symmetric key

### Business Continuity and Resiliency Recoverable Application Design



### **Additional Tips:**

- Use a message broker that implements high availability for critical transactions
- Design applications to gracefully degrade and apply compensating transactions
- Throttle high-volume users and Use load leveling to smooth spikes in traffic
- Implement Retry and Circuit Resiliency Patterns for remote operations for dealing with transient failures
- Implement asynchronous operations whenever possible and Monitor thirdparty services



### **Business Continuity and Resiliency**

### Testing, Deployment & Maintenance

### Infrastructure as Code and Immutable Infrastructure

- Infrastructure as code is the practice of using code to provision and configure infrastructure
  - Resource ManagerTemplates -Declarative Approach
  - Power Shell Scripts -Imperative Approach
- Immutable infrastructure is the principle that you shouldn't modify infrastructure after it's deployed to production



### Deployment and Maintenance Tasks

- Automate and test deployment and management tasks
  - Automate Provisioning of Azure Resources using ARM Templates
  - Use Desired State Configuration (DSC) to configure VMs
  - Automate deployment process of application code
- App Service Deployments Store Configuration as App Settings
- ☐ Give Resources Meaningful Names
- Organize resource groups by region, function and lifecycle
- Plan for and Test Disaster Recovery, and Operational Readiness, and Data Consistency Checks.

Design Release Processes to Maximize Application Availability by Utilizing Green Blue Deployment or Canary Releases.

- Green Blue Deployment is a technique where update is deployed into a production environment separate from live application
- Canary Releases are like Green Blue Deployment where small set of users are routed to new deployment

### Business Continuity and Resiliency

### Azure Site Recovery (ASR)

Manage Replication, and Failover & Failback Anywhere from Azure Portal

Hyper-V

Configure Configure Disaster Recovery Configure Failback

#### **Replication Options:**

- Azure VMs from one Azure region to another.
- On-premises VMware VMs, Hyper-V VMs, physical servers (Windows and Linux), Azure Stack VMs to Azure.
- AWS Windows instances to Azure.
- On-premises VMware VMs, Hyper-V VMs managed by System Center VMM, and Physical Servers to a Secondary Site.

## Azure Site Recovery Linux VMWare Windows

#### Features & Benefits

- Eliminating the need for Disaster Recovery Sites and Reducing Infrastructure Costs
- Automatically Replicating to Azure, and Extending Capacity at Cloud Speed
- Safeguarding against
   Workloads Outages and
   Continuous Health
   Monitoring

 $Suggested\ Reading:\ https://docs.microsoft.com/en-us/azure/site-recovery/site-recovery-overview$ 

# Migration Services

- Azure Migration Plan
- Azure Migrate
- Azure Database Migration Service
- Azure Directory Migration Service

### Migration Services Migration Plan

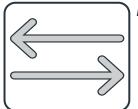
Migration Goals and Migration Phases





### Discover

- Discover current state of the Workloads and Assess the Optimal Resource Configurations for Azure
- Azure Migrate, Database Migration Assistant



### Migrate

- Move Selected Workload to Azure using Azure Migrate Tools
- Azure Migrate: Server Migration, Database Migration, and Azure Database Migration Service, and Data Box



### Optimize

- Tune Azure-based Workloads & Maximize ROI
- Azure Monitor, Azure Advisor, and Cost Management

### Migration Services **Azure Migrate**

Simplify your migration journey - Hub to discover, assess, and migrate workloads

### Migration goals Servers Databases VDI Web Apps Data Box Manage Discovered items. Support + troubleshooting New support request

Discover, assess, and migrate on-premises applications, infrastructure, and data. Centrally plan & track the migration across multiple Microsoft and independent software vendor (ISV) tools.

- Support for key migration scenarios across Servers, Data,
   Databases, Web Applications, and Virtual Desktops
- Seamless and integrated experience throughout discovery, assessment, and migration
- Diverse migration features powered by free Azure tools and enhanced by integrated ISV partners
- Centralized migration repository delivering end-to-end visibility and tracking

### **Migration Services**

### Azure Database Migration Service

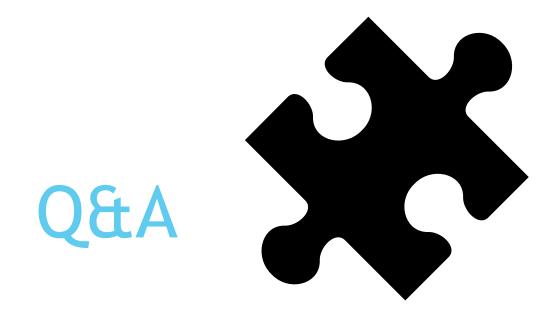
Managed Service for Seamless Migrations from Multiple Database Sources to Azure Database Platform

Target	Offline	Online	Source
Azure SQL DB	Yes	Yes	SQL Server
		Yes	RDS SQL
Azure SQL DB MI	Yes	Yes	SQL Server
		Yes	RDS SQL
		Yes	Oracle
Azure SQL VM	Yes		SQL Server
Azure Cosmo DB	Yes	Yes	Mongo DB
Azure DB for MySQL		Yes	MySQL
		Yes	RDS MySQL
Azure DB for PostreSQL		Yes	PostgreSQL
		Yes	RDS PostgreSQL
		Yes	Oracle

Source: https://docs.microsoft.com/en-us/azure/dms/resource-scenario-status

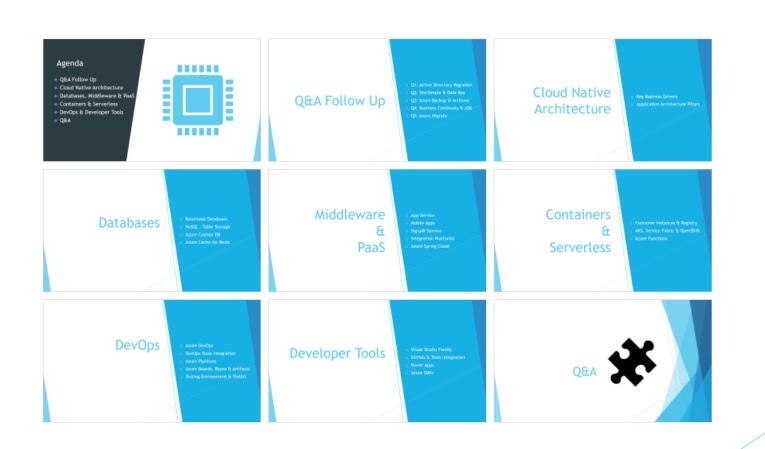
### Pre-requisite:

- Site-to-Site connectivity to your on-premises source servers
- Configure Network Security
   Group rules to allow traffic on ports 443, 53, 9354, 445,
   12000 for Azure Database
   Migration Service
- Source Database Access



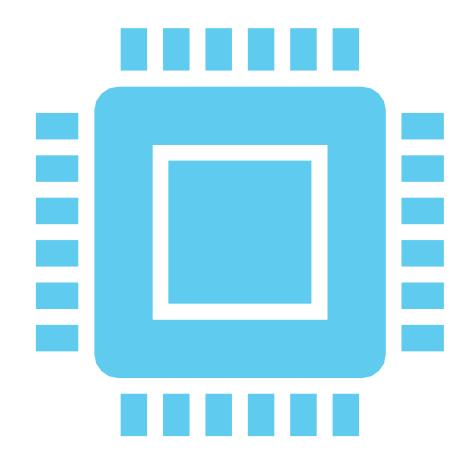
# Microsoft Azure Architect Technologies & Design Study Group Session 5: Cloud Native Design I

Jaswant Singh (Jas), Chief Enterprise Architect
NA GTS CTO Office - Cloud and Integration



### Agenda

- Q&A Follow Up
- Cloud Native Architecture
- Databases, Middleware & PaaS
- Containers & Serverless
- DevOps & Developer Tools
- **♦** Q&A



- □ Q1: Active Directory Migration
- □ Q2: StorSimple & Data Box
- Q3: Azure Backup & Archives
- Q4: Business Continuity & ASR
- □ Q5: Azure Migrate

### Q1: Active Directory Migration

What should you include in the solution?

A company named ABC Ltd., has a single-domain Active Directory forest named abc.com. ABC is preparing to migrate all workloads to Azure. ABC wants users to use single sign-on (SSO) when they access cloud-based services that integrate with Azure AD.

You need to identify any objects in Active Directory that will fail to synchronize to Azure AD due to formatting issues. The solution must minimize costs.

A:: Azure Advisor

□ B:: Microsoft Office 365 IdFix

C:: Azure AD Connect Health

□ D:: Azure Database Migration Service (ADMS)

□ E:: Azure Site Recovery (ASR)

### Q2: StorSimple & Data Box

**Identify True Statements** 

- A:: StorSimple can deliver a storage solution that can serve on-premise storage needs, remote offices running Hyper-V / VMWare and Azure deployments.
- B:: StorSimple is a one solution that can deliver SAN, NAS and Cloud Object Storage from the physical appliance only.
- C:: Azure Data Box is a simple 5 step process of Order, Receive, Copy Data, Return, and Upload.
- □ D:: Azure Data Box is an offline only method to send data to Azure.
- □ E:: The maximum data upload to Azure can be at 80 TB per day.
- ☐ F:: The PB Scale Data Box can upload up to a Peta Bytes Data to Azure.

### Q3: Azure Backup & Archives

**Identify True Statements** 

- A:: Azure Backup service is a hybrid backup solution that can provides backups to Azure, Azure Stack and On-Premise environments.
- B:: Users can move data from Azure Backups to Azure Archives using Azure Portal, Azure REST APIs and Azure Backup SDK applications one way only.
- C:: Azure Backup needs a Recovery Services Vault that can not be shared with Azure Site Recovery.
- D:: The Leading Use Case for Azure Archives is Long Term Backup Retention for Regulatory Compliance.
- E:: One can perform Azure Backups upload to Azure without Data Replication over the wire.
- ☐ F:: Azure Backup is an Agent Based Backup Service.

### Q4: Business Continuity & ASR

**Identify True Statements** 

- A:: Business Continuity can not be achieved without the digital services available after a disaster scenario.
- B:: Business Continuity provides Applications and Services list with associated RPOs and RTOs to be protected by the Resiliency Solution.
- □ C:: Azure Site Recovery can used for a Lift-n-Shift Migration Project.
- D:: Azure Site Recovery can protect applications and systems running in Azure only.
- E:: Azure Site Recovery provides a VM based Site Recovery and one can not failover by an application.

### Q5: Azure Migrate

**Identify True Statements** 

- A:: Azure Migrate simplifies your migration journey by serving as hub to discover, assess, and migrate workloads to Azure.
- □ B:: Azure Migrate Migration Phases are Discover, Migrate and Optimize.
- C:: Azure Migrate only supports Microsoft Tools for assets discovery and migration.
- □ D:: Azure Migrate is a required service to perform Lift-n-Shift Migrations to Azure.
- E:: Azure Database Migration Service can migrate your oracle databases to oracle databases running in Azure.

# Cloud Native Architecture

- Key Business Drivers
- Application Architecture Pillars

### **Cloud Native Architecture**

### **Key Business Drivers**

Source and Suggested Read: http://techblog.baghel.com/index.php?itemid=158

The Cloud Native Application Architecture is the leading mainstream application architecture to stay relevant for 2020 & beyond. The key business drivers for Cloud Native Application Architecture are:



Speed of Deployability of Everchanging Users Needs and Industry Innovation



Economical Application Experimentation and Operations & Maintenance



Ability to Utilize Best of Breed Technology, Platform and Framework and Adopt Next One Leading in Industry

### **Cloud Native Architecture**

### **Application Architecture Pillars**

Source and Suggested Read: http://techblog.baghel.com/index.php?itemid=158



- Micro Services Each service maintains its own independent software release cycle and run time environment for end to end autonomy. The end to end Autonomy is the key to receive true benefits of the Micro Services and may require Enterprise Architecture changes not just implementing an application utilizing fine grain services.
- DevOps and Continuous Integration & Continuous Delivery (CI/CD) DevOps is all about bringing end to end software release cycle under single leadership at the first line manager and automation to deliver the software to end users at cloud speed. It is a leading practice to create CI/CD pipeline for each micro service of an application to provide Micro Services Autonomy.
- **Everything as Code** In other words, plug-in automation everywhere just not for software release. Mutable deployments are critical for an efficient cloud native application architecture. Package everything as a code in one Package.

### Databases

- Relational Databases
- NoSQL Table Storage
- Azure Cosmos DB
- Azure Cache for Redis

### Patabases Relational Databases - SQL



Azure SQL Database

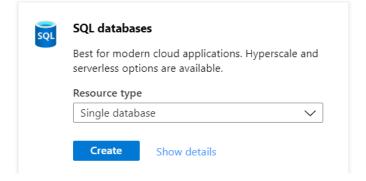


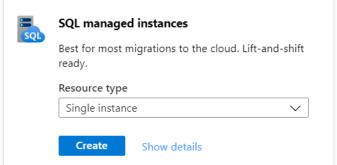
SQL Managed Instance

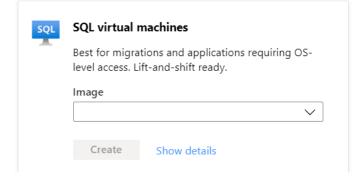


SQL Virtual Machines

#### How do you plan to use the service?







### **Databases**

### Relational Databases - Open Source



Azure Database for MariaDB

Provides Managed
Open Source
MariaDB
Server Engine



Azure Database for MySQL

Provides Managed
Enterprise Ready
MySQL
Powered by
MySQL Community Edition



Azure Database for PostgreSQL

Provides Managed
PostgreSQL
with
High Performance
Horizontal Scaling
using Hyperscale

### **Databases**

### No SQL - Table Storage

Key value store for rapid development using massive semi-structured datasets



Made for enterprise

Strong
consistency model
enables
data adds
and
data edits
immediately
available



Store petabytes of structured data

Highly Available
Scale up
without having
to manually
shard your
dataset



Supports flexible data schema

Web App
User Data
Address Books
Device Info
and other
Meta Data



Designed for developers

REST API and rich client libraries for building apps with .NET, Java, Android, C++, Node.js, PHP, Ruby, and Python

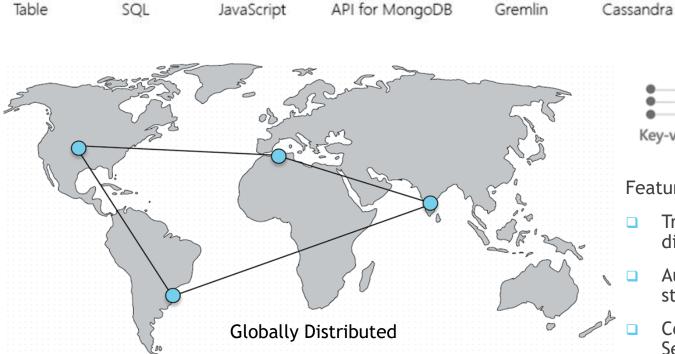
### Strong Bounded Staleness Stronger guarantees better performance and availability Session Consistent Prefix Eventual

### Azure Cosmos DB

SQL

Multi-model database service for any scale backed by industry-leading comprehensive SLAs

LEAF



Source: https://docs.microsoft.com/en-us/azure/cosmos-db/introduction

### Data models

etcd

**ETCD** 

...more APIs coming

Graph



Spark

#### Features and Benefits:

- Transparent multi-master Replication with single digit millisecond read & write latencies
- Automatic and elastic scaling of throughput and storage worldwide with high availability at 99.999%
- Consistency choices of Strong, Bounded Staleness, Session, Consistent Prefix, and Eventual

#### **Databases**

### **Azure Cache for Redis**

Memory data store to power fast and scalable applications



Open Source Compatible: Backed by Open Source Redis server & natively supports Data Structures



High Performance: Consistently serves read & write requests within single-digit milliseconds



Built in Reliability: Redundant pair of virtual machines (VMs) for Standard & Premium Tiers



Flexible Scaling: Scale Out/In without downtime within a Subscription Tier



Enterprise Grade Security: Industry standard SSL to secure data in transit and SSE for data at rest

#### Subscription Tiers:

- Basic (up to 20k connections, Shared Infrastructure Dedicated Service, up to 53 GB)
- □ Standard (+SLAs)
- Premium (+Redis Cluster, up to 120 GB, VNets Protection Unlimited Connections and Data Persistence)

#### Use Case(s):



DATA CACHE
COMPLEMENTS AZURE
DATABASE SERVICES



SCALABLE WEB APPS
WEB SESSION DATA
& OUTPUT PAGES



MESSAGING PUBLISH & SUBSCRIBE FUNCTIONALITY

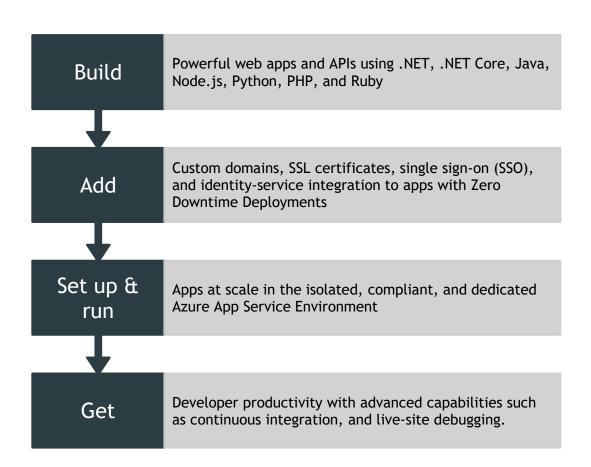
# Middleware & & PaaS

- App Service
- Mobile Apps
- ☐ SignalR Service
- Integration Platforms
- Azure Spring Cloud

### Middleware & PaaS

### App Service

Build, deploy, and scale web apps on managed platform







scale with business



for Containers

Deploy & run
containerized
applications on

Windows & Linux

Web Apps



API Apps

Build & consume APIs
in the cloud
using the language
of choice

### Middleware & Paas Mobile Apps

Scalable and globally available Mobile application development and deployment platform

#### Features and Benefits:

- Build Native using Client SDKs and Cross Platform Apps
- Integrates to Enterprise
   Systems and Identity
   Providers for Authentication and Authorization
- Build Offline Ready Apps with Data Sync
- Push Notifications to Millions in Seconds
- Powered by Azure App Service





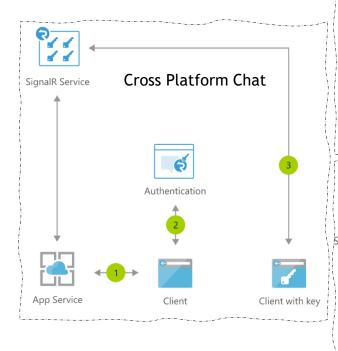
Source: https://docs.microsoft.com/en-us/azure/app-service-mobile/app-service-mobile-value-prop

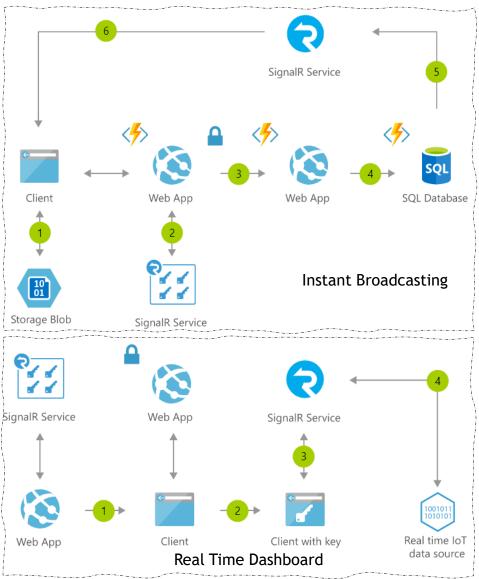
### Middleware & PaaS SignalR Service

Easily add real-time web functionality to applications

#### Features and Benefits:

- Adding real-time communications to web application is as simple as provisioning a service
- Enables to focus on core business instead of managing infrastructure
- Integrates with services such as Azure Functions, App Service, IoT, Analytics & Machine Learning and many more





Source: https://azure.microsoft.com/en-us/services/signalr-service/#solutions

### Middleware & PaaS

### Integration Platforms

Integrate on-premises & cloud applications, data, and processes across enterprise & partners



LOGIC APPS

Workflow
Automation
without writing
a single line of
code



SERVICE BUS

Connect across
environments with
Load Leveling &
Balancing, and
Loose Coupling



**EVENT GRID** 

Get reliable event delivery at massive scale



API MANAGEMENT

Secure & Scale the Enterprise API Economy

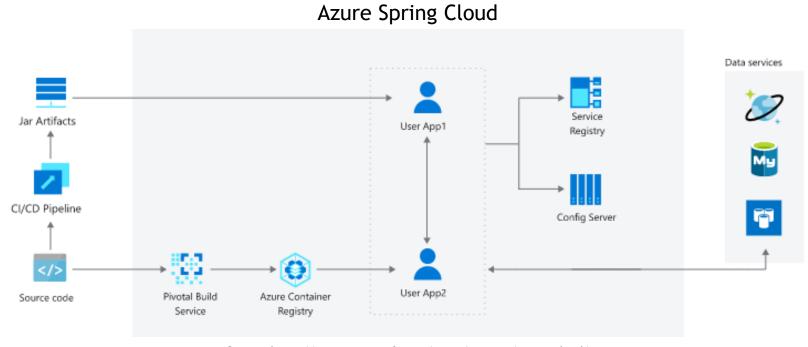
### Middleware & PaaS

### **Azure Spring Cloud**

Simplify Spring Boot app development and management

#### Features and Benefits:

- Develop and deliver Micro
   Services based Java apps using
   Spring Cloud Components
   including Pivotal Build Service,
   Service Discovery, Configuration
   Management, and Distributed
   Tracing
- Joint engineering, operation, and integrated support by Microsoft and Pivotal
- Integrated with Azure Monitor



Source: https://azure.microsoft.com/en-us/services/spring-cloud/

# Containers & & Serverless

- □ Container Instances & Registry
- □ AKS, Service Fabric & OpenShift
- Azure Functions

### Containers & Serverless

### **Container Instances**

Lightweight runtime for building and running Container Applications without Servers







APPLICATIONS SECURITY
BY
HYPERVISOR ISOLATION



LINUX AND WINDOWS CONTAINERS WITH PERSISTENCE STORAGE



PUBLIC IP ADDRESS AND DNS NAME



ON DEMAND CONTAINERS BURSTING AGILITY FROM AKS CLUSTER

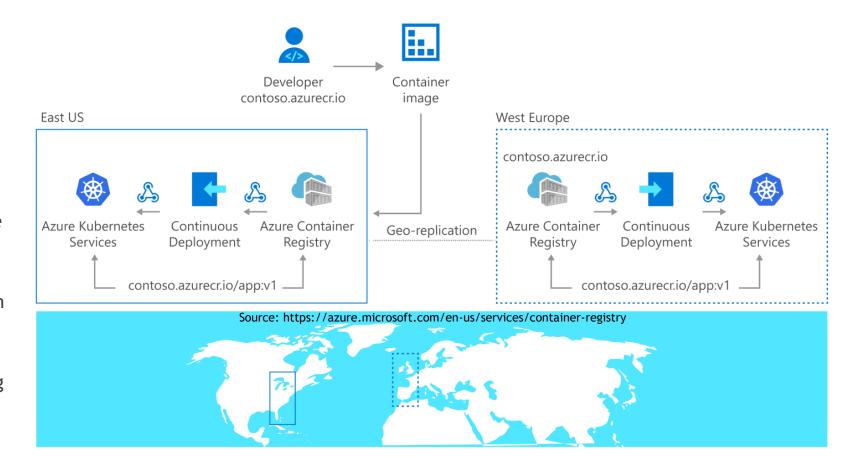
### Containers & Serverless

### **Container Registry**

Docker Images, and Open Container Initiative (OCI) Images & Artifacts Registry

#### Features and Benefits:

- Get an enterprise container repository with multi-master geo-replication
- VNeT Protection enables Private Network Only Access with RBAC using Azure AD
- Safeguard Content Delivery with Docker Content Trust
- Automate Image Pipelines for Development and Patching using Task Scheduling



### Containers & Serverless

### AKS, Service Fabric and OpenShift

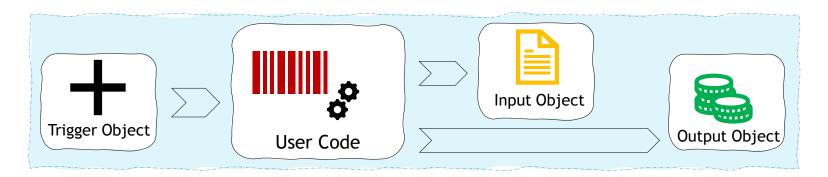
Containers Clusters As A Service for Development and/or Deployment Options on Azure

	Azure Kubernetes Service	Service Fabric	Red Hat OpenShift
Purpose	Simplifies deploying and managing containerized applications in Azure, Azure Stack and Azure IoT Edge Devices	Simplifies building, deploying, and managing distributed & scalable applications consisting of microservices & containers running on managed multi-node clusters	Built-in solutions with automated source code management, container and application builds, deployments, scaling and health management.
Leading Use Cases	<ul> <li>Complex application that uses         Machine Learning</li> <li>Migrate or build Applications         in Cloud to take advantage of         Agility by Micro Services</li> </ul>	<ul> <li>Stateless Web Apps</li> <li>Stateless and Stateful Business middle-tier services</li> <li>Free Open Source Software that powers core Azure infrastructure*</li> </ul>	<ul> <li>OpenShift PoCs</li> <li>Bursting On Prem OpenShift Deployment</li> <li>Managed OpenShift Platform in Cloud</li> </ul>
Support Model	Microsoft	Microsoft	Microsoft + Red Hat
SLAs	Not Available*	Not Available*	99.9% Availability

#### Containers & Serverless

### **Azure Functions**

Accelerate & simplify application development with serverless compute & delivers pay by execution





#### **Improve**

E2E development
experience of
building applications
anywhere with
continuous
integration and
continuous delivery
(CI/CD) & monitoring
in Cloud



#### Simplify

Complex orchestration challenges resolution with stateful Durable Functions Extension that is available with Premium and App Service Plans. Azure Functions by default are stateless



#### Connect

Services without hard-coding integrations for faster solutions development using functions triggers & binding library



#### Choose

Best hosting option for application & business needs from Azure Cloud to On-Prem Kubernetes, Azure Stack or Azure IoT Edge



#### Develop

With programming languages best for each unique scenario, from web services and APIs to Machine Learning workflows or automation scripts



#### Create

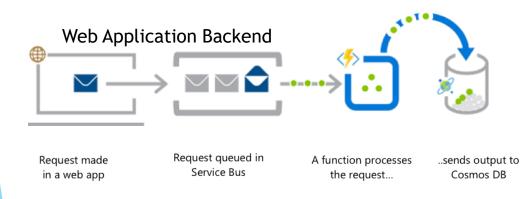
Applications with built-in security and grant access to your application using built-in authentication with Azure AD, and Microsoft, Twitter, Facebook, Google and other accounts

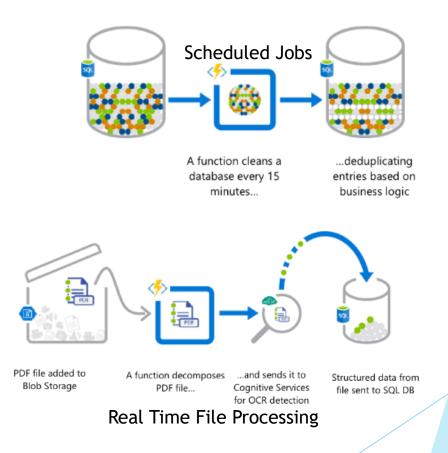
#### Containers & Serverless

### **Azure Functions**

**Industry Leading Use Cases** 

- Native Languages\*: C#, F#, Node.js, Java,
   JavaScript, Python and PowerShell
- Custom dependencies are supported via NuGet and NPM Libraries
- Subscription Tiers: Consumption\*, Premium & App Service Plans





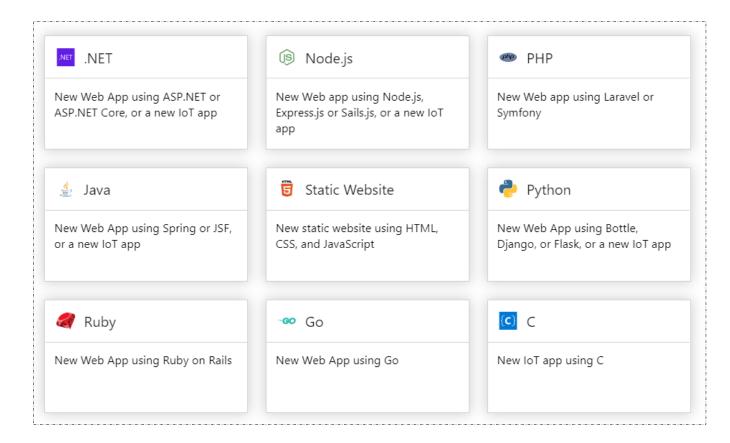
- Azure DevOps
- DevOps Tools Integration
- Azure Pipelines
- □ Azure Boards, Repos & Artifacts
- □ Testing Environment & Toolkit

# DevOps Azure DevOps

Create and ready to go: code repository, CI/CD pipeline, and the necessary Azure resources



Launch an app running in Azure in a few quick steps



# **DevOps Tools Integration**

Use your favorite DevOps toolchain - seamlessly integrated with Azure

Work with continuous integration and delivery tools:



Use Azure Pipelines or deploy directly to Azure Platform from your favorite CI/CD Delivery Solution, such as Jenkins ☐ Get the most from infrastructure automation & configuration management.



In addition to using Azure Resource Manager for infrastructure as code, one can provision and manage Azure infrastructure from third-party tools, such as Ansible, Chef, Puppet, and Terraform.

# **Azure Pipelines**

Continuously build, test, and deploy to any cloud and on-premise environments



# Cloud Hosted Pipelines

- 1. Simple and easy SaaS solution for DevOps Pipelines.
- 2. Existing templates for industry leading software development frameworks
- 3. Easy to build Pipeline for your own framework



### Any Language & Platform

- 1. Build, test, and deploy Node.js, Python, Java, PHP, Ruby, C/C++, .NET, Android, and iOS apps.
- 2. Run in parallel on Linux, macOS, and Windows.



### Containers & Kubernetes

- 1. Easily build and push images to container registries like Docker Hub and Azure Container Registry.
- 2. Deploy containers to individual hosts, ACI or Kubernetes.



#### **Extensible**

- 1. Explore and implement a wide range of community-built build, test, and deployment tasks
- 2. Hundreds of extensions from Slack to SonarCloud.



#### **Advanced Workflows**

- 1. Take advantage of easy build chaining and multiphased builds.
- 2. Support for YAML, test integration, release gates, reporting—and more.

# Azure Boards, Repos & Artifacts



#### **Boards**

- 1. Plan, track, and discuss work across your teams
- 2. Connected from idea to release, scrum ready and built for insights
- 3. Track work with Kanban boards, backlogs, team dashboards, and custom reporting



#### Repos

- 1. Private Git repository hosting and support for Team Foundation Version Control(TFVC)
- 2. Securely push code into your Git repos from any IDE, editor, or Git client
- 3. Add validations and extensions from the marketplace or build your own using web hooks and REST APIs.



#### **Artifacts**

- 1. Get unlimited, cloud-hosted private Git repos for your project
- 2. Universal Artifacts management for Maven, NPM, NuGet, and Python package feeds from public and private sources
- 3. Shared and add packages to any pipeline with built-in CI/CD, versioning and testing.

# Testing Environment and Toolkit

#### Azure DevTest Labs

Quick on demand testing environments

- Self Service Testing Environments with Policy driven Cost Management
- Quick to create & use Custom
   Templates from your latest bits and dev tools artifacts.
- Create environments directly from a continuous integration tool using plugins, REST API or Visual Studio Team Services Extension

#### **Azure Test Plans**

Manual and exploratory testing toolkit

- Capture rich scenario data as you execute tests to make discovered defects actionable.
- Test your application by executing tests across desktop or web apps.
- Take advantage of end-to-end traceability and quality for your stories and features.

# Developer Tools

- Visual Studio Family
- ☐ GitHub & Tools Integration
- Power Apps
- Azure SDKs

# Developer Tools Visual Studio Family

Integrated Development Environment (IDE) from Microsoft



#### **Visual Studio**

- 1. IDE designed for creating powerful, scalable applications for Azure
- 2. Local emulators and integration tools to build, run, and debug cloud apps
- 3. Built-In Cloud Explorer and Azure Monitor Integration



#### **Visual Studio Code**

- 1. Free and Open Source lightweight code editor for cloud development for Windows, Linux and macOS
- 2. Deploy and manage Azure resources from editor
- 3. Build and debug Node.js, Java Python and many others



#### **Visual Studio Online**

- 1. Cloud-powered development environments accessible from anywhere
- 2. Quickly create customizable environments from a template or existing code repo
- 3. Productive editing and collaboration feature like Alpowered completions, and real-time co-editing



#### **Visual Studio App Center**

- 1. Integrated services for building, testing, releasing, and monitoring mobile & desktop apps
- 2. Automate build, test, and distribution pipelines, and continuously monitor real-time application performance
- 3. Simple-to-use modular SDKs to quickly start

#### **Developer Tools**

# GitHub & Tools Integration

Continue Leveraging Industry Leading Open Source Software Development Tools in Azure



- 1. Increase collaboration with your teams and the open-source community with native Azure AD Integration
- 2. Automate your code-tocloud workflows
- 3. Identify, remediate and prevent code vulnerabilities



- 1. Easily create, develop, configure, test, and deploy using Azure Toolkit
- 2. Azure Service API clients for Java exposed as Eclipse Library
- 3. Deploy Java EE, Spring Boot Web App and Spark Jobs using Eclipse from anywhere



- 1. Deploy Java Web Apps and Spark & Hadoop Jobs to Azure from anywhere using Azure Toolkit on IntelliJ
- 2. The Azure Toolkit for IntelliJ makes it easy with the right templates & tools for Java developers and HDInsight users



- 1. Azure service API clients for Java are available, exposed as Maven artifacts
- 2. Azure provides a variety of packages, plugins, and tools for Java developers using Maven to natively build and interact with Azure services from anywhere

Deploy to Azure directly from Eclipse, IntelliJ, and Maven

# Power Apps

#### Low code platform for building apps quickly with automatic lifecycle management

#### Features and Benefits:

- Command line interface to build fully customized components & reusable user experiences
- Built-in connectivity to third-party platforms and deep integration with Azure DevOps and Services
- APIs and pro developer tools to extend any app with custom logic, offering an end-to-end application platform

#### Extend your Azure services with the Power Platform

Build applications, automate your business processes and analyze your data in just a few clicks.



#### PowerApps

Quickly create robust user experiences across Azure services, and extend using rich prodeveloper tooling. Learn more

Build an app 🗹



#### Power Automate

Connect all your Azure data with Power Automate to build workflows and approval processes for anyone in your organization. Learn more

Automate your workflows 🗗



#### ■ Power BI

Analyze your data 🗹

# Developer Tools Azure SDKs

Get the SDKs, Command Line and Standalone Tools



#### **Unified SDKs**

Collections of libraries to work with Azure Services:

- 1. .NET
- 2. Java
- 3. JavaScript, and
- 4. Python



#### **SDKs**

Legacy of Unified SDKs. Not recommended for new projects:

- 1. Go
- 2. PHP
- 3. .NET
- 4. Java
- 5. Python
- 6. TypeScript / JavaScript



#### **Command Line Tools**

Manage your Azure services and apps using scripts from the command line:

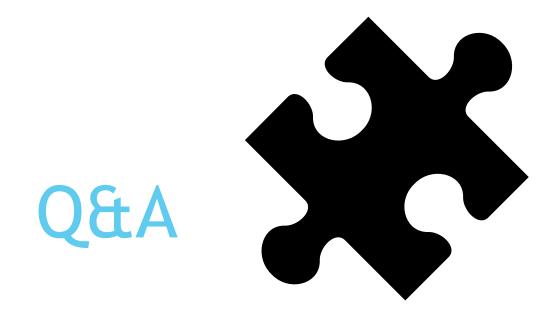
- 1. Azure command line interface
- 2. PowerShell
- 3. AzCopy Command Line Tool for Storage, and
- 4. Azure Storage Emulator



#### **Standalone Tools**

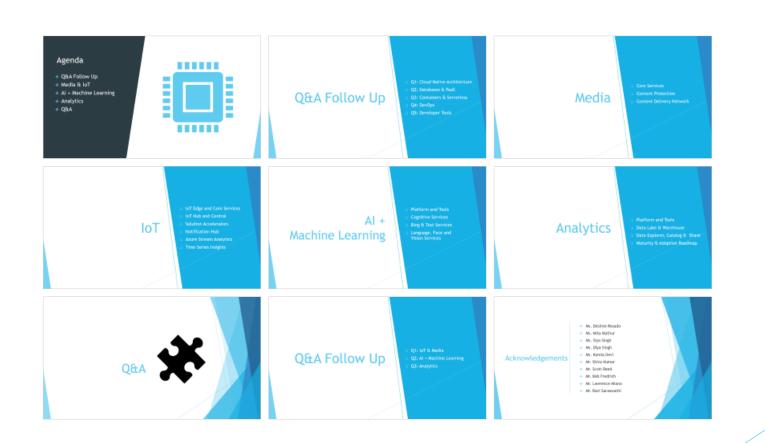
Manage Azure Resources from your platform of choice:

- 1. Azure Storage Explorer
- 2. Azure Data Studio
- 3. Azure CloudShell



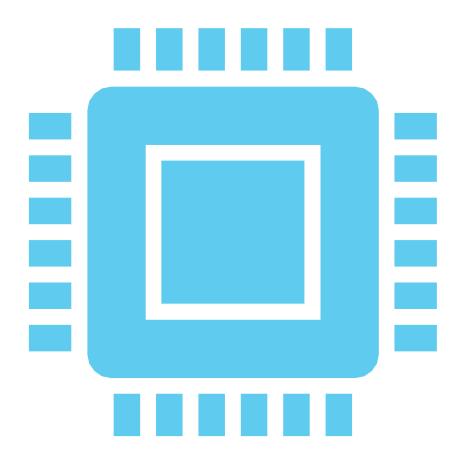
# Architect Technologies & Design Study Group Session 6: Cloud Native Design II

Jaswant Singh (Jas), Chief Enterprise Architect
NA GTS CTO Office - Cloud and Integration



# Agenda

- Q&A Follow Up
- ❖ Media & IoT
- Al + Machine Learning
- Analytics
- **♦** Q&A



- □ Q1: Cloud Native Architecture
- Q2: Databases & PaaS
- Q3: Containers & Serverless
- □ Q4: DevOps
- □ Q5: Developer Tools

# Q1: Cloud Native Architecture

#### **Identify True Statements**

- A:: The leading industry trends of User Experience, Cognitive Enterprise and API Economy are driving the Cloud Native Architecture Adoption.
- B:: Automation and Autonomy are two key tenants of the Cloud Native Architectures.
- C:: You must have Micro Services and Containers to deliver Cloud Native Application Architectures.
- D:: The next wave of Cloud Native Applications architectures will primarily utilize serverless computing and low code applications platforms.
- □ E:: Micro Services, SOA and API Economy are synonyms to each other.
- F:: Cloud Native Applications Architecture can maintain affinity to the underlying Operating System and Server Platform.

### Q2: Databases & PaaS

#### **Identify True Statements**

- A:: Azure App Service is the foundation for Web Apps, Web App for Containers, API Apps, and Mobile Apps.
- B:: Azure API Management is an API Proxy that provides you security, billing and metering capability to deliver API Economy to partners and consumers.
- C:: Azure Spring Cloud and Azure Red Hat OpenShift both are multi vendor support offering from Microsoft.
- D:: Azure Open Source Database Choices are MySQL and PostgreSQL only.
- E:: Azure Cosmos DB consistency level strong doesn't provide data adds and data edits immediately available.
- F:: Azure SQL Database is suited for born in cloud application that provides you operating system level access.

# Q3: Containers & Serverless

#### **Identify True Statements**

- A:: In a bursting scenario, Azure Kubernetes Services can benefit from Azure Containers Instances.
- B:: Azure Kubernetes Services can be used for Development, Deployment and Monitoring of the containers applications.
- C:: Azure Fabric is available as open source free for on premise development.
- D:: An Enterprise Containers Applications Development and Deployment must have a Private Container Repository.
- E:: Azure Functions with all the bells and whistle available is a true serverless computing.

# Q&A Follow Up Q4: DevOps Identify True Statements

- A:: Azure DevOps ready to go project delivers you code repository, CI/CD pipeline and the necessary azure resources.
- B:: Using Azure Pipelines one can continuously build, test, and deploy to Azure Cloud only.
- C:: Azure Pipelines can run in parallel on Linux, macOS, and Windows.
- D:: Azure Pipelines simplifies containers deployments to Azure Container Instances,
   Azure Kubernetes Services and Individual Hosts.
- E:: Using Azure Boards, track work with Kanban Boards, Backlogs, Team Dashboards, and Custom Reporting.
- □ F:: Azure Artifacts provides Universal Artifacts management for Maven, NPM, NuGet, and Python package feeds from private sources only.

# Q5: Developer Tools

#### **Identify True Statements**

- A:: Azure Studio Family products are Visual Studio, Visual Studio Code, Visual Studio
   Online and Visual Studio App Center.
- B:: Azure Power is low code platform to quickly build applications with automatic lifecycle management.
- C:: Azure SDKs are categorized as SDKs, Unified SDKs, Command Line Tools and Standalones Tools.
- □ D:: Azure recommends that all new projects use SDKs instead of Unified SDKs.
- E:: Visual Studio App Center is an integrated services for building, testing, releasing, and monitoring mobile apps only.

- Core Services
- Content Protection
- Content Delivery Network

### **Core Services**

Deliver high-quality video content anywhere, any time, and on any device



#### **MEDIA SERVICES**

Manage, transform, and deliver media content with cloud-based workflows



#### **ENCODING**

Scalable & Studio Grade Encoding in the Cloud



#### AZURE MEDIA PLAYER

Automatically picks the best format for a browser or device



### LIVE & ON-DEMAND STREAMING

Deliver content to virtually all devices with scale to meet business needs



#### **VIDEO INDEXER**

Unlock video insights by automatic extraction of metadata

### **Content Protection**

Secure media content from cloud upload to playback











SIMPLIFY KEY
MANAGEMENT AND
ALLOW DYNAMIC
ENCRYPTION ON THE FLY

USE AES CLEAR KEY AND MULTI-DRM (PLAYREADY, WIDEVINE, AND FAIRPLAY STREAMING) INTEGRATE WITH ACTIVE DIRECTORY OR YOUR OWN AUTHENTICATION SYSTEM HIGHLY-SECURE
PLAYBACK WITH NATIVE
HTML5 OR CLIENT SDKS
FOR ALL DEVICE

CONFIGURE
PROTECTION RULES
USING APIS OR PORTAL

### Content Delivery Network

Secure and reliable global content delivery and acceleration



Deep Integration Seamlessly works with Azure services, including Web Apps, Media Services, and Storage.



Massive Capacity
Distributed and global
presence enables handling of
sudden traffic and heavy
loads



Developer Friendly APIs and developer tools enables applications delivery with performance, reliability & security



Robust Security
Mitigate security threats such
as Distributed Denial of
Service (DDoS) Attack and
Optimized HTTPS



Multiple Providers
Integrates with services from
Akamai and Verizon for
optimized delivery



Advanced Analytics
Gain real time and granular
insights about customer
workflows and business needs

IoT

- □ IoT Edge and Core Services
- □ IoT Hub and Central
- Solution Accelerators
- Notification Hub
- Azure Stream Analytics
- ☐ Time Series Insights

# Internet of Things (IoT) IoT Edge and Core Services

#### **IoT Edge Services**

Cloud Intelligence & Analytics to Edge Devices

- Certified 1000+ IoT Edge Hardware works with Windows and Linux container engines
- Open source free runtime that supports languages such as C, C#, Java, Node.js, and Python
- Respond in near real time, and remotely manage and deploy workloads from Azure
- Offload AI & Analytics workloads to Edge that operates offline and with intermittent connectivity

#### Windows 10 IoT Core Services

Manage device updates & assess device health

- Keep devices stable & secure for 10 years with Windows 10 IoT Core support with monthly security & reliability updates with no feature updates
- Manage with Device Update Center using the same content distribution network that's used by millions of customer to manage Windows updates
- Evaluate the trustworthiness of a device using Device Health Attestation and take corrective action.

# Internet of Things (IoT) IoT Hub and Central

#### IoT Hub

Cloud solution backend to connect virtually any device

- Security-enhanced bidirectional communication with IoT devices at scale
- Built-in IoT device management and provisioning at scale
- Full integration with Event Grid and serverless compute, simplifying IoT application development
- Compatibility with Azure IoT Edge for building hybrid IoT applications

#### IoT Central

IoT Application Platform

- Rapidly build enterprise-grade IoT applications on a secure, reliable, and scalable infrastructure
- Azure IoT Central connects your IoT devices to the cloud with ease. Find devices matched for desired solution in Azure Certified IoT device catalog
- Library of connectors & extensibility
  APIs bridge the gap between your
  business applications and IoT Connecting IoT data & decision makers

# Internet of Things (IoT) Solution Accelerators

Kick-start your implementation of common IoT scenarios

Get all the required cloud-based services including all required application code for a successful, efficient, and streamlined build and deployment for IoT scenarios:



Remote Monitoring



Industrial IoT





Device Simulation

#### Internet of Things (IoT)

### **Notification Hub**

Send push notifications to any platform from anywhere



Use Any Back End

Use Microsoft .NET, PHP, Java, and Node.js located on premise or in the cloud



**Dynamic Tags** 

Tailor push notifications by activity, interest, location, or preference.



Reach all major platform

iOS, Android, Windows, Kindle, and Baidu



Massive Scale

Reach instantly to millions of Mobile Devices



**Templates** 

Using templates send localized messages by language, market and user preferences

#### Internet of Things (IoT)

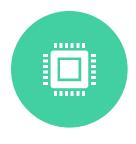
### **Azure Stream Analytics**

Real Time Powerful Insights to Data Streams at Subsecond Latencies



#### End-to-end Analytics

Pipeline in minutes with familiar SQL syntax and extensible with JavaScript and C#



#### Rapid Scalability

Build robust streaming data pipelines and analyze millions of events



#### **Hybrid Architectures**

Stream processing with the ability to run the same queries in the cloud and on the edge



#### Enterprise Grade Reliability

Built-in recovery and machine learning capabilities for advanced scenarios

#### Internet of Things (IoT)

# Time Series Insights

Real Time Insights to drive Operational Intelligence and Transformation



INSTANT DATA INGESTION
AND
NO EXTRA CODING
OR
DATA PREPARATION



WARM & COLD DATA
ANALYTICS
FOR QUICK INTERACTIONS
WITH STREAMING &
HISTORICAL DATA



POWERFUL VISUALIZATION
OF
ASSET-BASED DATA
FOR
AD-HOC ANALYSIS



DATA CONTEXTUALIZATION
BY CUSTOM MODEL, WITH
NESTING MENUS SHOWING
HIERARCHIES, RELATIONSHIPS,
AND PROPERTIES

# Al + Machine Learning

- Platform and Tools
- Cognitive Services
- ☐ Bing & Text Services
- Language, Face and Vision Services

# AI + Machine Learning Platform and Tools

Al and Machine Learning Model Development, Deployment & Management



Data Science VMs Rich pre-configured environment for AI development



Machine Learning Studio
Easily build, deploy, and manage
predictive analytics solutions



Azure Machine Learning
Bring AI to everyone with an endto-end, scalable, trusted
platform with experimentation
and model management



Azure Open Datasets Platform to host and share curated open datasets to accelerate development of machine learning models

#### Al + Machine Learning

### Cognitive Services

Smart API capabilities to improve users experience

- Azure Cognitive Search
  Al-powered cloud search service for mobile and web app development
- Azure Cognitive Services

  Add smart API capabilities to enable contextual interactions
- Azure Bot Service Intelligent, serverless bot service that scales on demand
- QnA Maker
  Distill information into conversational, easy-to-navigate answers

## Al + Machine Learning Bing and Text Services

App development using artificial intelligence capabilities in search & text

Bing Custom Search

An easy-to-use, ad-free, commercialgrade search tool that lets you deliver the results you want

- Bing Image Search
   Images search, metadata, thumbnails, and get comprehensive results
- Bing Spell Check
   Detect and correct spelling mistakes in your app
- Bing Web Search
   Get enhanced search details from billions of web documents
- □ Bing Video Search
  Videos search, metadata and get
  comprehensive results

Bing Visual Search Get rich insights to help build compelling image applications on the

device of your choice

- Bing News Search
  News grouped and filtered by topic,
  local news and searchable metadata
- Bing Entity Search Enrich your experiences by identifying and augmenting entity information from the web
- Bing Autosuggest
   Give your app intelligent autosuggest
   options for searches
- Content Moderator Image, Text and Video Moderation APIs and Human Review Tool

- Speech to Text
  Convert spoken audio to text for more natural interactions
- Speech Translation
   Easily integrate real-time speech translation to your app
- Text Analytics Easily evaluate sentiment and topics to understand what users want
- Translator Text Easily conduct machine translation with a simple REST API call
- Text to Speech Convert text to speech to create more natural, accessible interfaces

## Al + Machine Learning Language, Face and Vision Services





Kinect DK
Build computer vision and speech models using a developer kit with advanced AI sensors

Custom Vision
Easily customize your own state-of-the-art computer vision models for your unique use case

Computer Vision

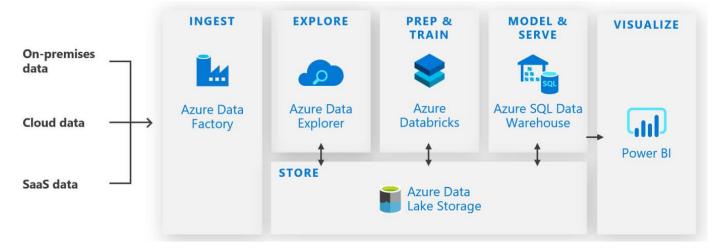
Distill actionable information from images

## Analytics

- Platform and Tools
- □ Data Lake & Warehouse
- □ Data Explorer, Catalog & Share
- Maturity & Adoption Roadmap

### Analytics Platform and Tools

Source: https://azure.microsoft.com/en-us/services/databricks/











#### **AZURE DATABRICKS**

Unlock insights from all your data and build artificial intelligence (AI) solutions

#### R SERVER FOR HD INSIGHT

Predictive analytics, machine learning, and statistical modeling for big data

#### **AZURE ANALYSIS SERVICES**

Analytics Engine
Platform that
provides enterprisegrade data models
in the cloud

#### POWER BI EMBEDDED

Visualize data with customer-facing reports, dashboards and analytics

## Analytics Data Lake & Warehouse



Azure
Synapse Analytics
SQL Data Warehouse



Azure Data Lake Storage Massively Scalable



HDInsight
Hadoop, Spark, HBase
and Storm Clusters



Event Hubs Receive Devices Telemetry



Data Factory
Hybrid Data
Integration & Ingestion

### **Analytics**

### Data Explorer, Catalog & Share

Services to use and monetize data assets

#### Azure Data Explorer Scalable data exploration service

- Enables real-time analysis on large volumes of data streaming from applications, websites, IoT devices. Get results from 1 billion records in less than a second
- Ask questions and iteratively explore data on the fly for innovation and operations excellence
- Identify patterns, anomalies, and trends in data, optionally write in persistence storage with retention policy

### Data Catalog Drive value from data assets

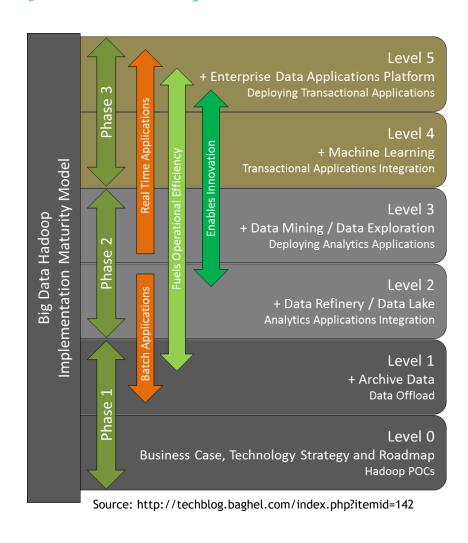
- Enterprise-wide metadata catalog that makes data asset discovery straightforward, and enables us to spend time using data then looking for it
- Register enterprise data assets and control who can discover. Let data live where it belong and integrate into tools and applications using REST APIs.
- Understand its usage and intent, provide your informed insights into the catalog, and enable a virtuous cycle of use.

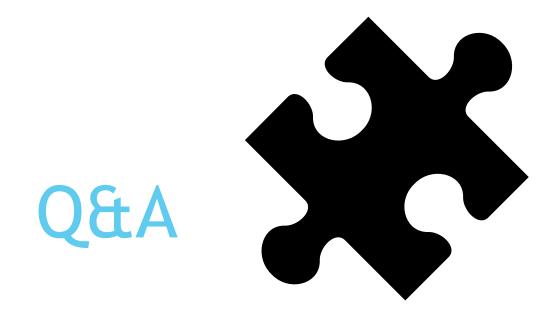
### Azure Data Share Sharing big data with partners

- Serverless code-free service
- Share data as REST API in just few clicks, in any format and any size, from multiple sources
- Using user friendly interface implement security control with full visibility into what you share, who receives your data, and the terms of use by Azure Security Measures.
- Data is encrypted in transit, and metadata is encrypted at rest and in transit

### **Analytics**

### Maturity & Adoption Roadmap





## Q&A Follow Up

- □ Q1: IoT & Media
- ☐ Q2: AI + Machine Learning
- ☐ Q3: Analytics

### **Q&A Follow Up**

### Q1: Media & IoT

#### **Identify True Statements**

Select all the True Statement(s) from the following:

- A:: Content Delivery Network (CDN) Services can Protect your applications from Distributed Denial of Service Attacks
- B:: Azure Content Protection can deliver Content Access Control for Media applications with Azure AD only
- C:: Azure CDN Services Seamlessly Integrates with Akamai and Verizon Services and one implement Hybrid CDN powered by Azure, Akamai and Verizon.
- D:: Windows 10 IoT Core Services delivers 10 years stability and reliability for IoT implementations by providing the support with monthly security & reliability updates with no feature updates
- E:: Azure Stream Analytics and Time Series Insight are the Analytics Tools for IoT solutions only.
- F:: Notification Hub can send Personalized Push Notifications and that can be triggered from either any Application running Anywhere or Azure Portal.

#### Q&A Follow Up

### Q2: AI + Machine Learning

### **Identify True Statements**

Select all the True Statement(s) from the following:

- A:: In Azure, one can build Computer Vision Solution using Kinect DK, Custom Vision and Computer Vision Services.
- B:: Using Content Moderator one can moderate data from Image, Text and Video using the Moderation APIs only.
- C:: One can deliver Search Engine capability to their Public Presence only using the Bing Web Search and Bing Custom Search.
- D:: Users can create end to end modern Virtual Assistant by simply just using the Azure Bot Service
- E:: QnA Maker provides a quick bridge between semi structured data of existing knowledge base to a Virtual Assistant implementation using Azure Bot Service

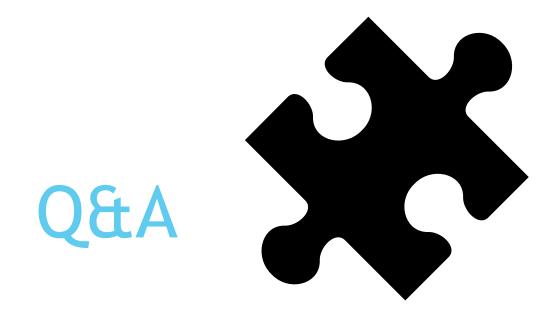
# Q&A Follow Up Q3: Analytics Identify True Statements

Select all the True Statement(s) from the following:

- A:: In an enterprise modern end to end setup for analytics, Data Lake feeds data into Data Warehousing that get used by the day to day Analysis and Data Visualization.
- B:: Data Warehousing can Store Structured and Unstructured Data for AI & Analysis.
- C:: Structured Data Stores enforces Schema on the Data Writes while Unstructured Data Stores users create Schema on the Data Reads.
- D:: Azure Data Share provides access to Data using REST API by moving the Data into a Centralized Repository.
- E:: Azure Data Catalog keeps the user's insights aka tribal knowledge in the system as metadata.
- F:: Azure Data Explorer enables Real Time Analysis on large volumes of Data Streaming from Applications, Websites, IoT Devices that can deliver analysis results from 1 billion records in less than a Second

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### Disclaimer

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