

Survey of Cloud Computing and Azure Foundation

Cloud Computing Overview

What is Cloud Computing?

"The practice of using a network of remote servers hosted on the Internet to store, manage, and process data, rather than a local server or a personal computer."

Oxford Dictionary

What do you think Cloud Computing
is?



Cloud Computing Perspectives

Perspectives highly influenced by roles and responsibilities
within an organization

- End-User
- Application Developer
- IT Infrastructure Manager
- CIO
- CFO
- Service Provider

What is Cloud Computing? – Take 2

Further perspectives include:

- “An approach to computing that’s about Internet scale and connecting to a variety of devices and endpoints.”
- “Treating hardware and software resources as a utility.”
- “A way to save a ton of money by only paying for what you need.”
- “A way to scale huge when you need something done fast.”

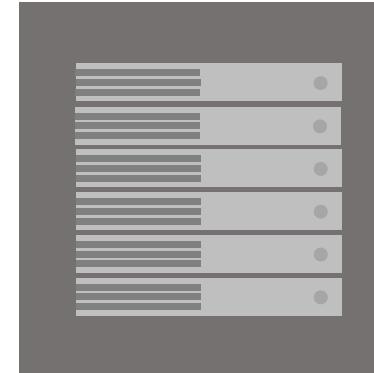
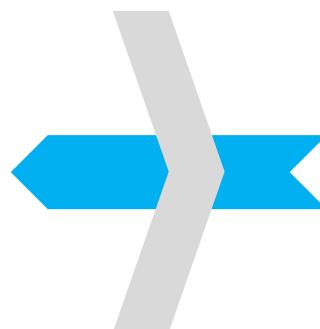
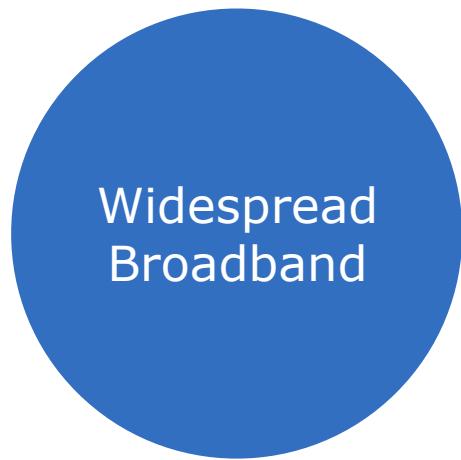
Evolution of Cloud Computing

Order of Evolution

Stage	Characteristics
Grid Computing	Solving large problems with parallel computing Made mainstream by Global Alliance
Utility Computing	Computing resources offered as a metered service Late 1990s
Software as a Service	Subscription-based software accessed over the Internet Gained momentum after 2001
Cloud Computing	Next-generation datacenters with virtualization technology Full stack of service - IaaS, PaaS, & SaaS

Key Enabling Technologies

- Ubiquitous fast wide-area networks
- Powerful and inexpensive servers
- High-performance virtualization technology



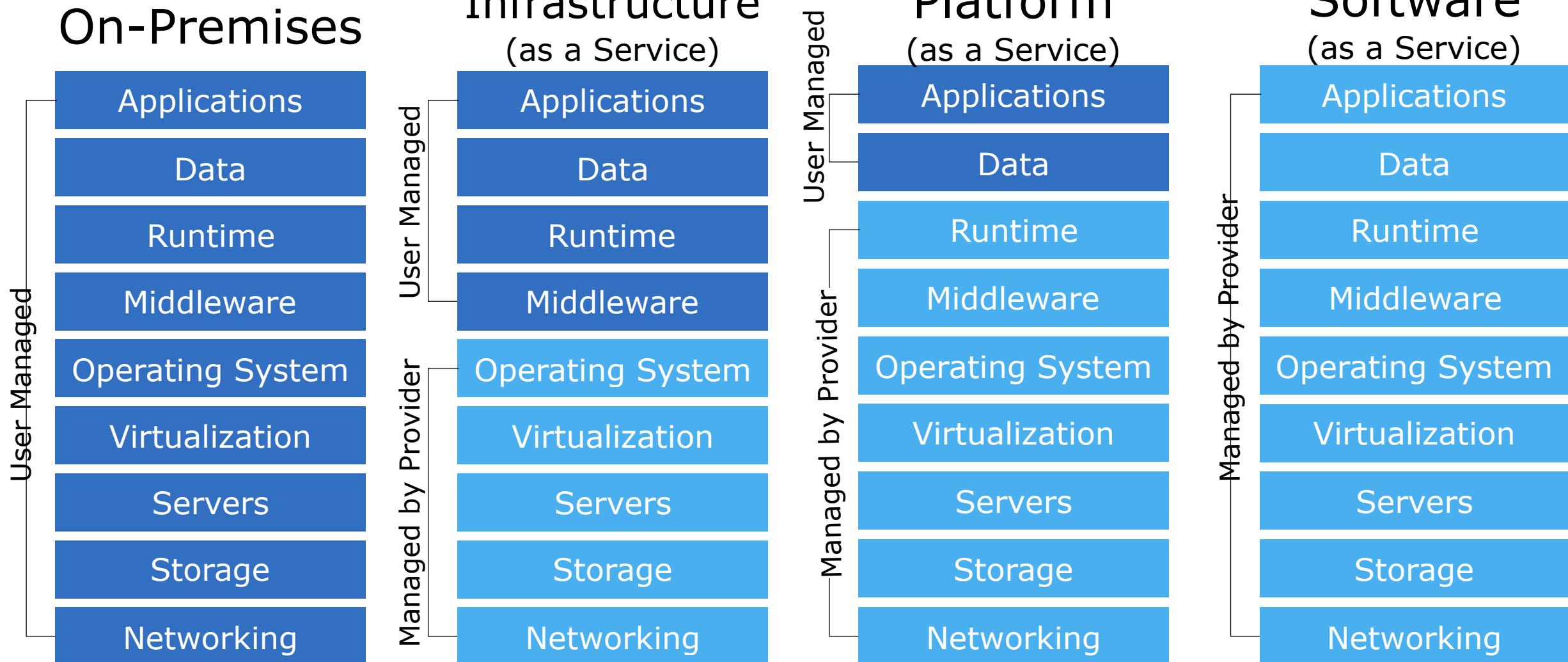
Five Key Cloud Characteristics

- On-demand self-service
- Ubiquitous network access
- Location-independent resource pooling
- Rapid elasticity
- Pay for what you use

Cloud Computing Service Models

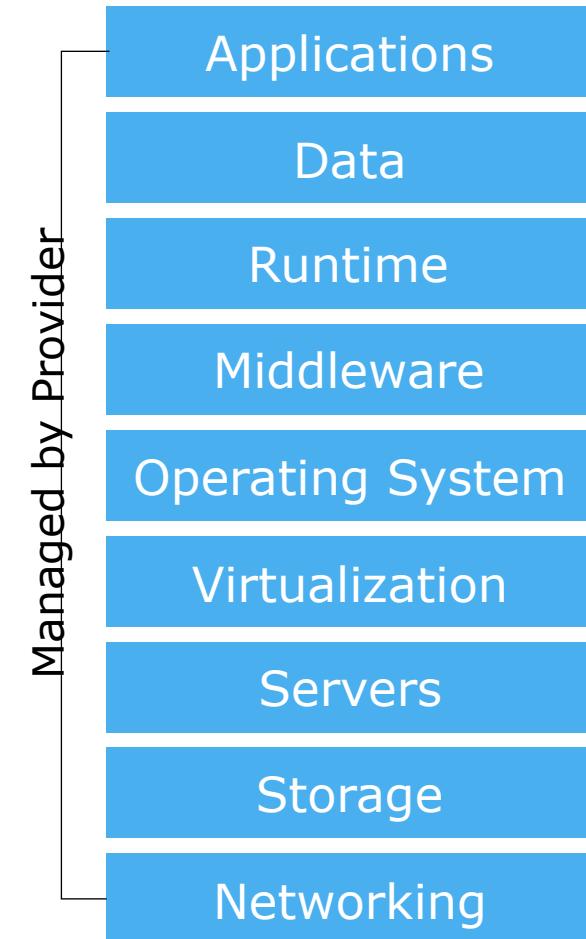
Model	Description
Software as a Service (SaaS)	Consume it End-User Applications delivered as a service, rather than by on-premises software
Platform as a Service (PaaS)	Build on it Application platform or middleware provided as a service on which developers can build and deploy custom applications
Infrastructure as a Service (IaaS)	Migrate to it Computing, storage, or other IT infrastructure provided as a service, rather than as a dedicated capability

Service Model Division of Responsibility



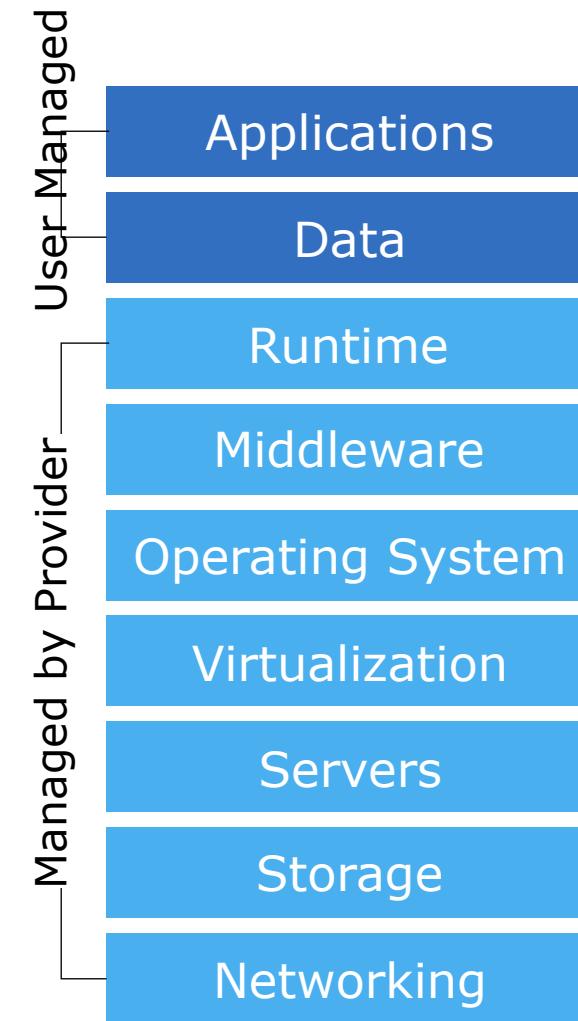
Software as a Service (SaaS)

- Internet hosted software
- Full vendor maintenance
- No upfront cost
- Pay for services as they are consumed



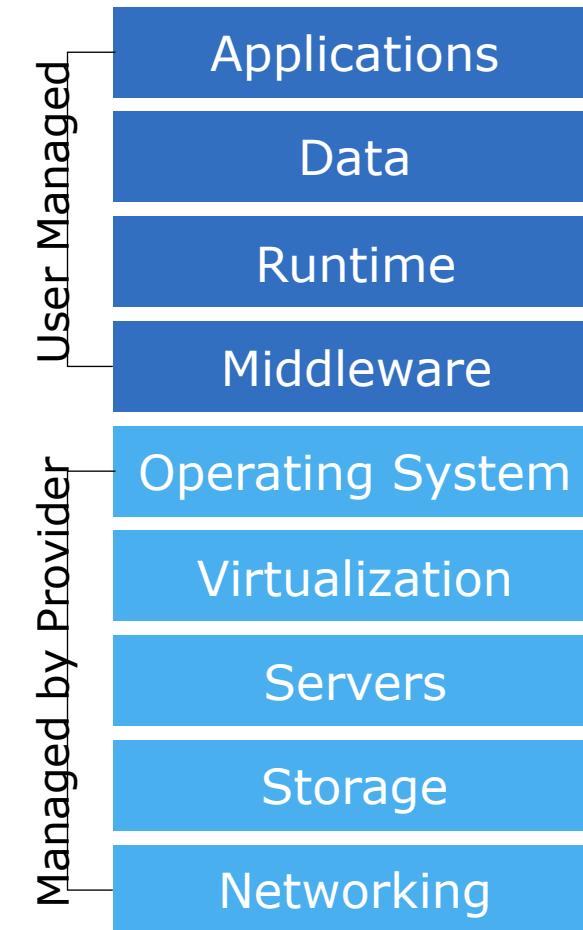
Platform as a Service (PaaS)

- Delivers and manages various development environments
- Environment and tools can be easily provisioned and torn down

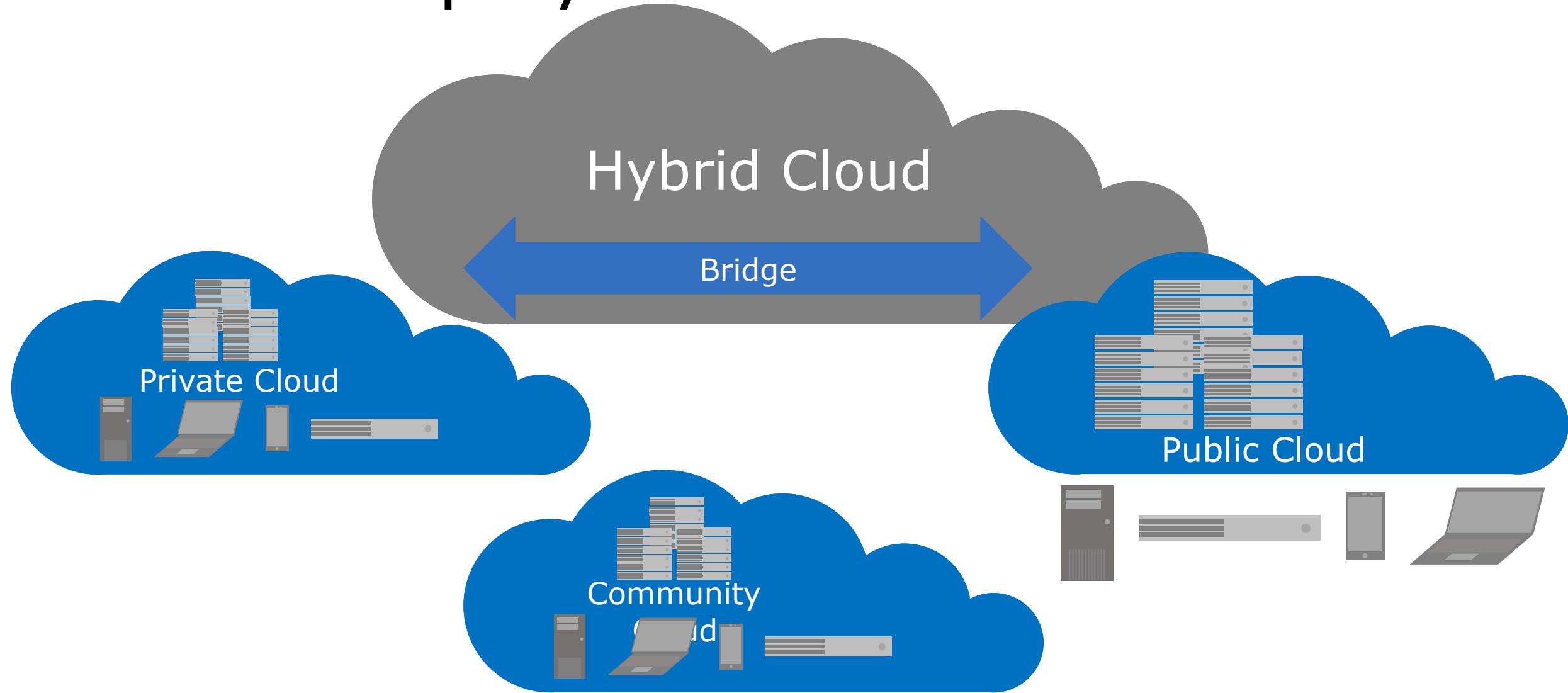


Infrastructure as a Service (IaaS)

- Dedicated virtual machines (VMs)
- Users configure server type, operating system, storage, network, etc.
- Scale up and down



Cloud Deployment Model



Cloud Deployment Models – Advantages & Characteristics

Model	Advantages and Characteristics
Public	Shifts capital expense to operating expense Offers pay-as-you-go pricing Supports multiple tenants
Private	Leverages existing capital expense Can help reduce operating costs Intended for a single tenant
Hybrid	Bridges one or more community, private, or public clouds Allows manipulation of CapEx and OpEx to optimize cost Supports resource portability
Community	Allows sharing of CapEx and OpEx to reduce costs Brings together groups with a common interest Supports resource portability

Why Cloud Computing?

24x7
Support

Pas As
You Go

Lower TCO

Reliability,
Scalability

Device- &
Location-
Independent

Easy & Agile
Deployment

**Why Cloud
Computing?**

Utility Based

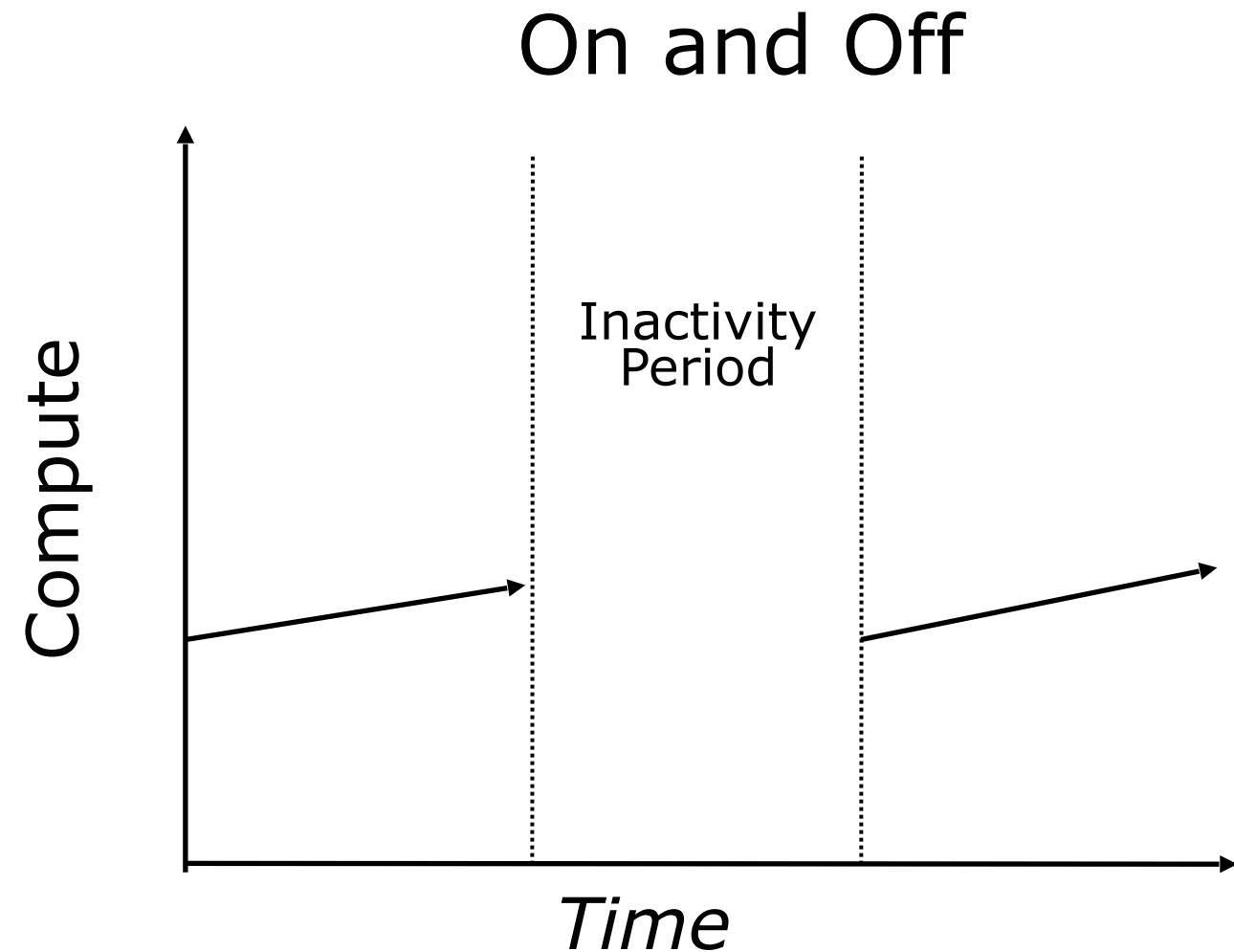
Highly
Automated

Lower
Capital
Expenditure

Free Up
Internal
Resources

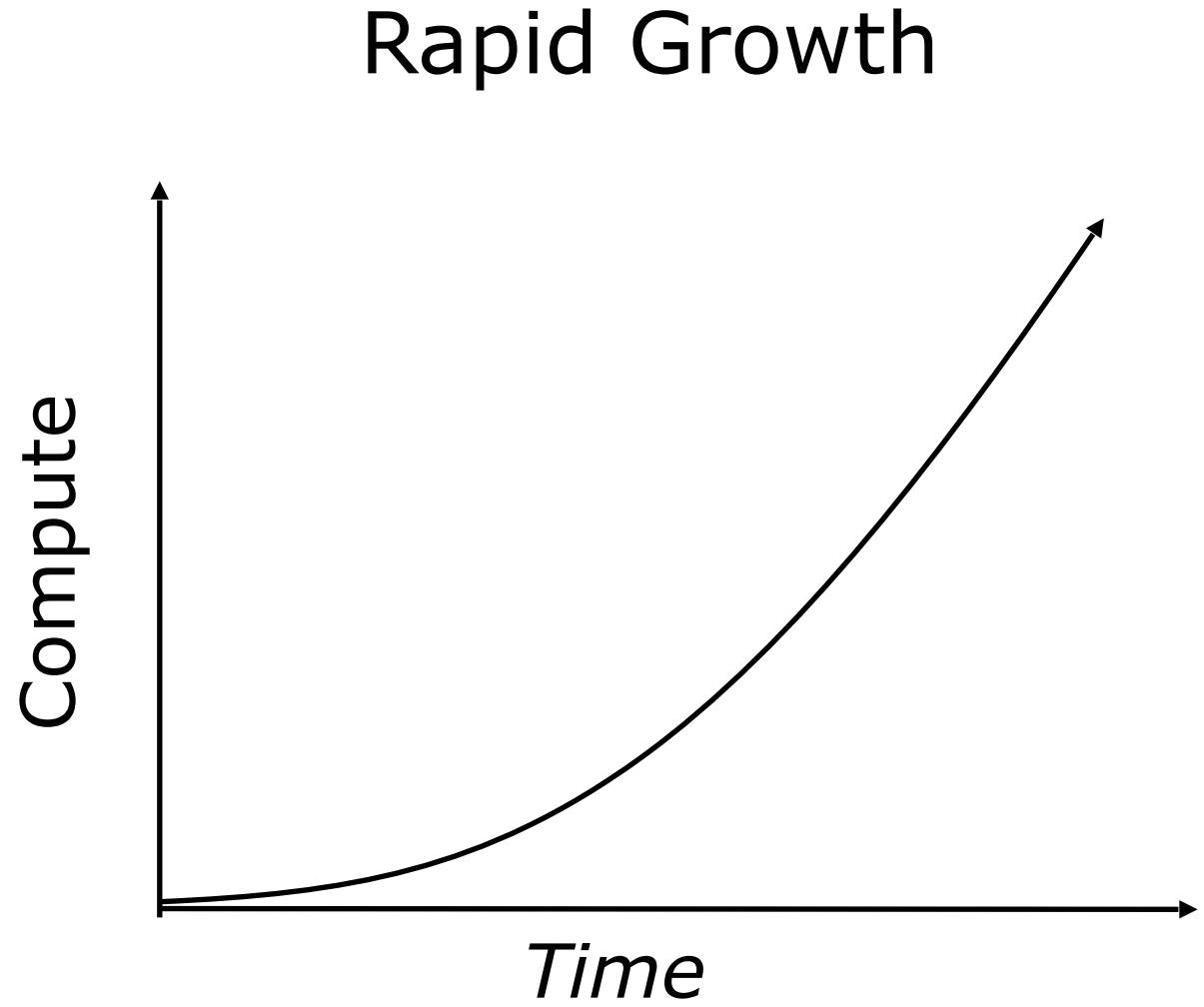
Typical Computing Pattern

- On & off workloads
 - Batch jobs
- Wasted Capacity
- Time to market can be cumbersome



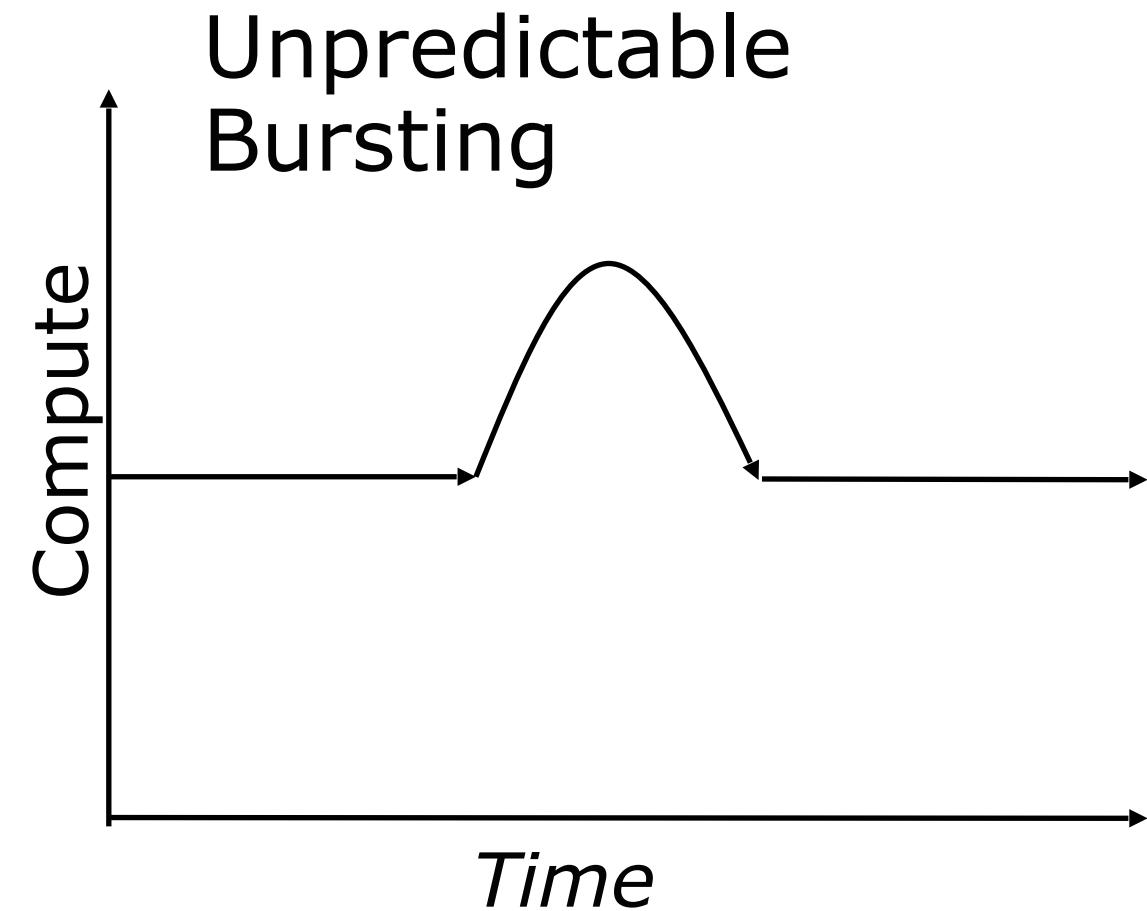
Typical Computing Pattern

- Rapidly growing company
- Major challenge for IT dept. to keep up with growth
- Potential loss of business opportunity
- Potential customer service problems



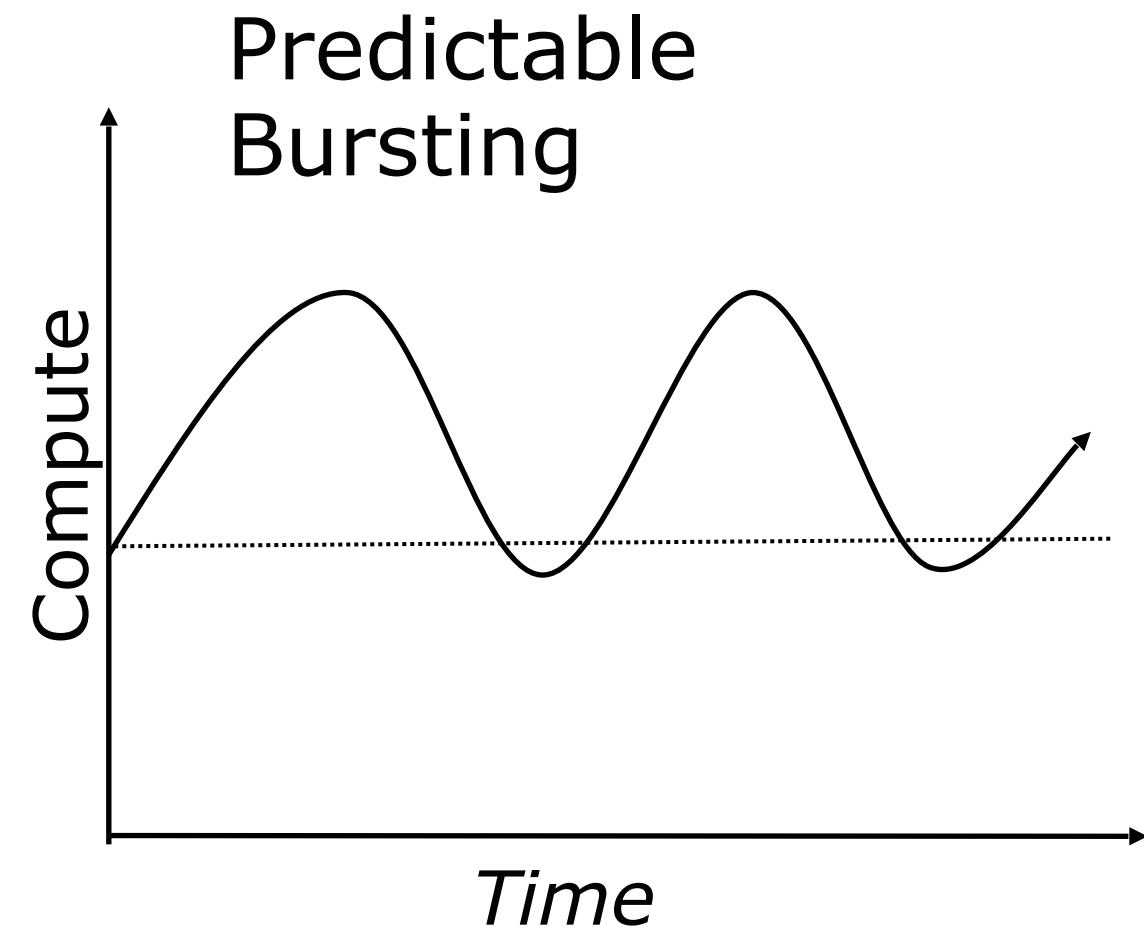
Typical Computing Pattern

- Unexpected peak in demand
- Loss of business opportunity
- Wasted capacity if demand wanes



Typical Computing Pattern

- Seasonal peaks and troughs
- Provisioning dilemma
 - Wasted capacity or
 - Loss of business



Azure Datacenter Regions

North America

West US
Central US
N. Central US
East US
East US 2
S Central US
Brazil South

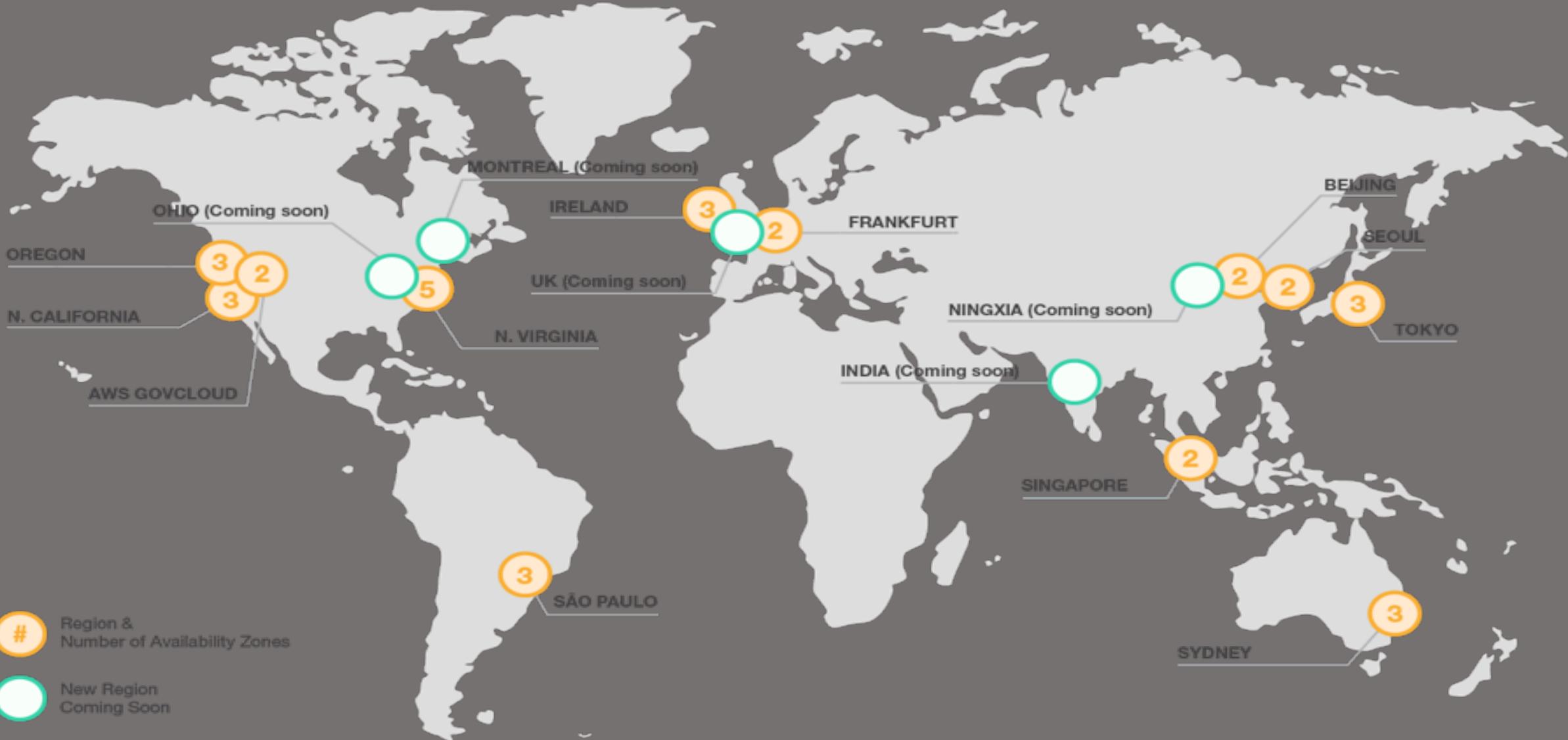
Europe

N. Europe
W. Europe

Asia Pacific

Japan West
China North
China South
E. Asia
S.E. Asia
Australia East
Australia Southeast

Amazon AWS Datacenter Regions

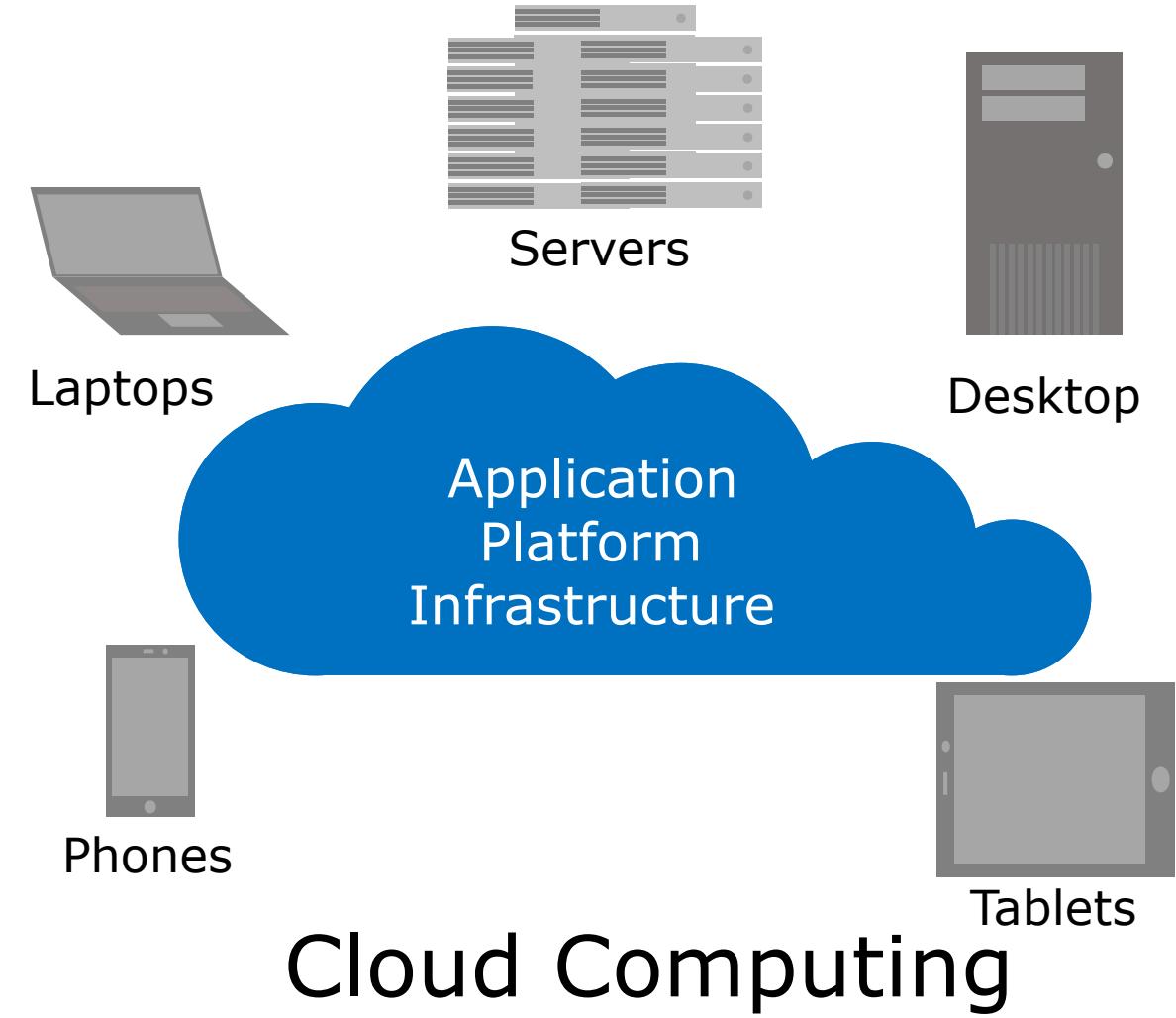


Cloud Computing Examples

- A large enterprise quickly & economically deploys new internal applications to its distributed workforce.
- An e-commerce website accommodates sudden demand for a “hot” product caused by a viral buzz.
- A pharmaceutical research firm executes large-scale simulations using computing power provided by cloud vendors.
- A media company serves unlimited video, music, and other media to their worldwide customer base.

Cloud Computing Nutshell

- End-users connect over the Internet to the cloud from their own personal computers or portable devices in order to access services.
- To the end-user, the underlying infrastructure such as the hardware, operating system, etc., is invisible



Cloud Vendor - Azure & AWS

Microsoft Azure and Amazon Web Services (AWS) offer broad and deep capabilities with global coverage

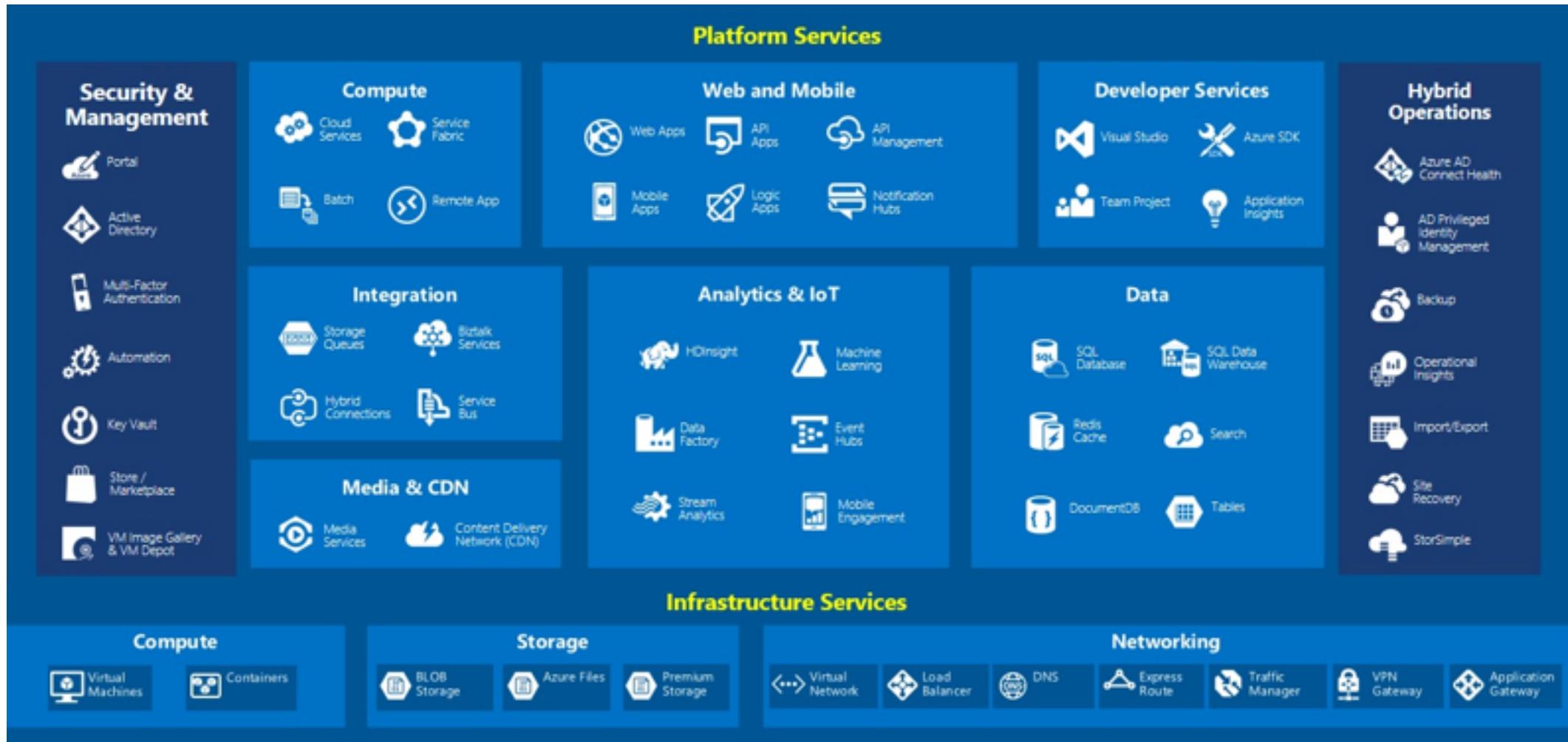
Category	Azure Service	AWS Service
Computing infrastructure	Virtual Machines	EC2
Object storage infrastructure	Blob Storage	S3
Networking	Virtual Network	Virtual Private Cloud
Relational database-as-a-service	SQL Database	RDS
NoSQL document database	DocumentDB	DynamoDB
Big data processing	HDInsight	Elastic MapReduce (EMR)
Visualization	Power BI	QuickSight

Cloud Vendor - Bluemix & Google

IBM Bluemix and Google Cloud each offer and deploy applications on highly-scalable and reliable infrastructure

Category	Bluemix	Google Service
Computing infrastructure	Virtual Server, Containers	Compute Engine
Object storage infrastructure	Object, Block Storage	Cloud Storage
Networking	Virtual Private Network	Cloud Virtual Network
Relational database-as-a-service	SQL Database	Cloud SQL
NoSQL document database	MongoDB	Cloud Datastore, Bigtable
Big data processing	Analytics for Apache Hadoop	BigQuery, Cloud Dataproc
Visualization		

Azure Services



Azure Usage

- Azure Active Directory Users
 - More than 500 Million
- Storage transactions per day
 - More than 777 Trillion
- Messages processed by Azure IoT per month
 - More than 1.5 Trillion
- Active Websites
 - More than 250,000
- Percentage of Fortune 500 Companies using Azure
 - More than 80%
- Authentications per week
 - More than 13 Billion
- SQL Databases in Azure
 - More than 1.5 Million
- Developers registered with Visual Studio Online
 - More than 1 million

Vendor Lock-In

Companies that adopt cloud computing must be wary of potential vendor lock-in issues

- Company's entire data is stored with a single vendor's cloud storage
- Company relies on a single vendor for all of its computations
- Changing vendors can be very costly

Summary

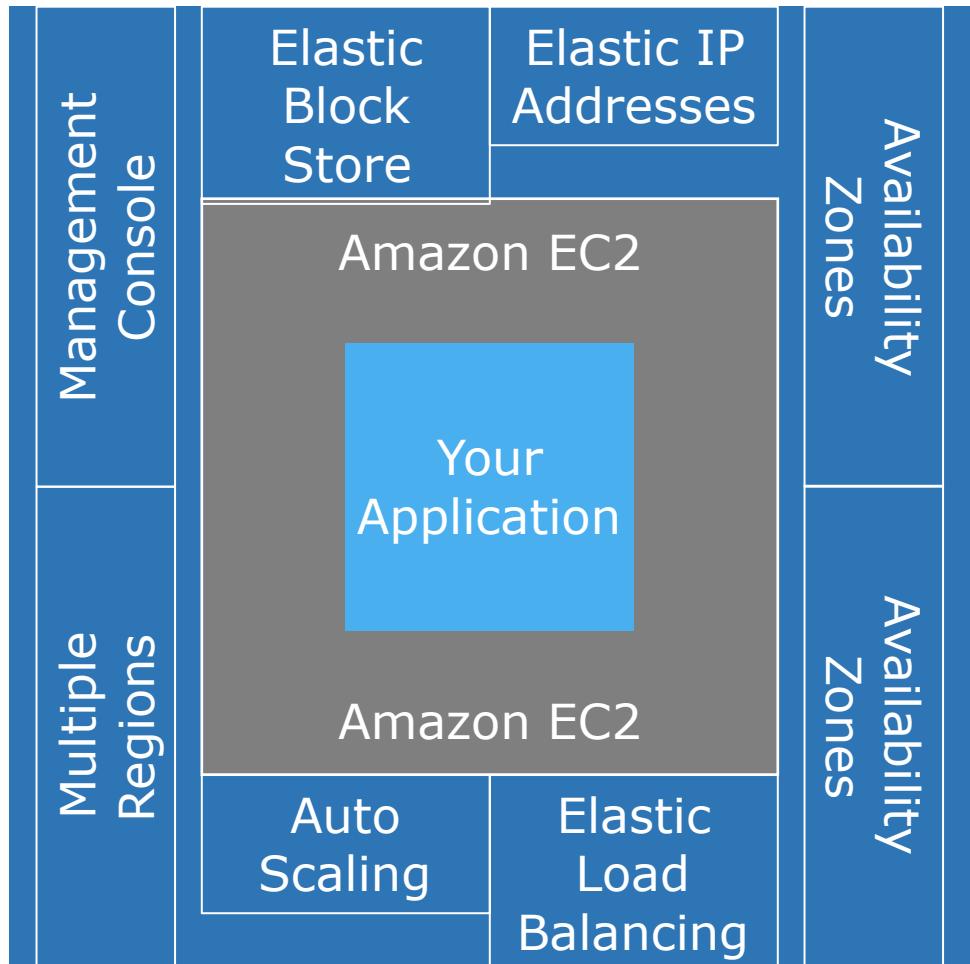
In this lesson, you have learned:

- Cloud Computing
 - Ubiquitous via network access
 - Location-independent shared pool of computing resources
 - On-demand rapid provisioning and tear down
 - Pay only for current client requirements
- Service Models
 - IaaS, PaaS, SaaS
- Deployment Models
 - Public, Private, Community, and Hybrid

Survey of Cloud Computing and Azure Foundation Cloud Computing Services

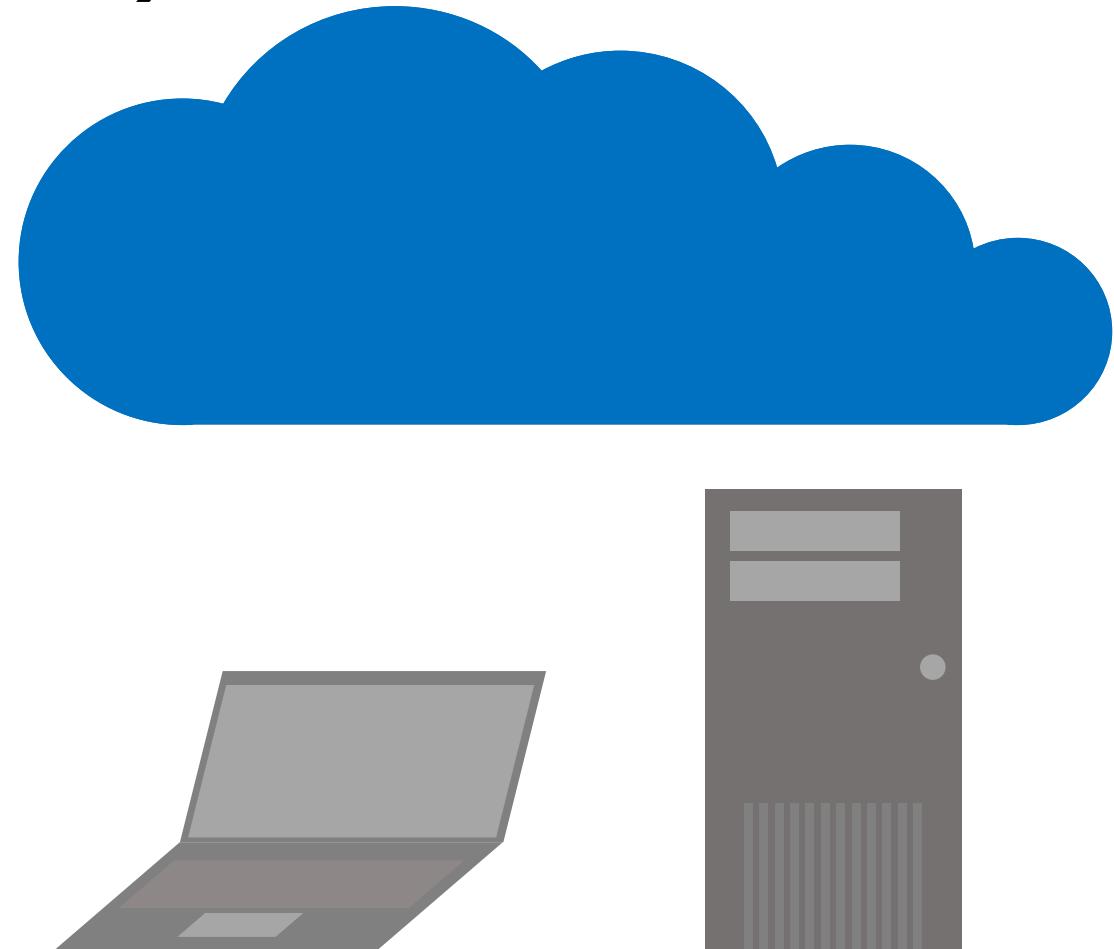
AWS EC2 and S3

- Amazon Elastic Cloud Computing
 - Resizable and elastic compute capacity in the cloud
 - Abundant community images
- Amazon Simple Storage Service
 - Online file storage web service
 - Accessible through REST, SOAP, and BitTorrent
- Elastic load balancing
- Automatic scaling



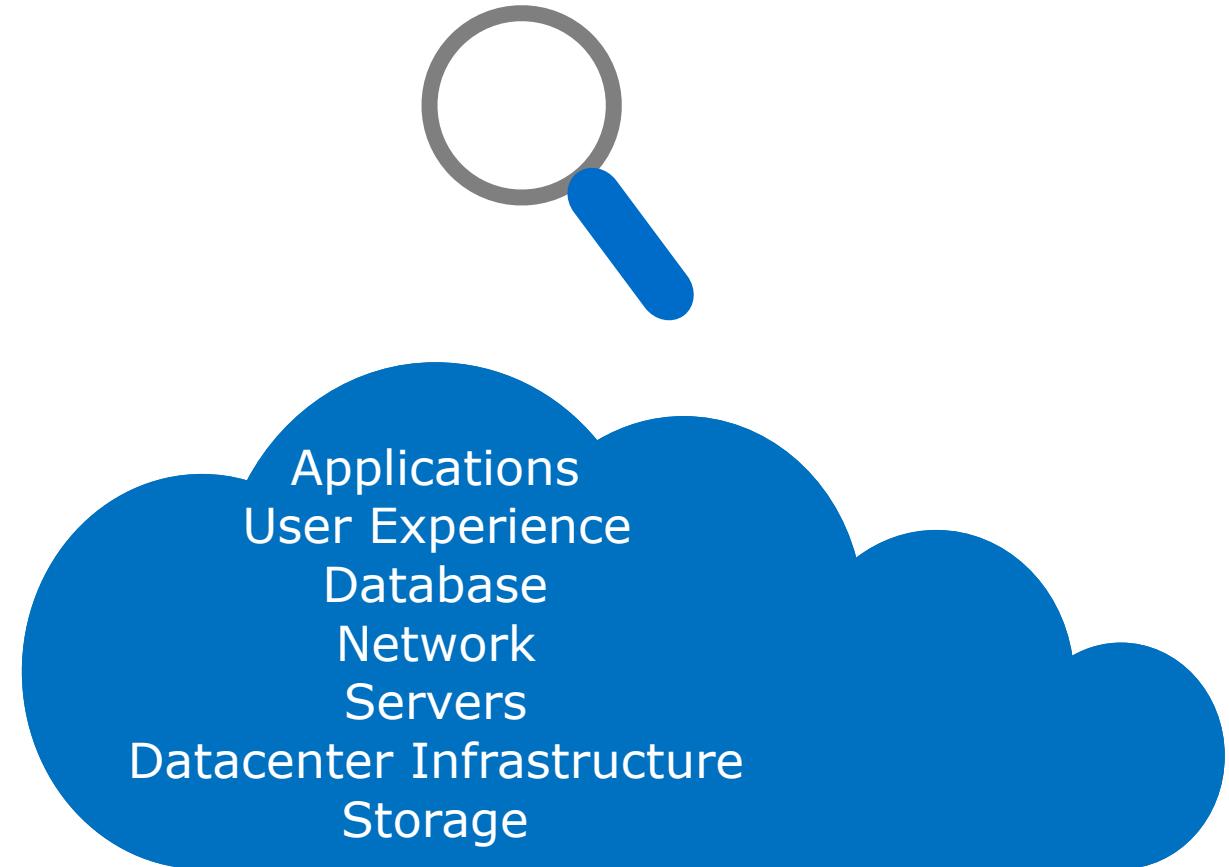
Desktop (as a service) Cloud Service

- Provides and manages a virtual desktops
- Allows smaller companies who find Virtual Desktop Infrastructure (VDI) to be cost prohibitive to deliver similar services
- Quickly deploy new solutions across the entire enterprise located in multiple regions



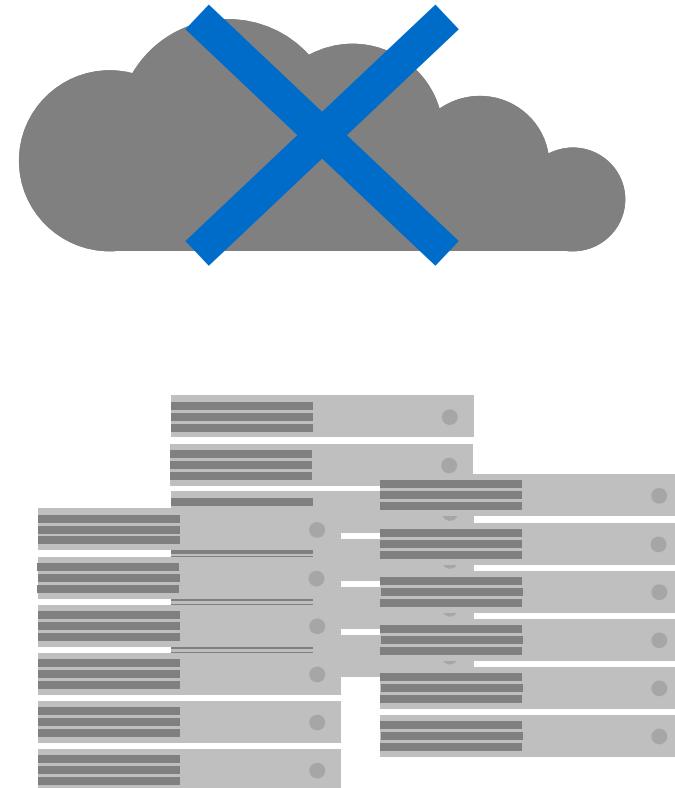
Monitoring (as a service) Cloud Service

- Consists of tools and applications meant to monitor certain aspects of an application, server, system, or any other IT component
- State monitoring is the most common service
 - The state of a component is constantly evaluated and results are displayed in real time



Metal (as a service) Cloud Service

- A bare metal provisioning system to rapidly deploy physical servers
- *Flexibility* of cloud computing with *power* of actual physical servers
- Serves as a layer underneath IaaS



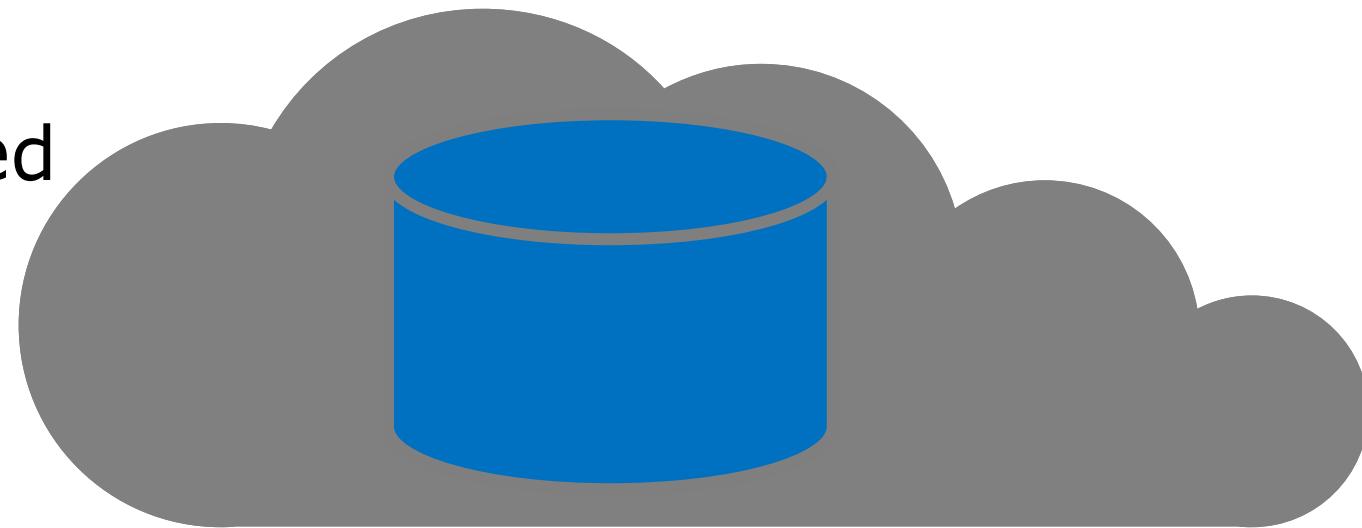
Communication (as a service) Cloud Service

- Includes enterprise communication solutions such as VoIP (Voice over IP), instant messaging (IM) and video conferencing that can be leased
- Vendor is responsible for all hardware and software and offers guaranteed Quality of Service



Database (as a service) Cloud Service

- Cloud-based approach to the storage and management of structured and unstructured data
- Rather than offering raw storage platforms, this service offers functionality of database platforms such as SQL Server, MySQL, Oracle, and NoSQL



Survey of Cloud Computing and Azure Foundation

Services in Azure

Topics

What is Microsoft Azure?

Virtual Machines

Cloud Services

App Service

Modules of Azure Service

What is the Azure Portal?

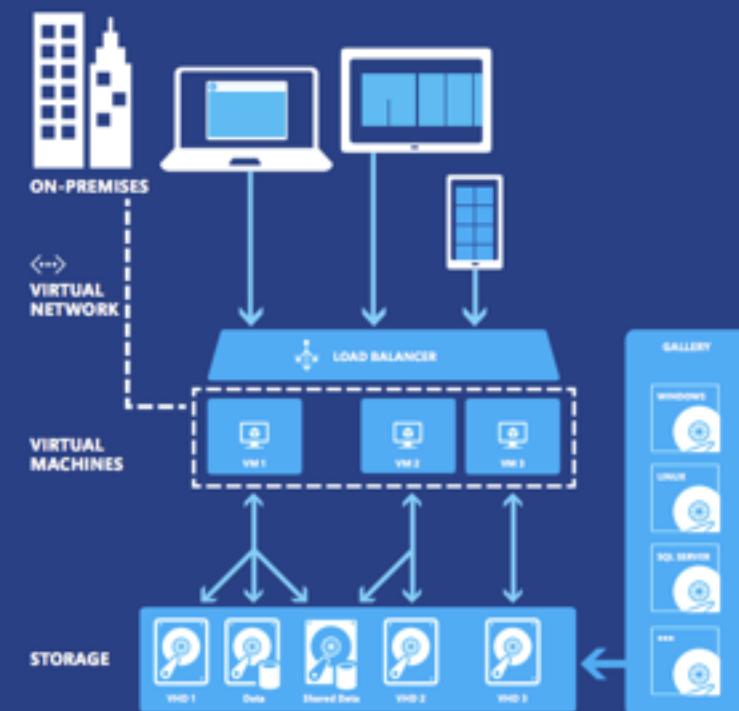
What is Microsoft Azure?

Azure is a flexible, open, and secure public and hybrid cloud

Virtual Machines

VMs are basic cloud building blocks. Get full control over a virtual machine with virtual hard disks. Install and run software yourself.

Configure multiple machines with different roles to create complex solutions. VMs are nearly identical to conventional (real) servers, and are the easiest way to move existing workloads to the cloud.



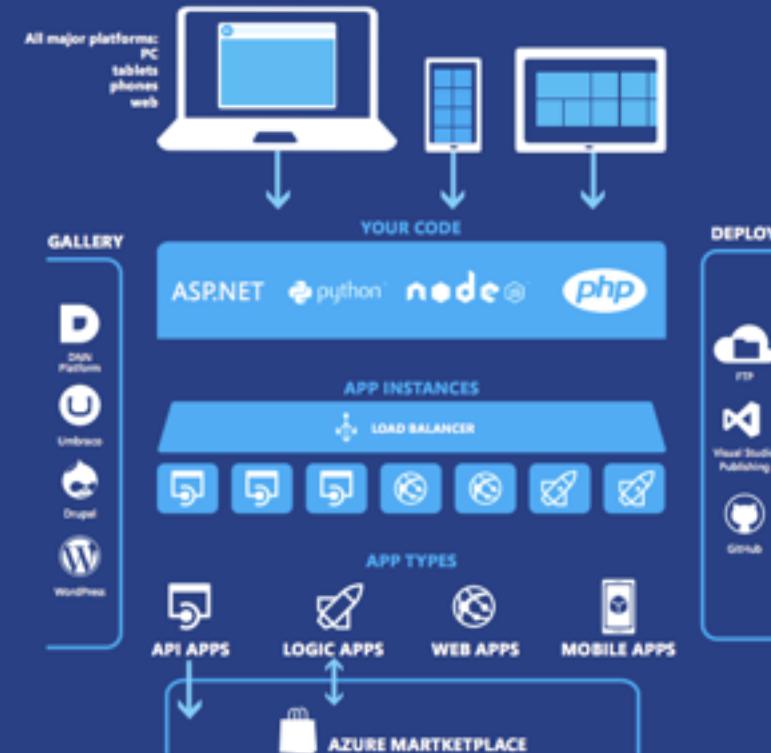
Cloud Services

Easily access and manage these general-purpose VMs. We maintain and update each VM as needed with system updates. You configure the VM size as needed, and scale out as many copies as needed. Two types of VMs: worker roles and web roles—worker roles are made for computing and running services. The web role is simply a worker role with IIS already installed and configured.



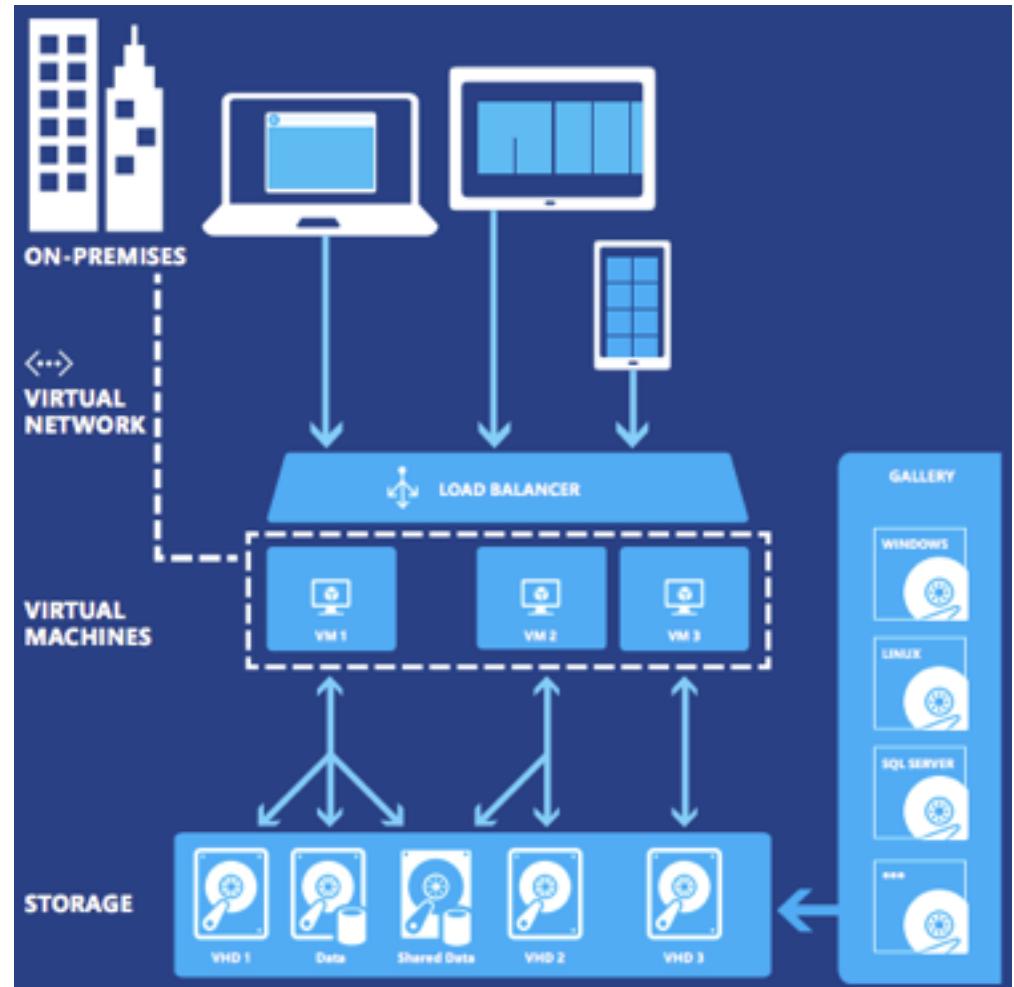
App Service

Azure App Service is a high productivity solution for developers who need to create enterprise-grade web and mobile app experiences. App Service provides a complete platform as a service solution that enables you to deploy and elastically scale applications in the cloud, and seamlessly integrate them with on-premises resources and SaaS-based applications.



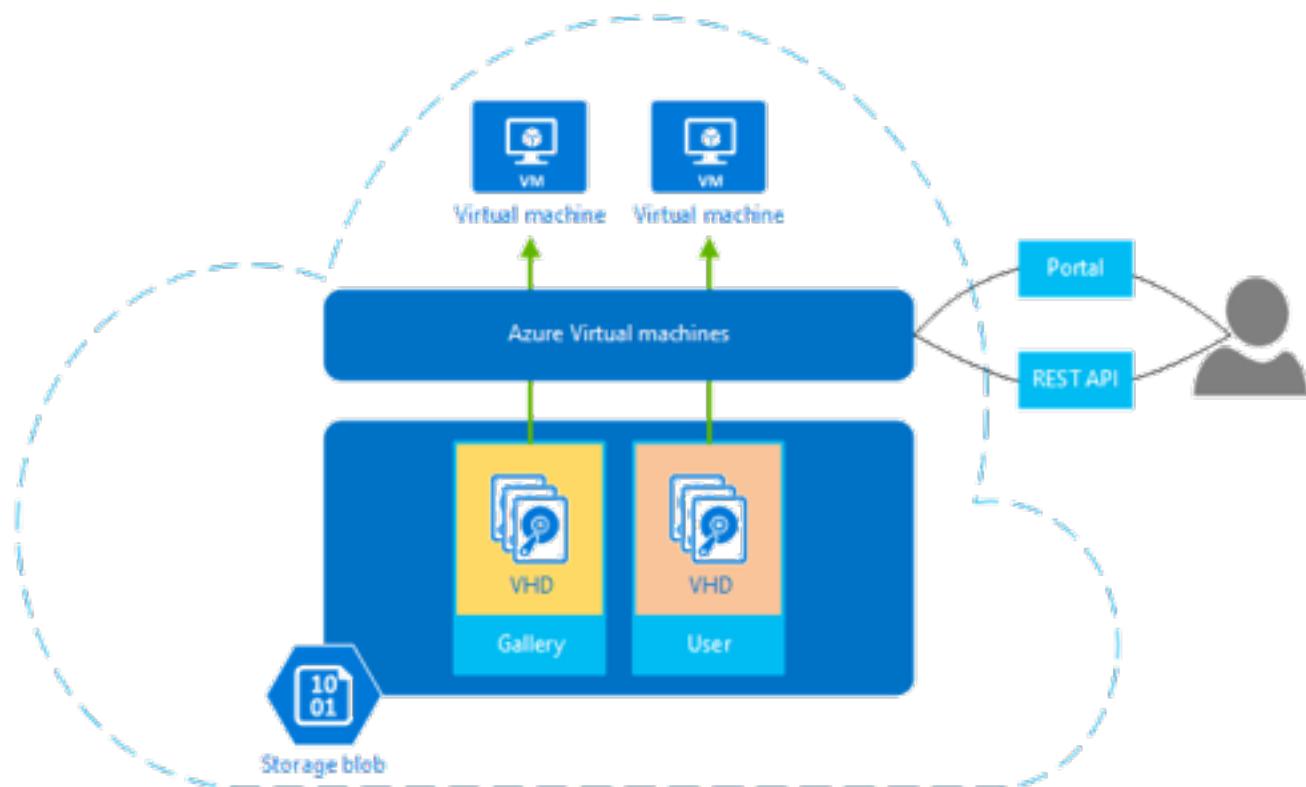
Virtual Machines

- Basic cloud building blocks
- Full control over virtual machines
- Install and run user applications
- Gallery of VM images available



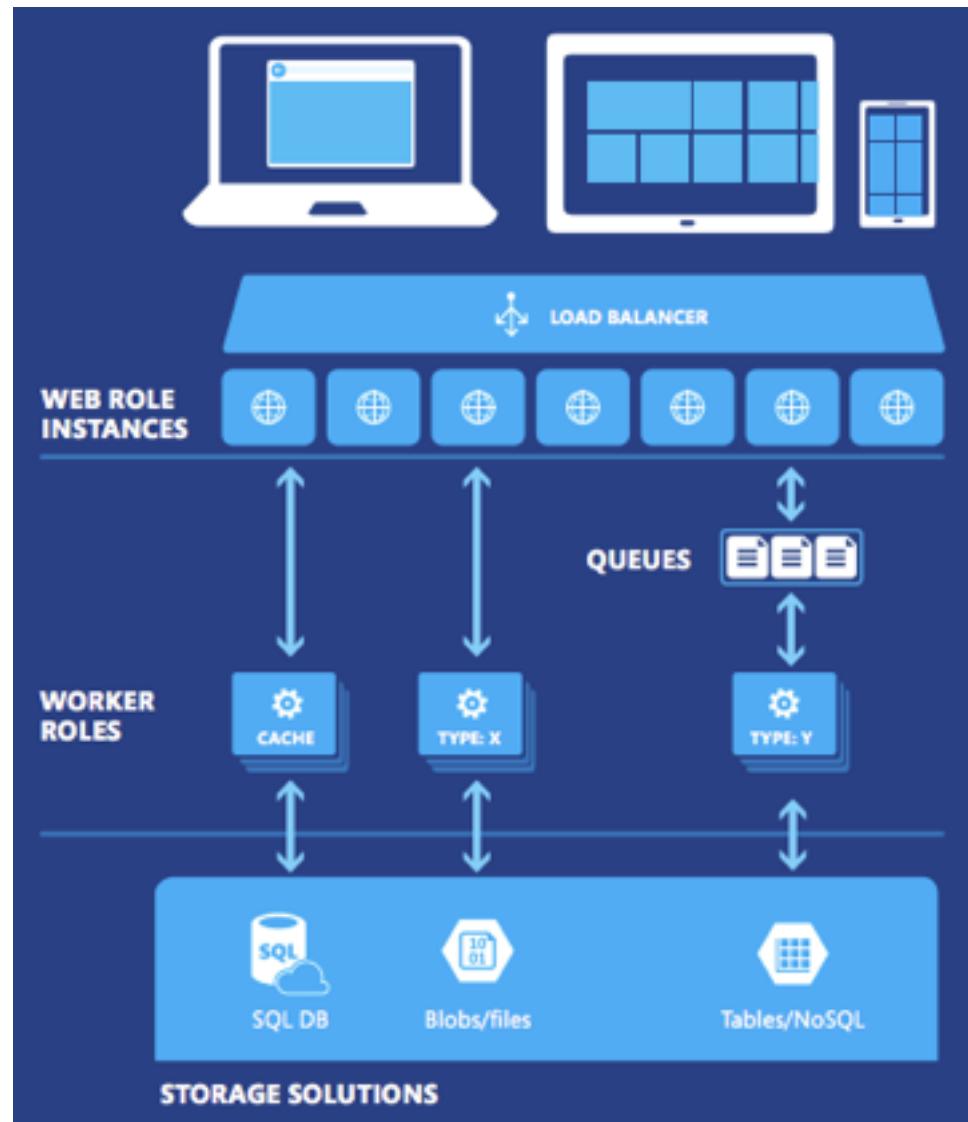
Azure Virtual Machines – IaaS

- IaaS Service
- VHD (Virtual Hard Disk) for persistent storage
- Different types of VMs can be configured together to provide complex solutions



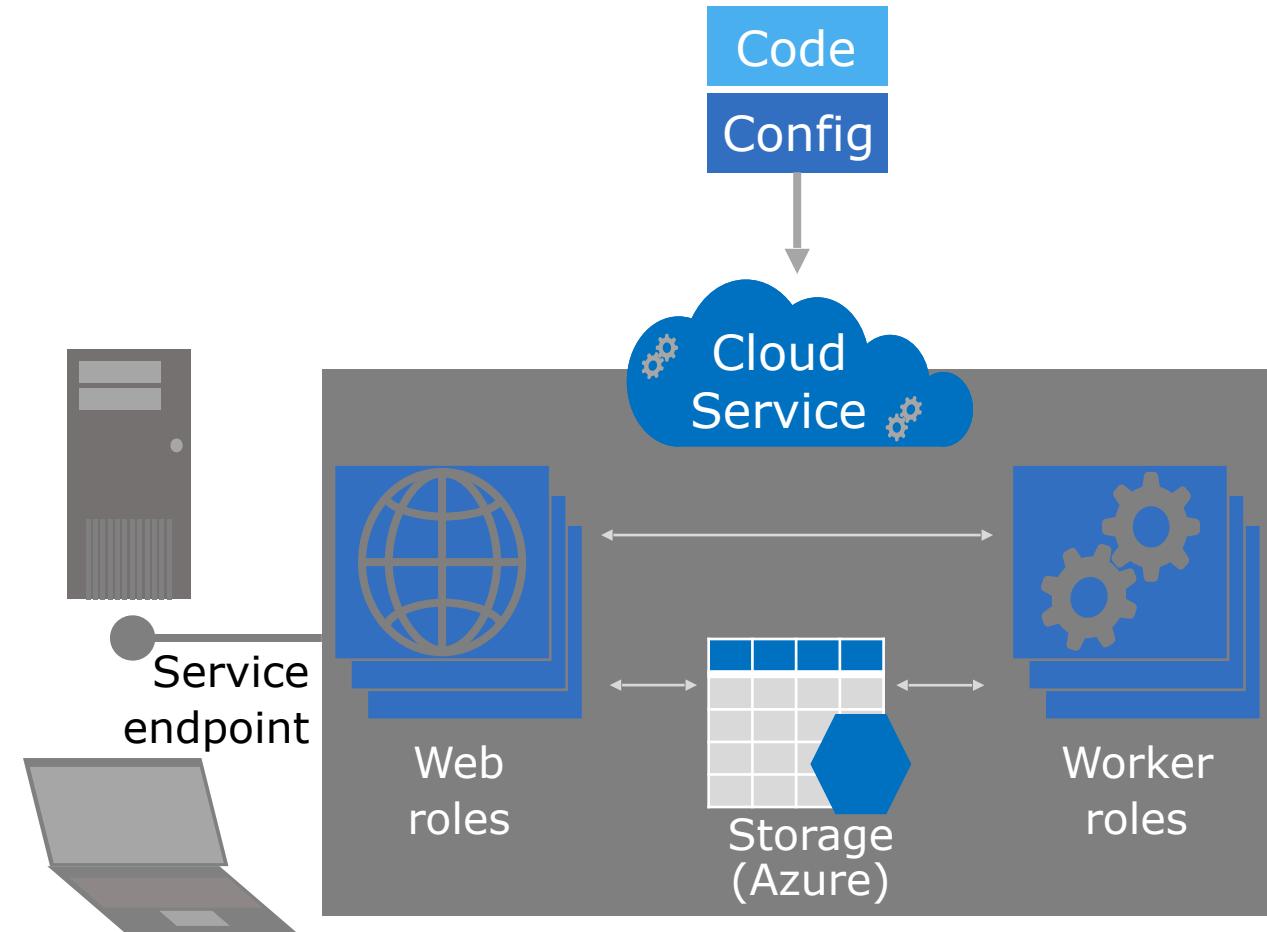
Cloud Service

- General purpose VMs available to user
- Users configure size of VM to fit their needs
- Vendor maintains VM with system update



Cloud Services - PaaS

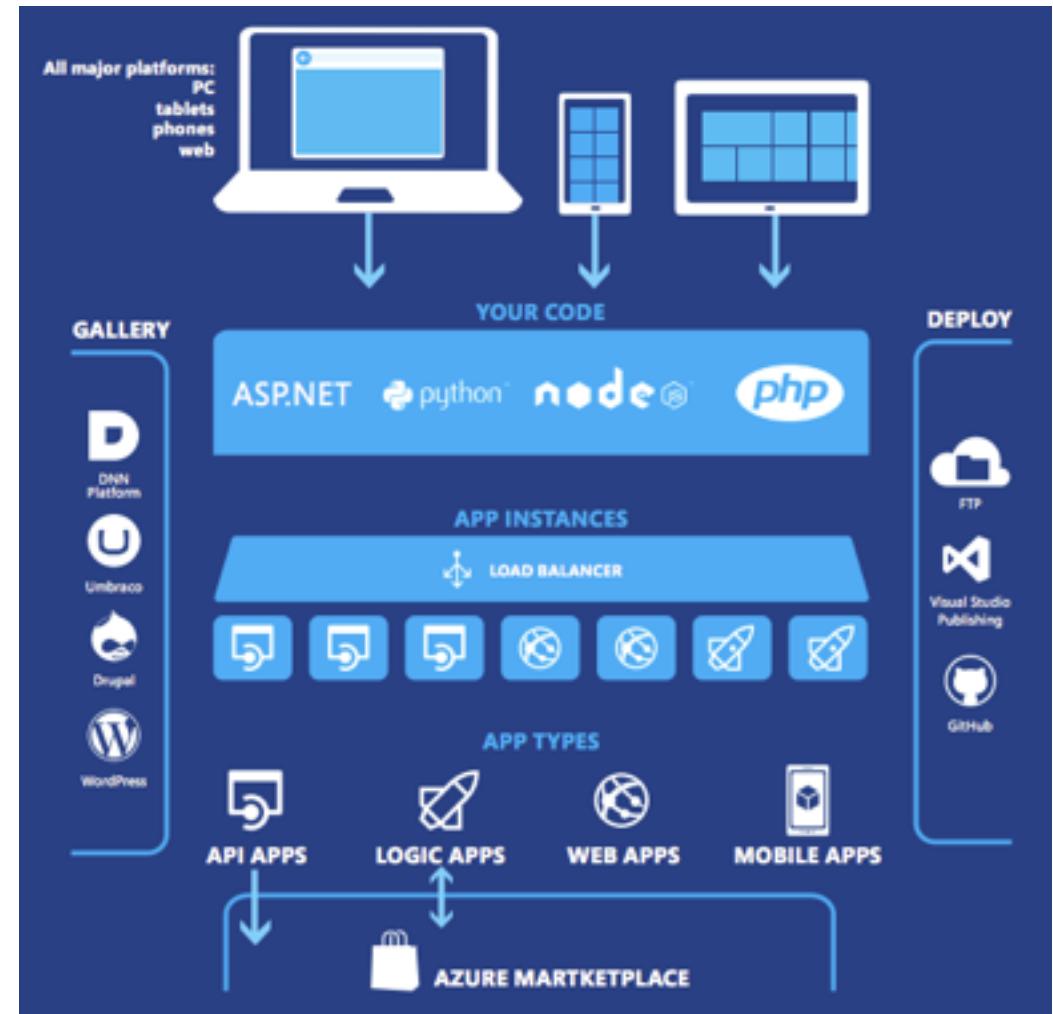
- PaaS service
- More flexibility over VMs than App Services
- Multiple worker role and/or web role VMs allowed for single application
- Single service access point for application end-user



App Service

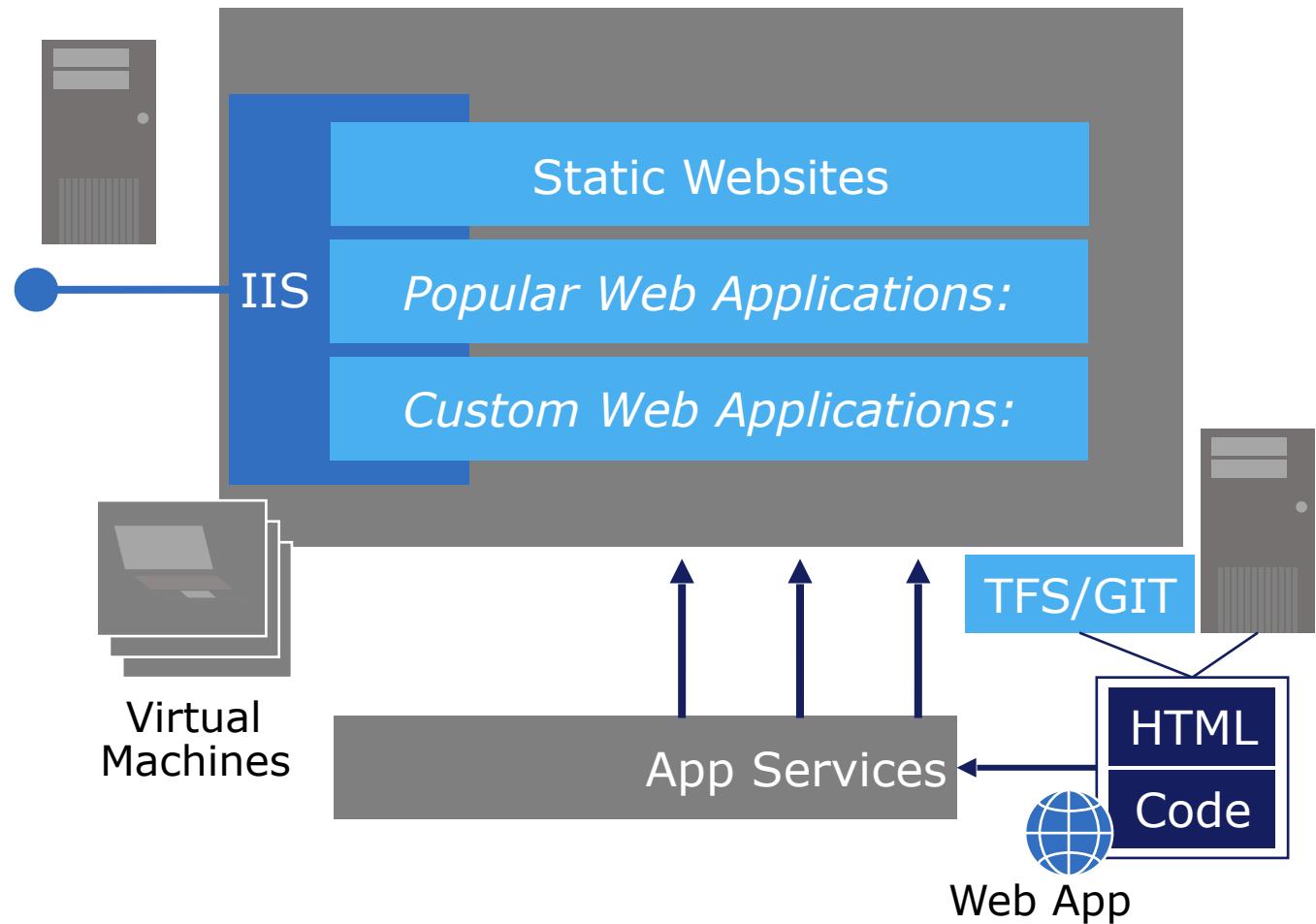
Features

- Multiple languages and frameworks
- Global scale with high availability
- Connections to SaaS platforms and on-premises data
- Security and compliance
- Application Templates
- DevOps optimization



App Service - PaaS

- PaaS service
- Optimal for quick web and mobile apps development
- Popular web apps – Drupal, Wordpress, etc.
- Custom web apps – ASP.NET, PHP, Node.js, etc
- Integration with SAP, Oracle EBS, SQL Server, and PeopleSoft via BizTalk Services



Why App Service - Web Apps?

- Services optimized to rapidly build, deploy and manage enterprise grade websites
- Jump-start using large list of existing templates
- Automatically scale depending on usage and traffic
- Integration and versioning with Visual Studio Team system, Github, TeamCity, Hudson or BitBucket
- Tools for staged deployment and verification
- Easy connection and access to on-premises data



Web Apps

Other Options

Azure also offers other compute hosting models for more specialized purposes

Model	Description
Mobile	Optimized to provide a cloud back-end for apps that run on mobile devices.
Batch	Optimized for processing large volumes of similar tasks, ideally workloads which lend themselves to running as parallel tasks on multiple computers.
HDInsight (Hadoop)	Optimized for running MapReduce jobs on Hadoop

Azure Service Modules - 1

Azure provides a broad collection of integrated services

Compute	Web and Mobile	Data and Storage	Analytics
Virtual Machines	App Service	DocumentDB	HDInsight
Cloud Services	Logic Apps	SQL Database	Machine Learning
Batch	Web Apps	Redis Cache	Data Factory
RemoteApp	Mobile Services	Storage	Data Catalog
Service Fabric	API Management	StorSimple	Data Lake Store
Azure Container Service	Mobile Engagement	Search	Data Lake Analytics
		SQL Data Warehouse	
		SQL Server Stretch Database	

Azure Service Modules - 2

Azure provides a broad collection of integrated services

Networking	Media and CDN	Hybrid Integration	Identity and Access Management
Virtual Network ExpressRoute Application Gateway Traffic Manager Azure DNS Load Balancer VPN Gateway	Media Services Content Delivery Network	BizTalk Services Service Bus Backup Site Recovery	Azure Active Directory Multi-Factor Authentication Azure Active Directory Domain Services Azure Active Directory B2C

Azure Service Modules - 3

Azure provides a broad collection of integrated services

Developer	Management	Intelligence	Internet of Things
Visual Studio Application Insights Azure DevTest Labs	Key Vault Scheduler Automation Log Analytics Security Center	Cognitive Services	Machine Learning Stream Analytics Push Notification Event Hubs Internet of Things Azure IoT Hub

Popular Products in Azure

Virtual Machines



Provision Windows and Linux Virtual
Machines in minutes

App Service



Create web and mobile apps for any
platform and any device

SQL Database



Managed relational SQL Database-as-a-
service

Storage



Durable, highly available and massively
scalable cloud storage

Cloud Services



Create highly available, infinitely scalable
cloud applications and APIs

DocumentDB



Managed NoSQL document database-
as-a-service

Azure Active Directory



Synchronize on-premises directories and
enable single sign-on

Backup

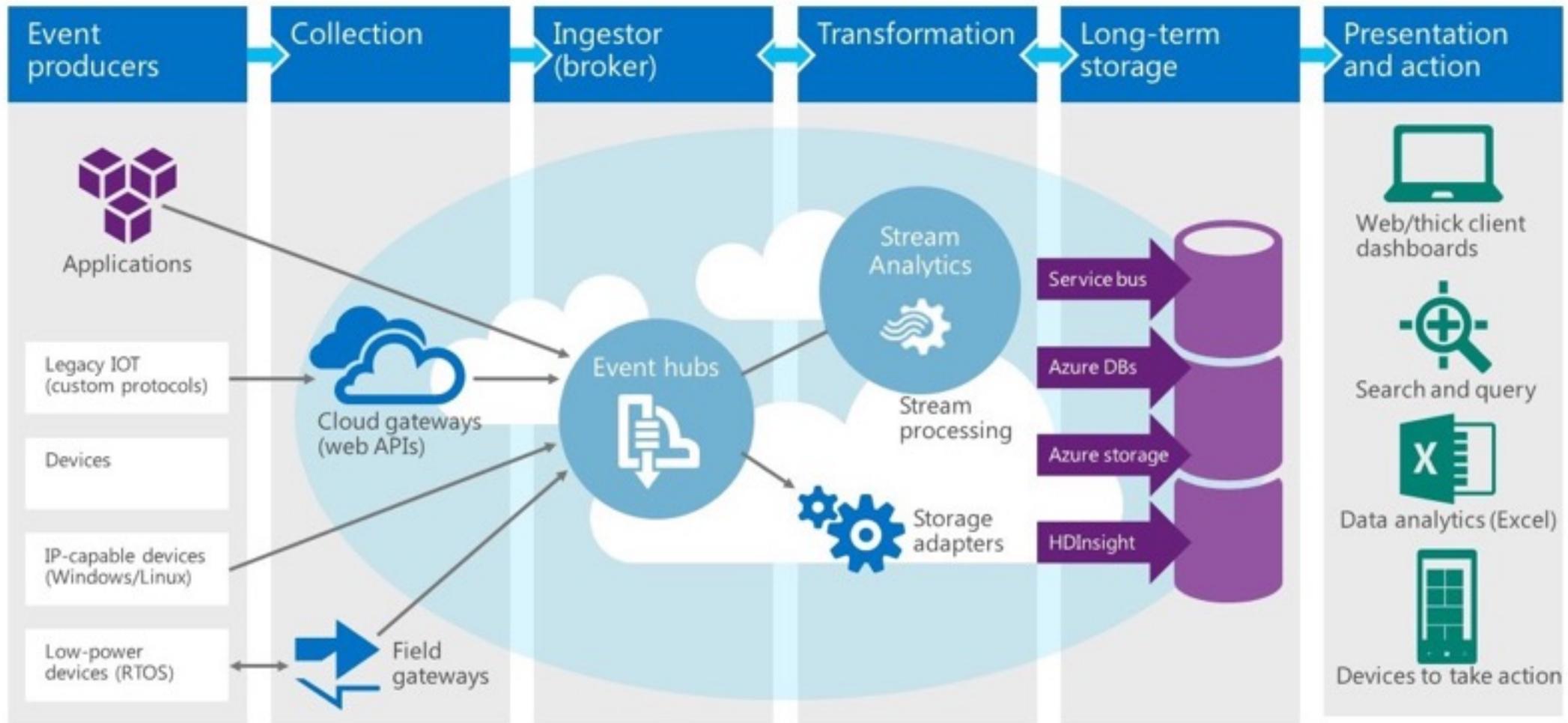


Simple and reliable server backup to the
cloud

NoSQL vs. SQL DB

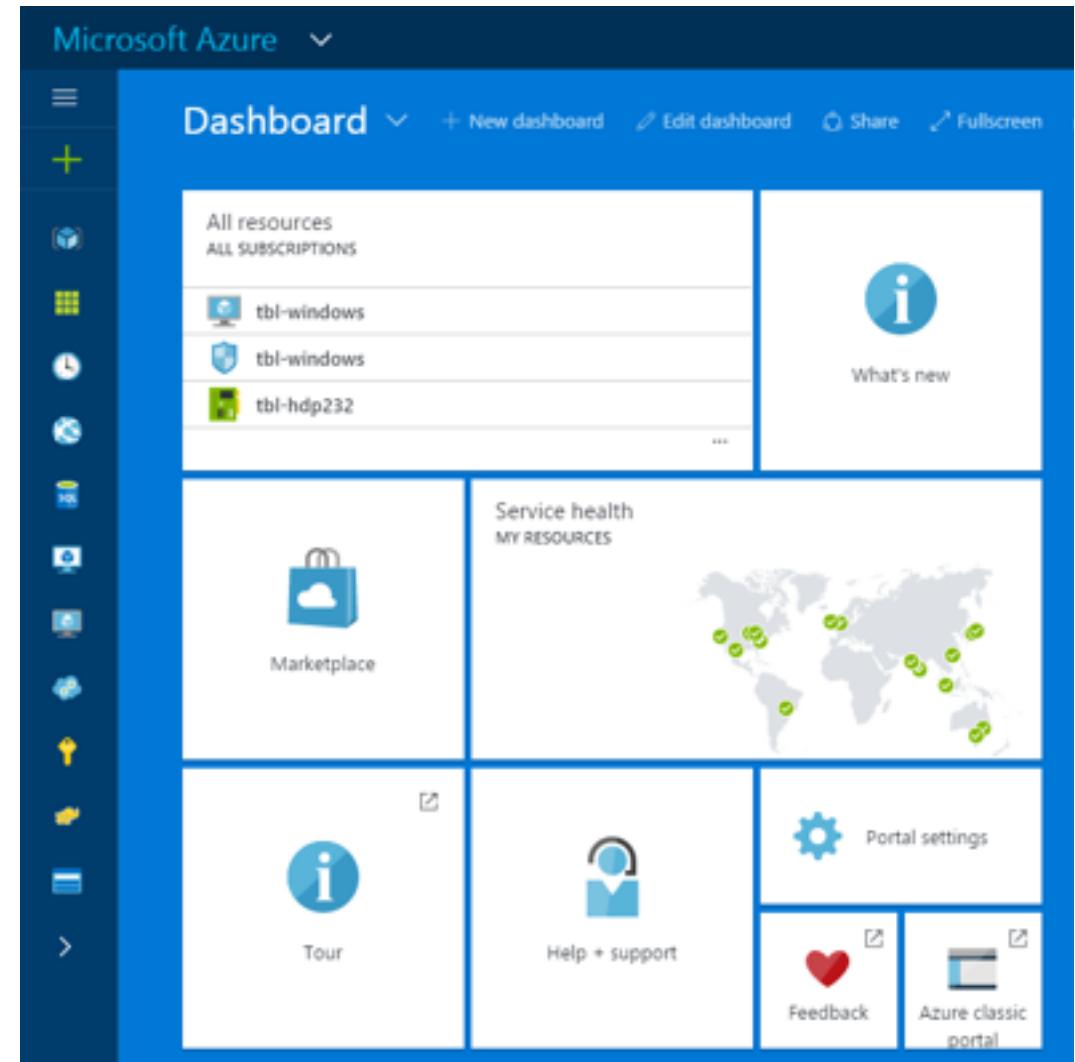
	NoSQL	SQL
Model	Non-relational – Stores data in JSON documents, key/value pairs, wide column stores, or graphs	Relational – Stores data in a table
Data	Offers flexibility as not every record needs to store the same properties. Good for semi-structured data.	Great for solutions where every record has the same properties. Good for structured data.
Schema	Dynamic or flexible schemas – database is schema-agnostic and the schema is dictated by the application. This allows for agility and highly iterative development.	Strict schema – Schema must be maintained and kept in sync between application and database
Transactions	ACID transaction support varies per solution.	Supports ACID transactions.
Consistency	Consistency varies per solution, some solutions have tunable consistency	Strong consistency supported.

Azure Services Work Together

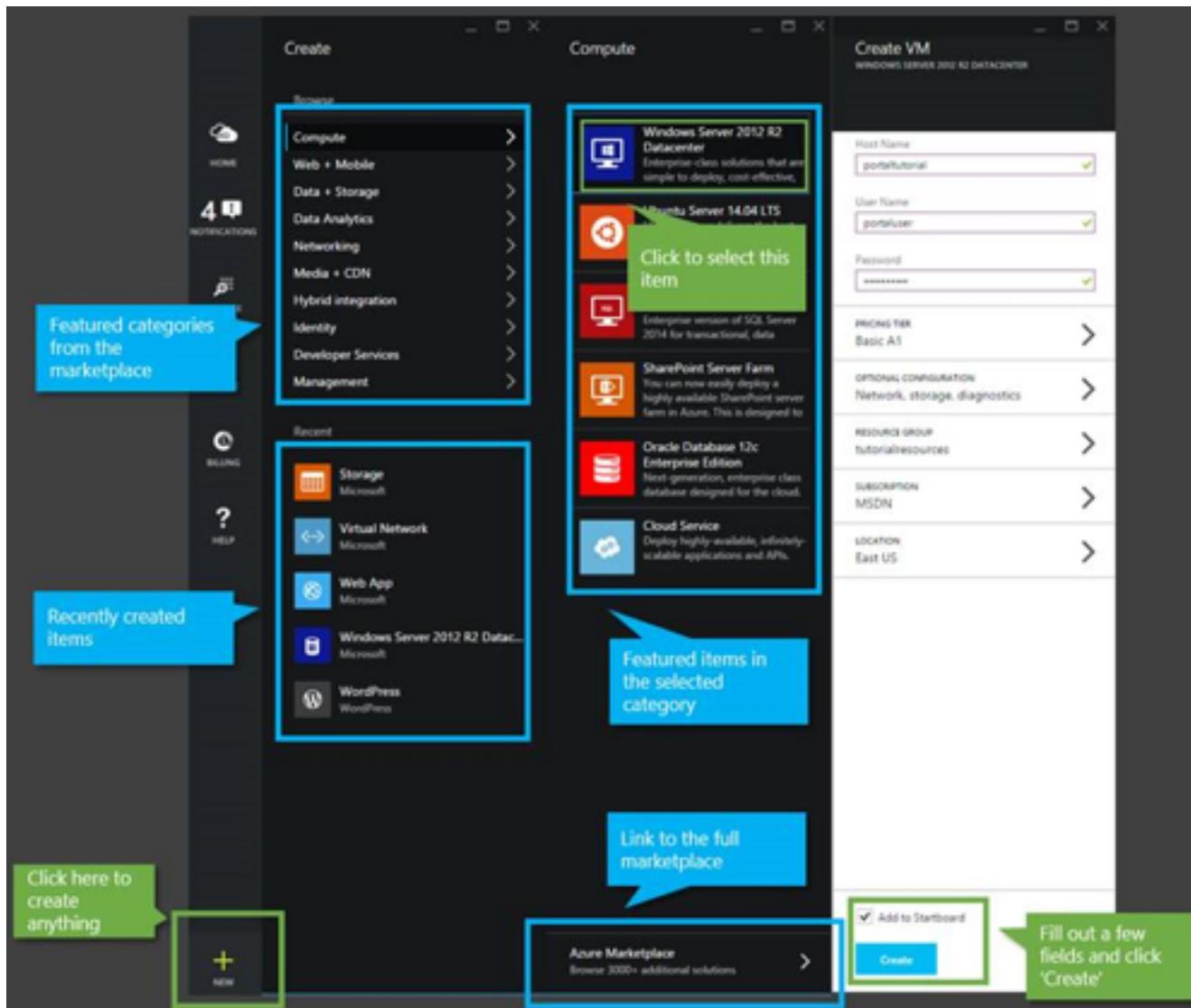


Access Services Through Azure Portal

- The Microsoft Azure portal is the central location where Azure resources and services are provisioned and managed
- Marketplace for solutions
- Customized start screen



Creating a Resource in Azure Portal



Role-Based Access Control in Azure Portal

Azure Role-Based Access Control (RBAC) enables fine-grained access management for Azure.

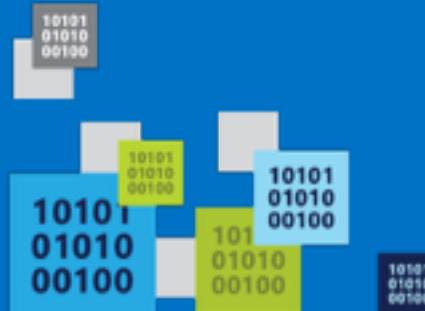
- Built-in roles
 - Owner has full access to all resources including the right to delegate access to others.
 - Contributor can create and manage all types of Azure resources but can't grant access to others.
 - Reader can view existing Azure resources.

Summary

In this lesson, you have learned:

- Key capabilities in Microsoft Azure
 - Virtual Machines
 - Cloud Services
 - App Service
- Modules of Azure Service
- How Azure portal service is utilized

Building Cloud Solutions



Host your applications on Azure



Infrastructure as a
Service
IaaS

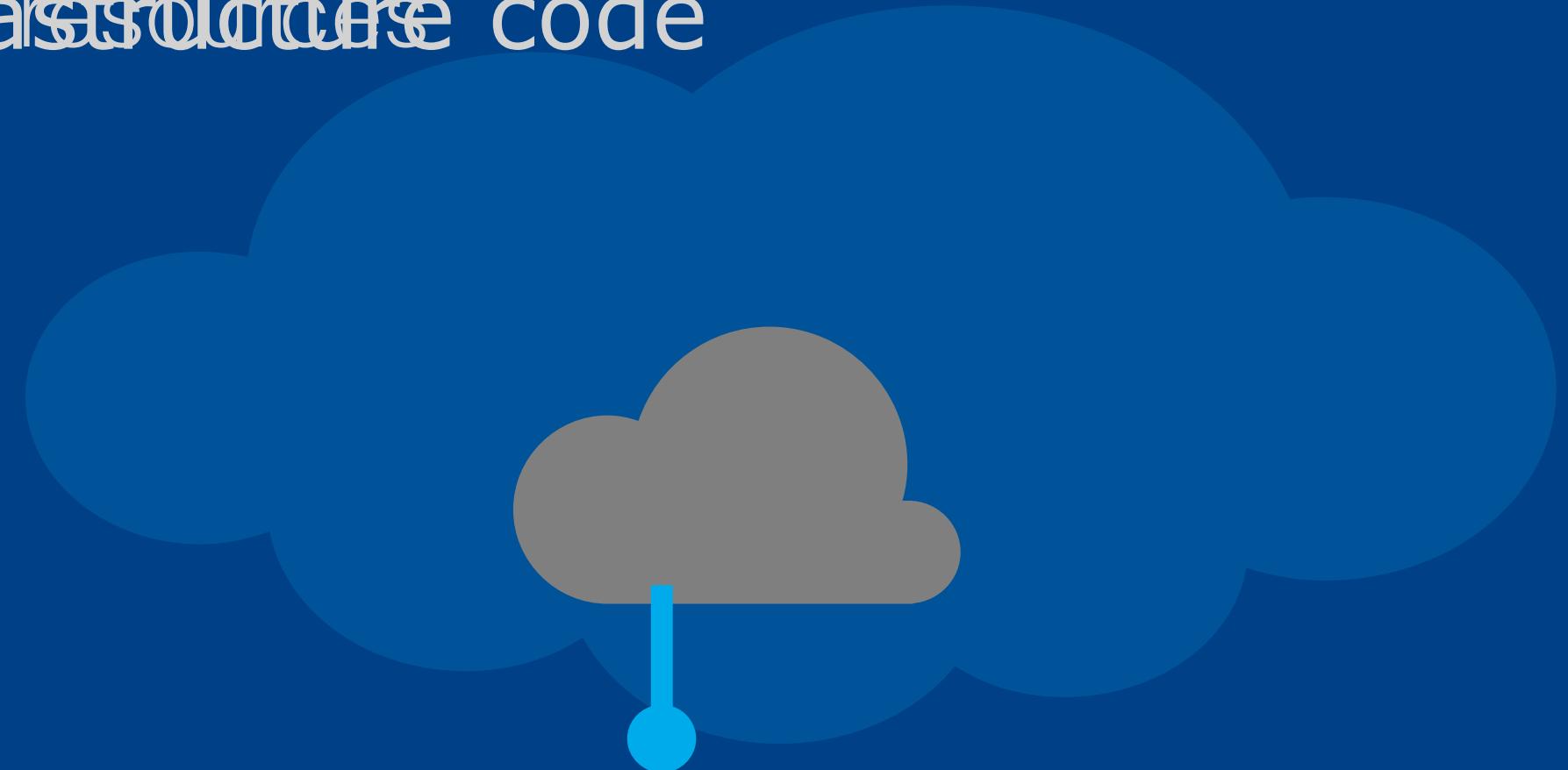


Platform as a Service
PaaS



Your service

- → Your application code
- ~~Requiring datasets or source code~~



Speed to market



Automation Innovation
Reduced cycle time Elasticity

Versioning environments

Continuous Deployment

Continuous Improvements

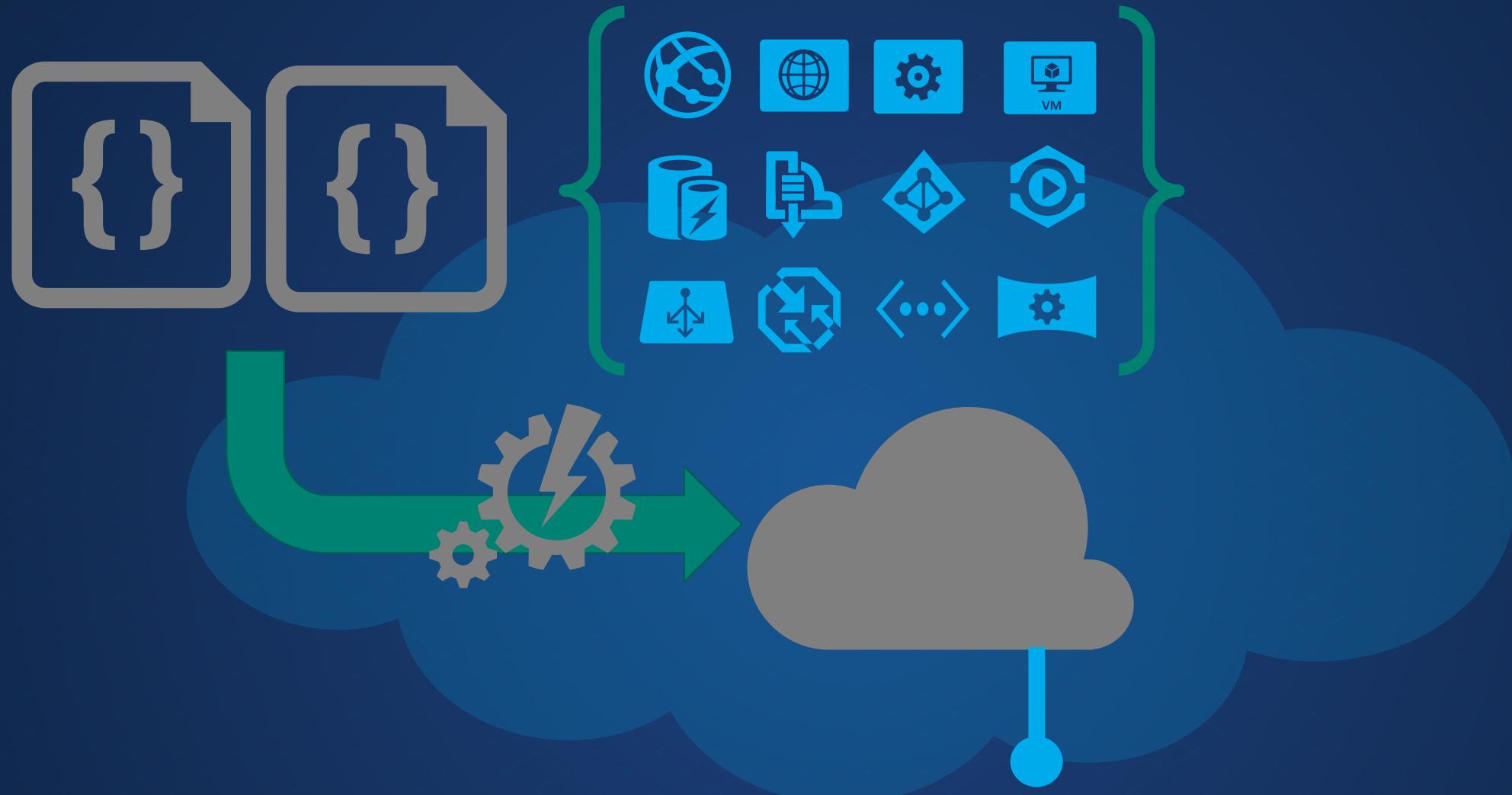


Feed QoS

Agility

Growth Insights back TCO

Availability



You: Code (application, infrastructure)
Azure: Resources (IaaS, PaaS, SaaS)



Tools

Microsoft Azure

Command Line

Visual Studio

Consistent
Management
Layer

SERVICE MANAGEMENT API

RESOURCE MANAGER



Cloud +

On-Premises

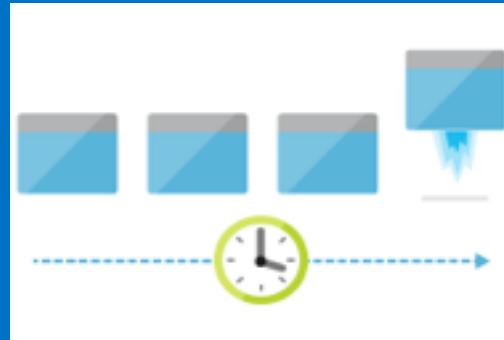


ADFS
AAD

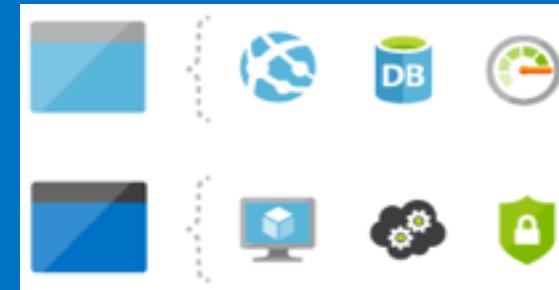
RESOURCE PROVIDER CONTRACT

Provider
Rest Points





Deploy



Organize



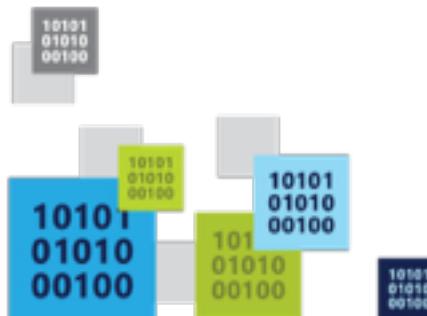
Control

- Deploy application lifecycle container with repeatable declarative model based template
- Organize resources by environment, role, department and user responsibility
- Control and monitor resources through RBAC, centralized audit and resource lock

Cloud Services

Cloud Services

- Focus on your application
- Scalability, availability and reliability
- Monitoring and diagnostics

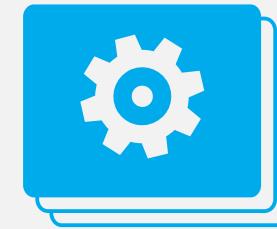


What is a Cloud Service?

A container of related service roles



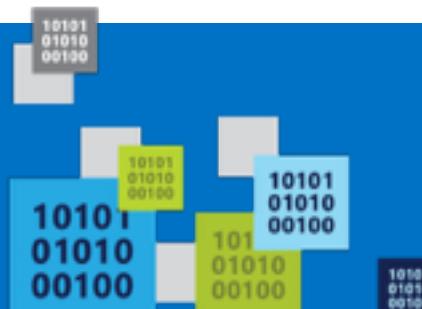
Web Roles



Worker Roles



VMs



How do roles communicate?

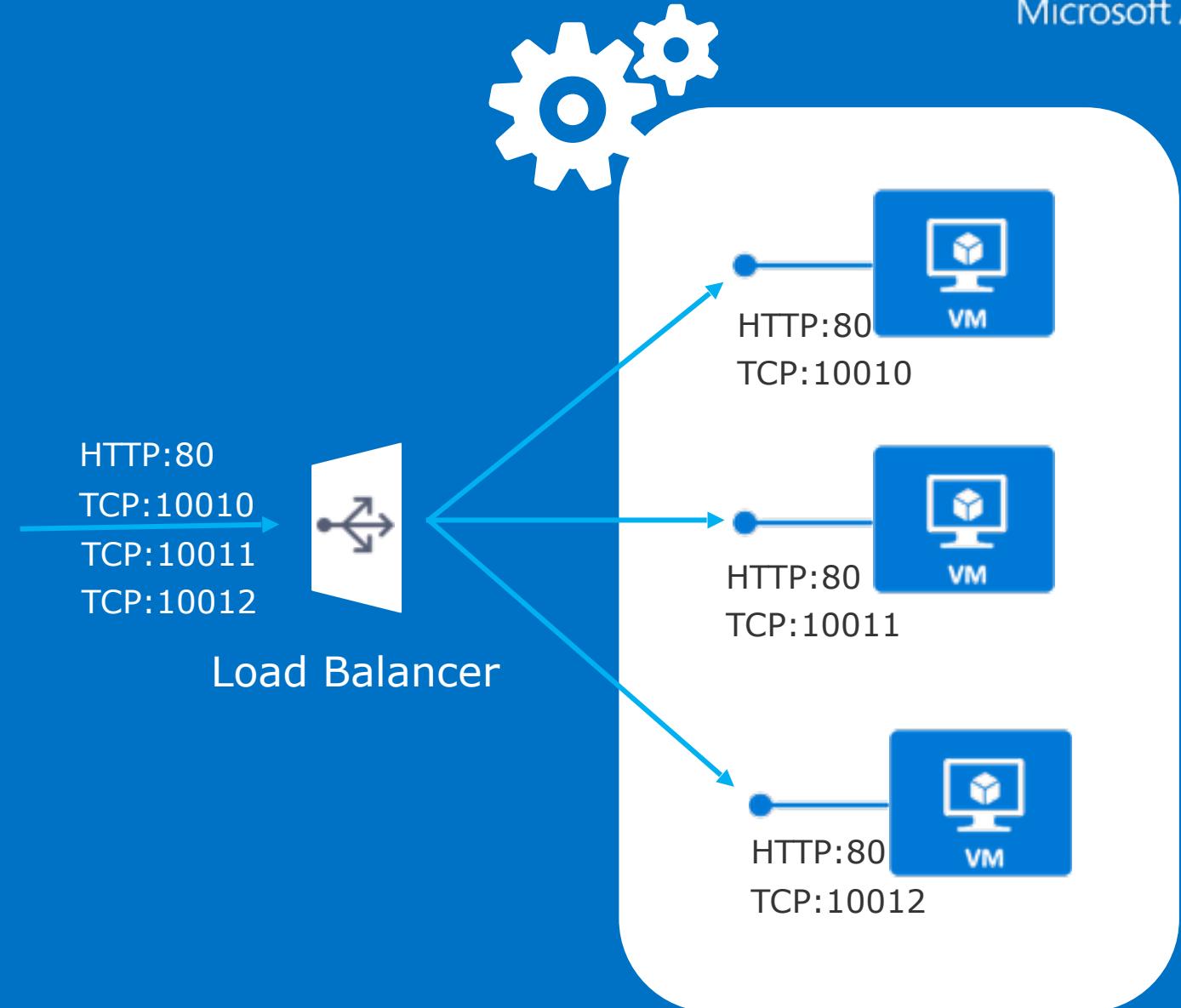
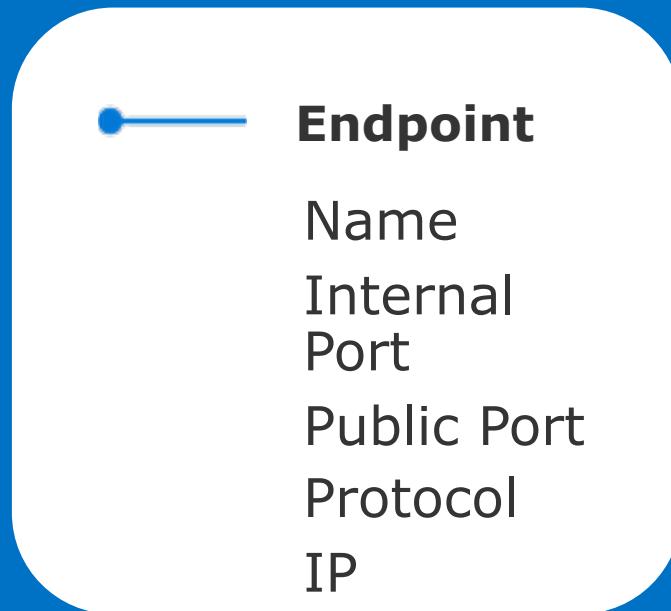
- Public endpoints
Publicly accessible, load balanced
- Internal endpoints
Private to cloud service, not load balanced
- Instance Input endpoints
Address individual instance



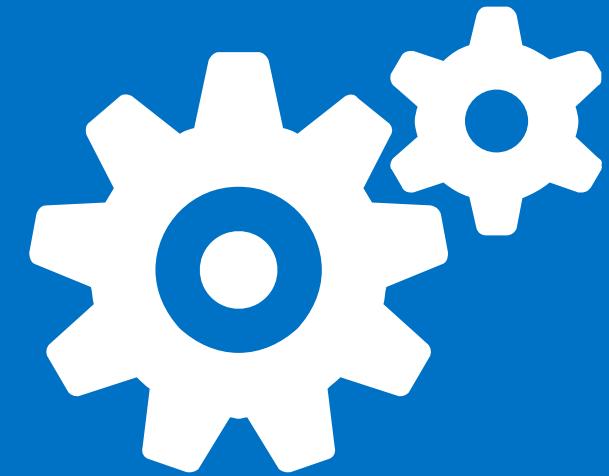
Microsoft Azure

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Microsoft



Worker Role



Web Role

All features of a worker role + IIS 7, 7.5 or IIS 8.0*

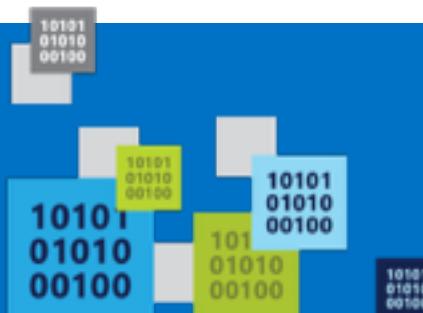
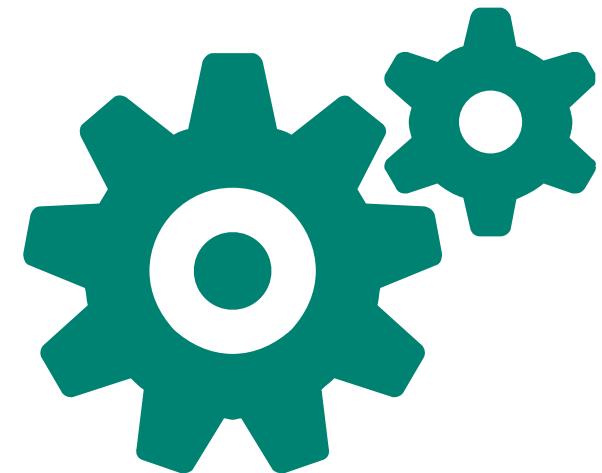
- All features of a worker role + IIS 7, 7.5 or IIS 8.0*
- ASP.NET 3.5 SP1, 4.0 or 4.5* – 64bit
- Hosts
 - Webforms or MVC
 - FastCGI applications (e.g. PHP)
 - Multiple Websites
- Http(s)
- Web/Worker Hybrid
 - Can optionally implement RoleEntryPoint 2012



*with Windows Server

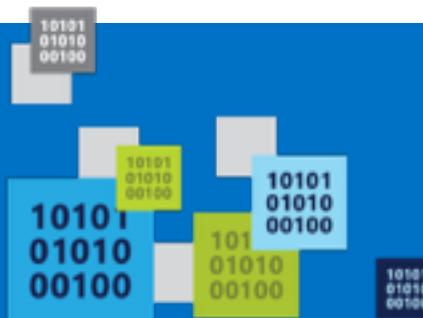
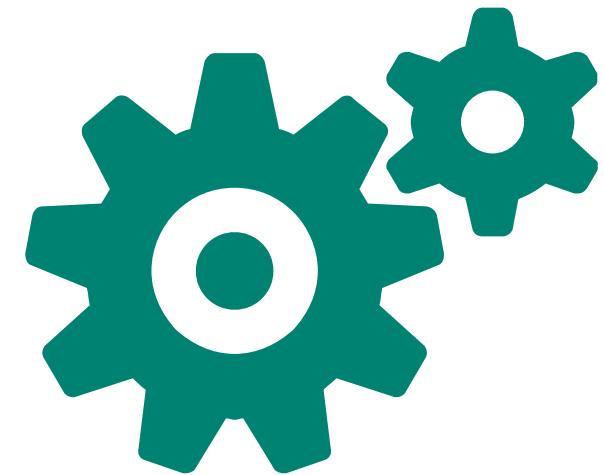
Worker Role Patterns

- Queue Polling Worker
 - Poll and Pop Messages within while(true) loop
 - E.g. Map/Reduce pattern, background image processing
- Listening Worker Role
 - Create TcpListener or WCF Service Host
 - E.g. Run a .NET SMTP server or WCF Service



Worker Role Patterns

- External Process Worker Role
 - OnStart or Run method executes `Process.Start()`
 - Startup Task installs or executes background/foreground process
- Custom Role Entry Point (executable or .Net assembly)
- E.g. Run a database server, web server, distributed cache



Roles and Instances

Roles are defined in a Hosted Service

A role definition specifies:

VM size

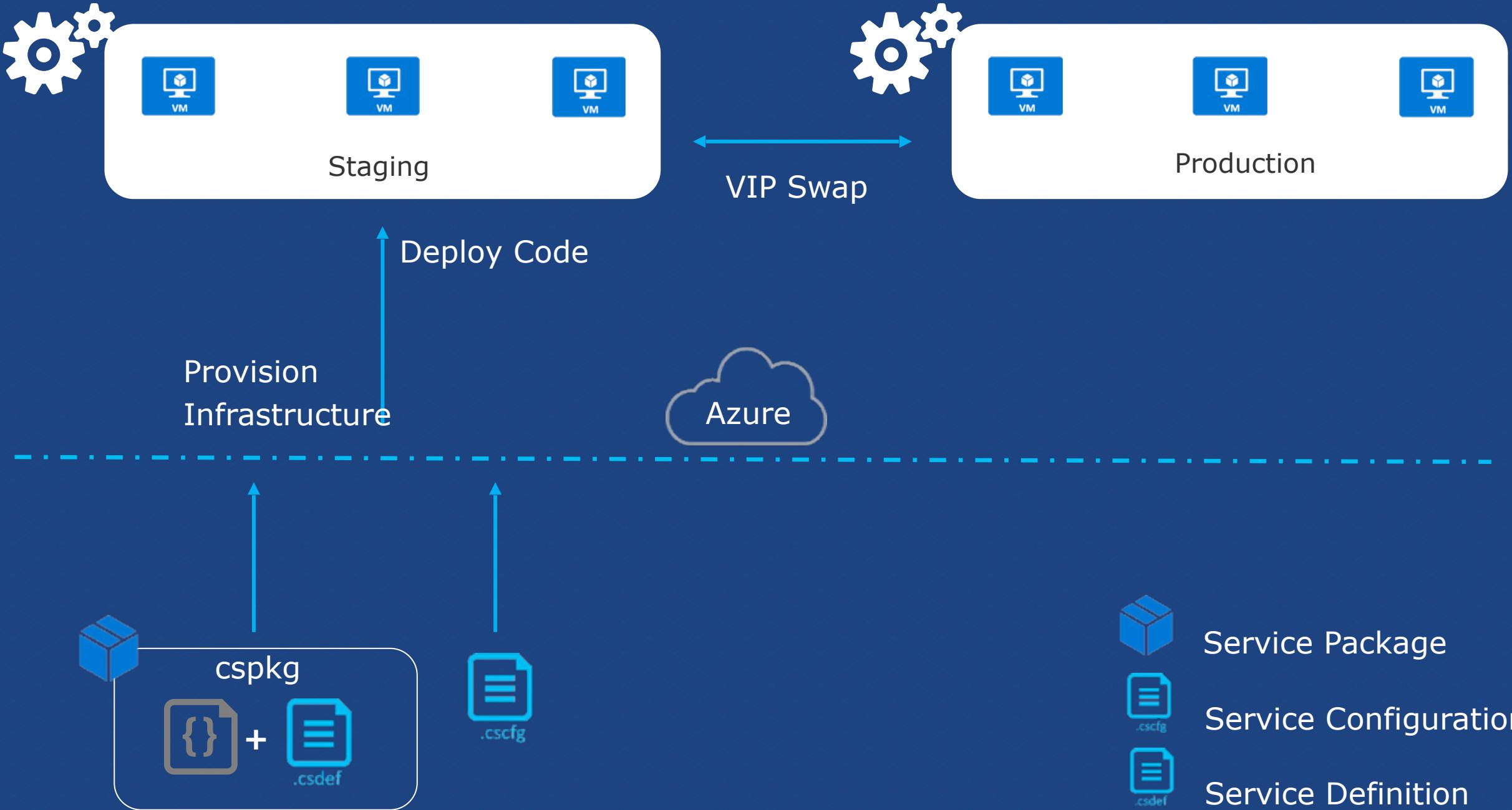
Communication Endpoints

Local storage resources

etc.

At runtime each Role will execute on one or more instances

A role instance is a set of code, configuration, and local data, deployed in a dedicated VM



- Development experience using the Azure SDK, integrated seamlessly with Visual Studio.
- Deploy using any language you like, including .NET, Java, Node.js, PHP, Python, or Ruby.
- Test your application before deploying to the cloud using the Azure Emulator, which brings the platform's key functionality right to your dev machine.

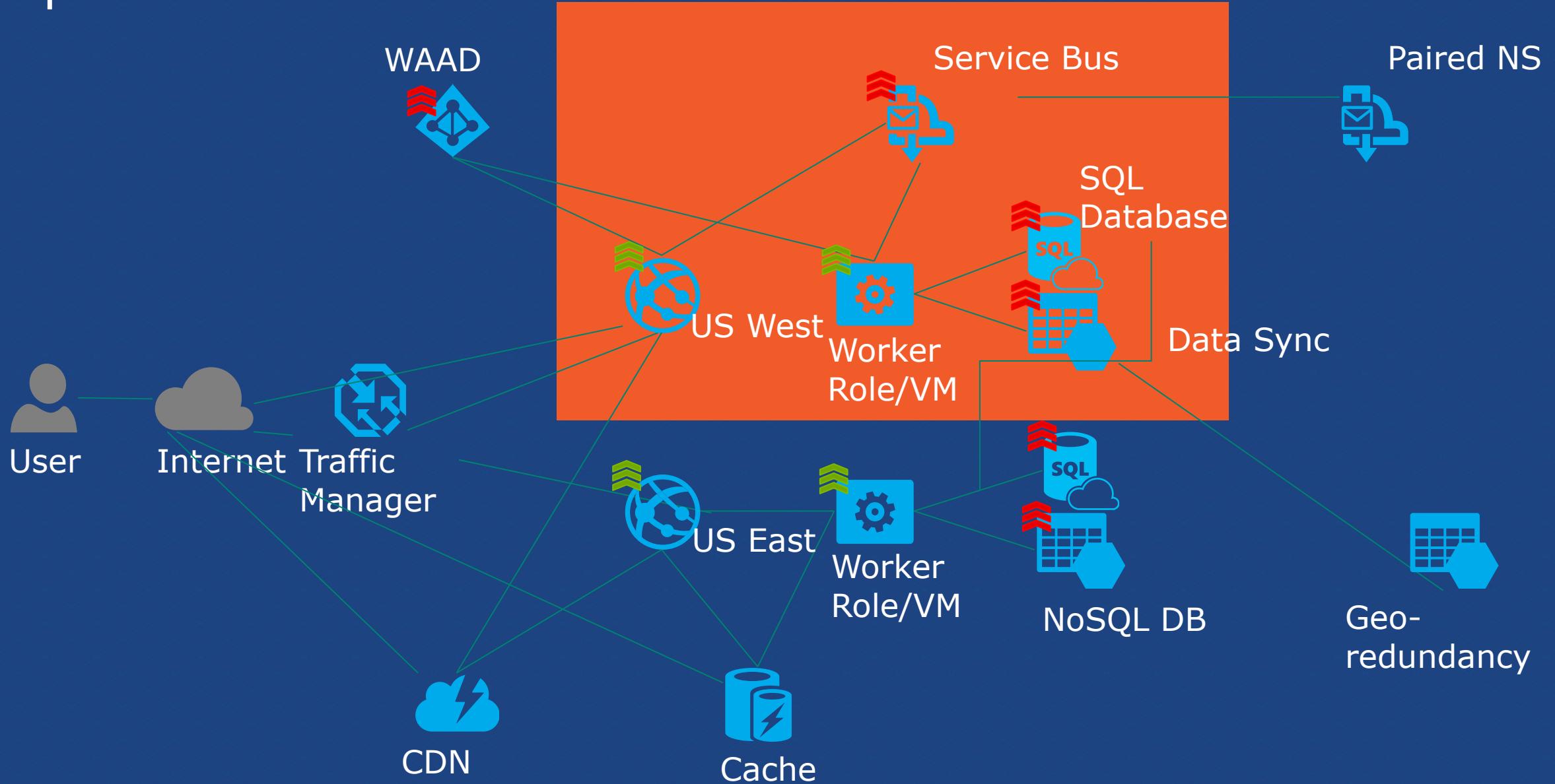


Design for Cloud

A different mindset

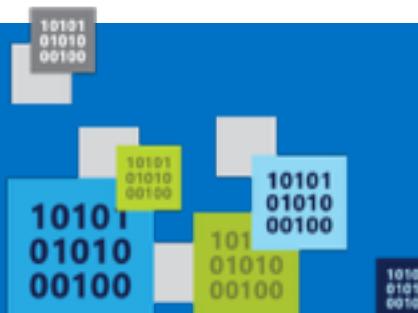
- → Embracing errors
- → Design for availability, reliability, scalability
- → Performance

Sample architecture



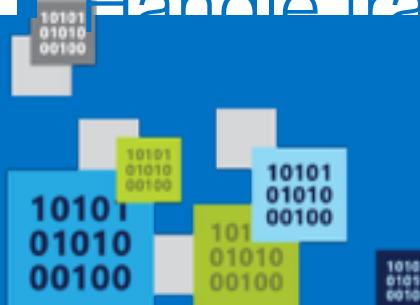
Redundancy in Microsoft Azure

- Storage Redundancy Options
- SQL Database Geo-Replication
- Caching with high availability option
- Load-balanced App Service Apps, Cloud Service and Virtual Machines
- Built-in redundancy in Azure Virtual Network gateways
- Failover with Azure Traffic Manager



Resiliency in Microsoft Azure

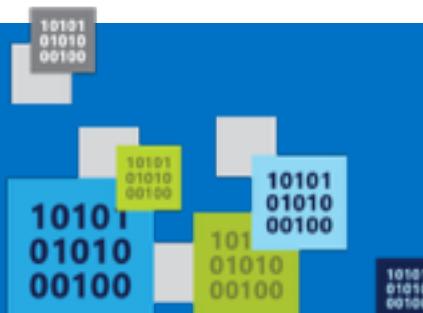
- Auto recovery – Service Healing
- Fault domain - prevent single point of failure
- Virtual machine Availability set – fault domain and rolling host updates
- Upgrade domain - service availability during upgrade
- Deployment Slots and VIP swap
- Emulator, Intellitrace and enhanced diagnostics
- Telemetry - native and 3rd party support
- Handle transient errors with Application Block



What does failsafe mean for my applications?

It depends... but some general practices apply.

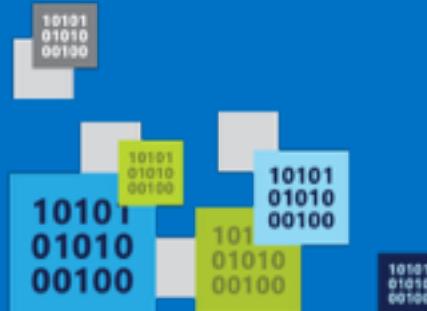
- Take advantage of Microsoft Azure features
- Avoid single point of failure
- Failure mode analysis
- Transient errors
- Graceful degradation
- Eliminate human factors



Scaling in Microsoft Azure

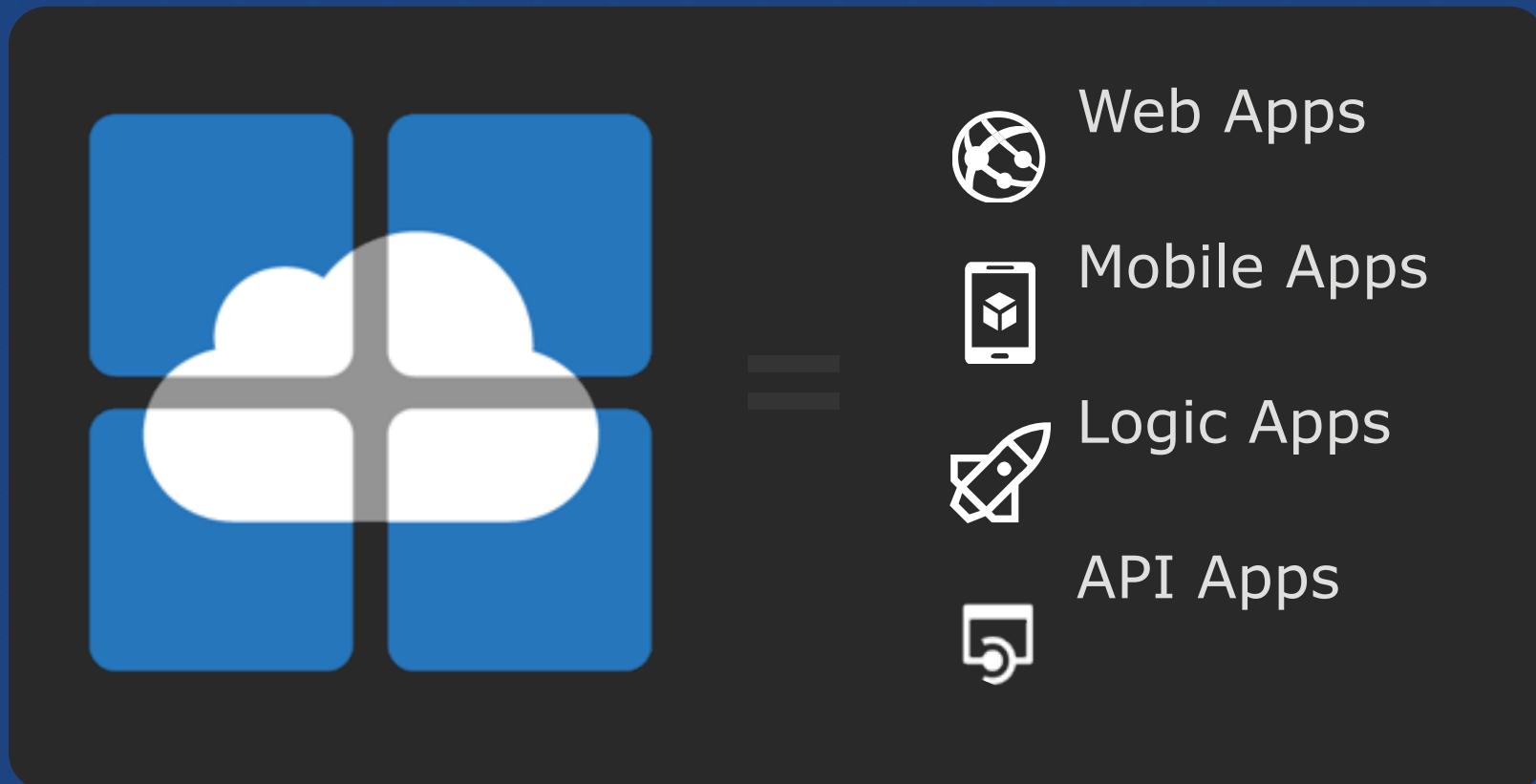
- Scale up by choosing different VM sizes
- Scale out by adding more instances
- Auto-scale with Autoscaling Application Block
- Scale out by using multiple service entities
- CDN to distribute user traffic
- Caching to offset server workloads

App Service Web Apps



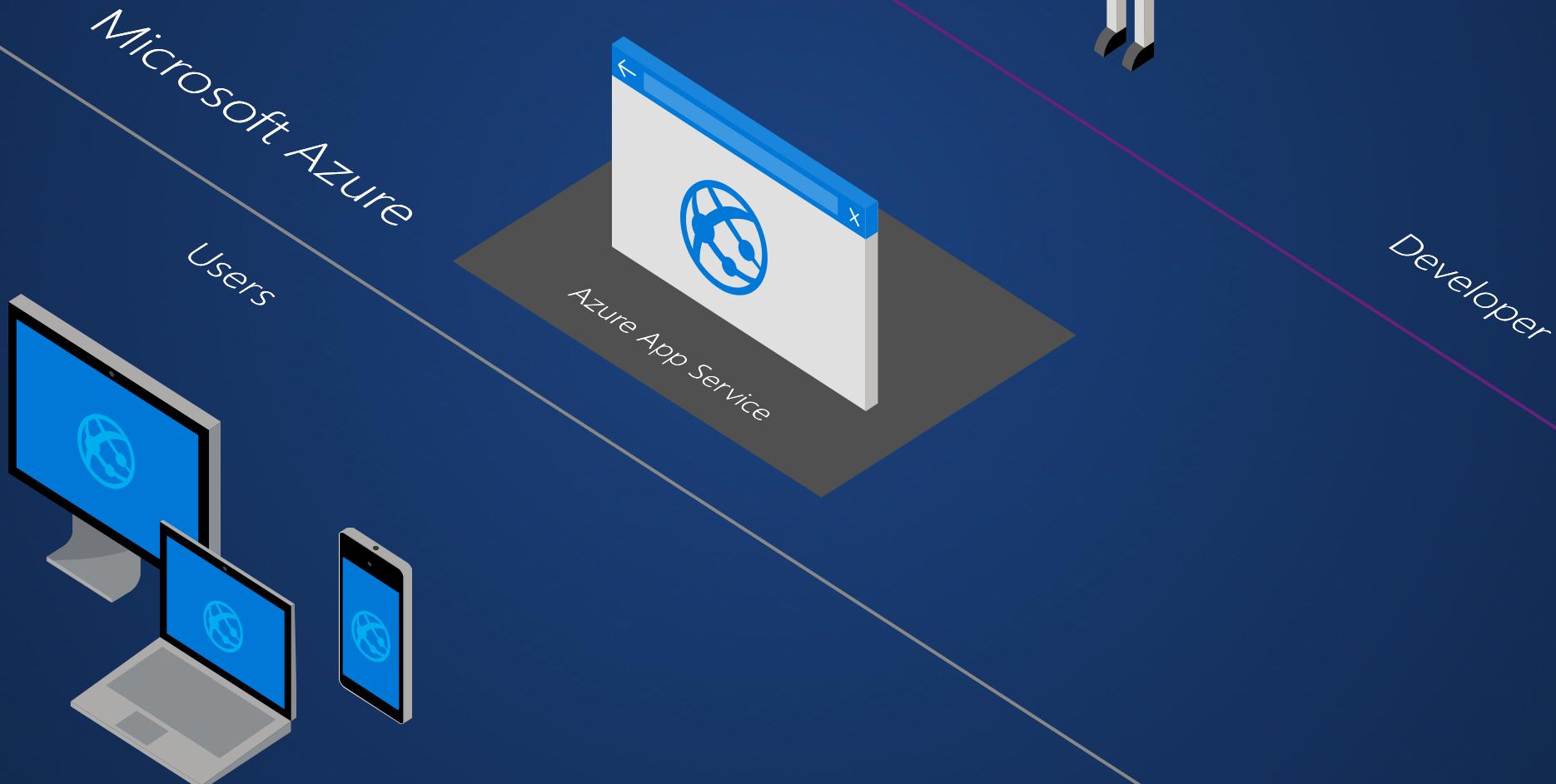
Azure App Service

Build and scale cloud apps



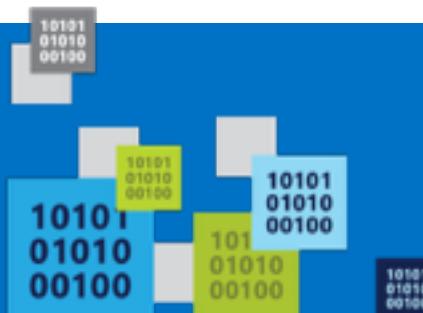
Develop apps with...

.NET | Node.js | PHP | Python | Java



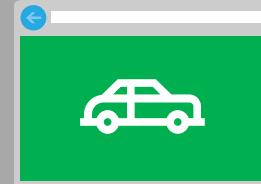
Benefits of App Services

- Automatic OS patching
- Enterprise-grade security
- High availability
 - Automated scale out/in
 - Built-in load balancing
- Supports many languages and platforms
 - .NET, Node.js, Python, Ruby and many more
- Easy continuous deployment
 - Continuous delivery from third-party source control providers
 - Built-in Git repo





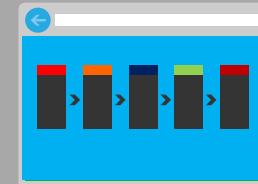
Web Apps



Customer site



Logic Apps



Order Completed



Mobile Apps



Administration App



Customer App



API Apps



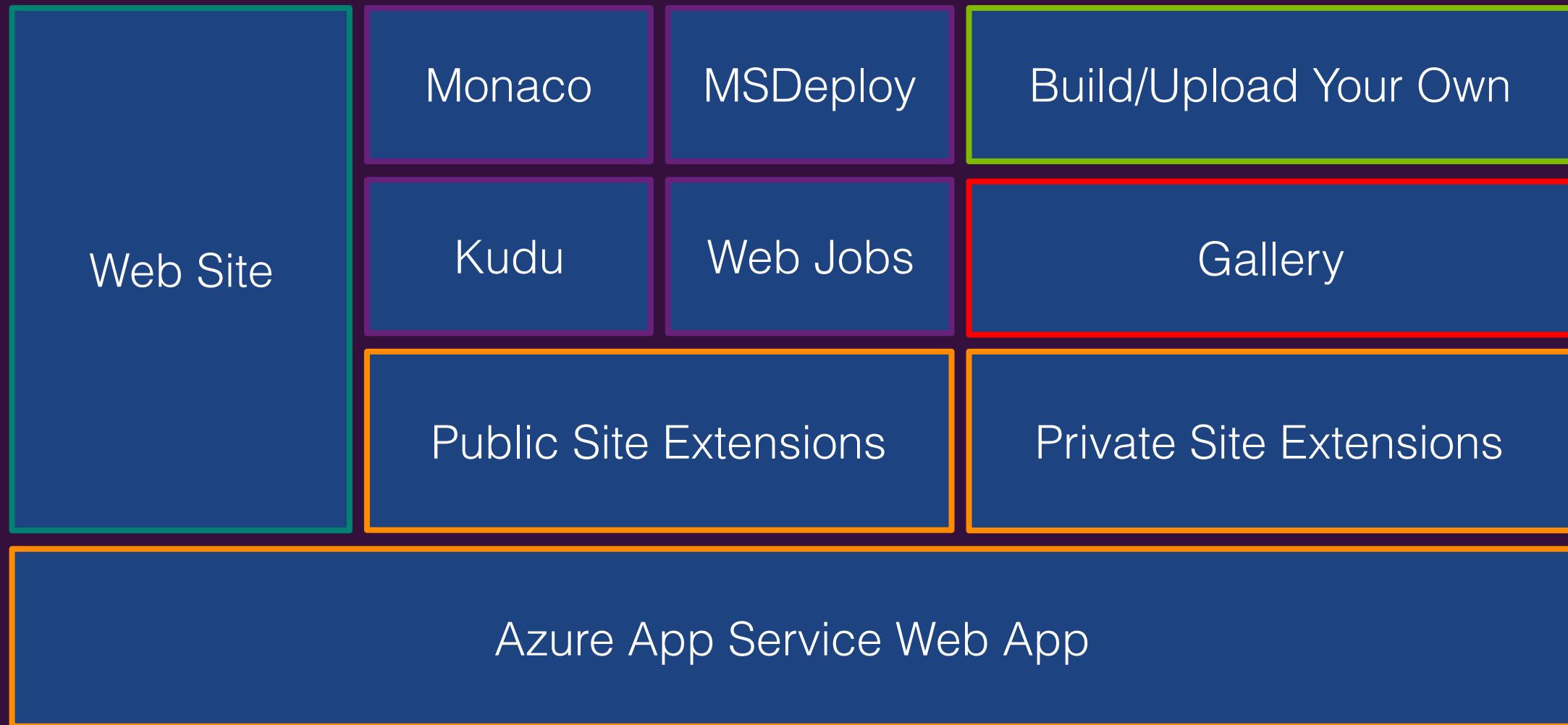
Full capability set available including:



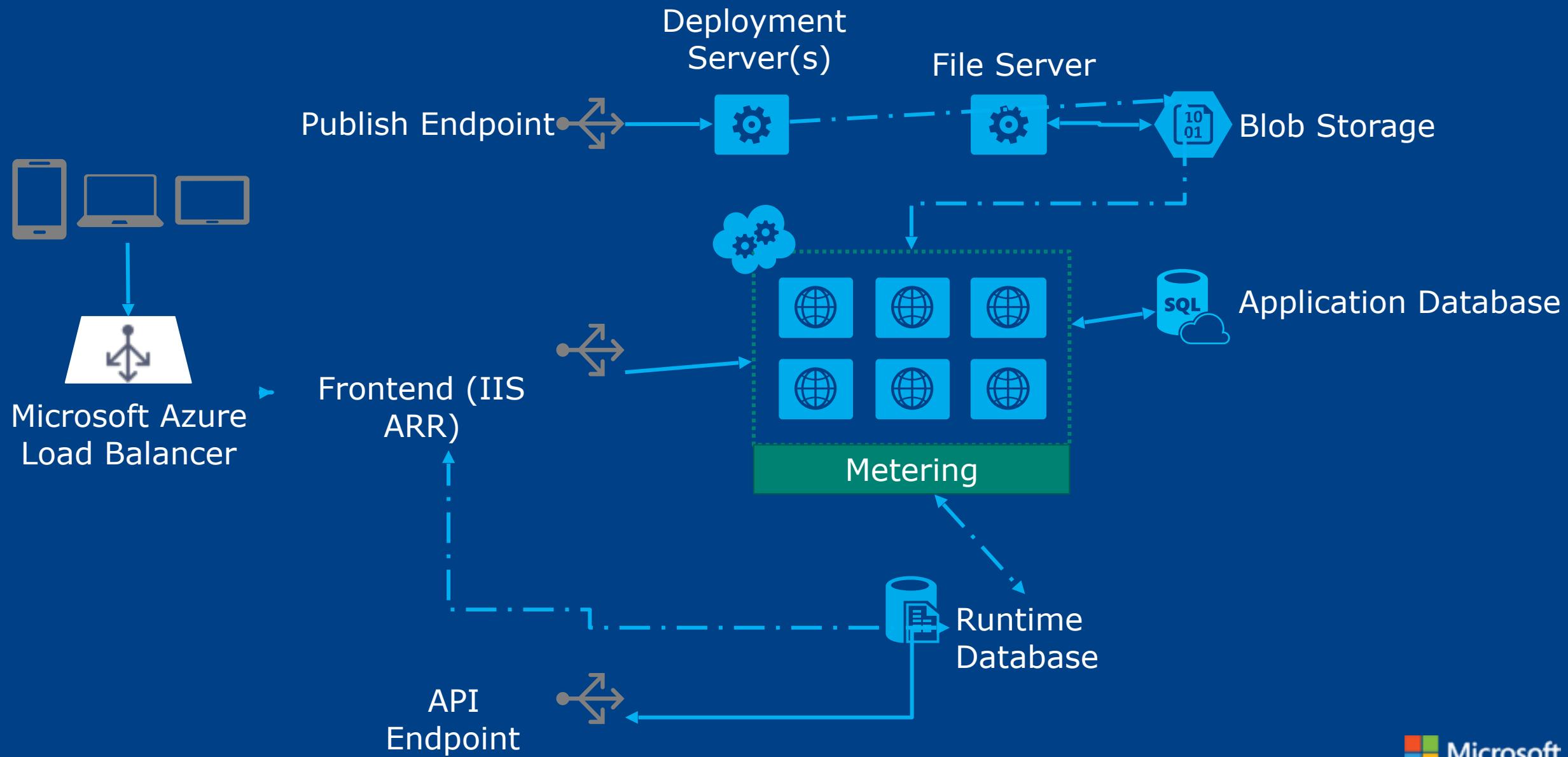
WEB APPS

Web apps run as-is
no changes required

- .NET, Node.js, Java, PHP, and Python
- WebJobs for long running tasks
- Integrated VS publish, remote debug...
- CI with GitHub, BitBucket, VSO
- Auto-load balance, Autoscale, Geo DR
- Virtual networking and hybrid connections
- Site slots for staged deployments



App Service Web App Architecture



WebJobs: Light-weight CPU Intensive Tasks



run.cmd, run.bat



run.exe



run.ps1



run.sh



run.php



run.py



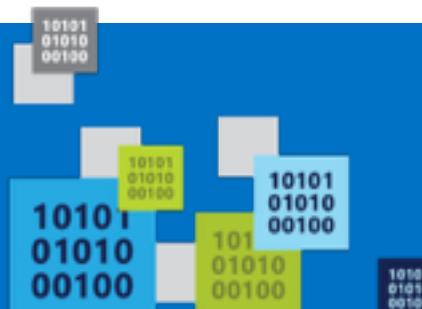
run.js

WebJobs SDK
Feature:

Scale: Singleton, Multi-instance

BlobTrigger, TableTrigger, QueueTrigger,
ServicebusTrigger

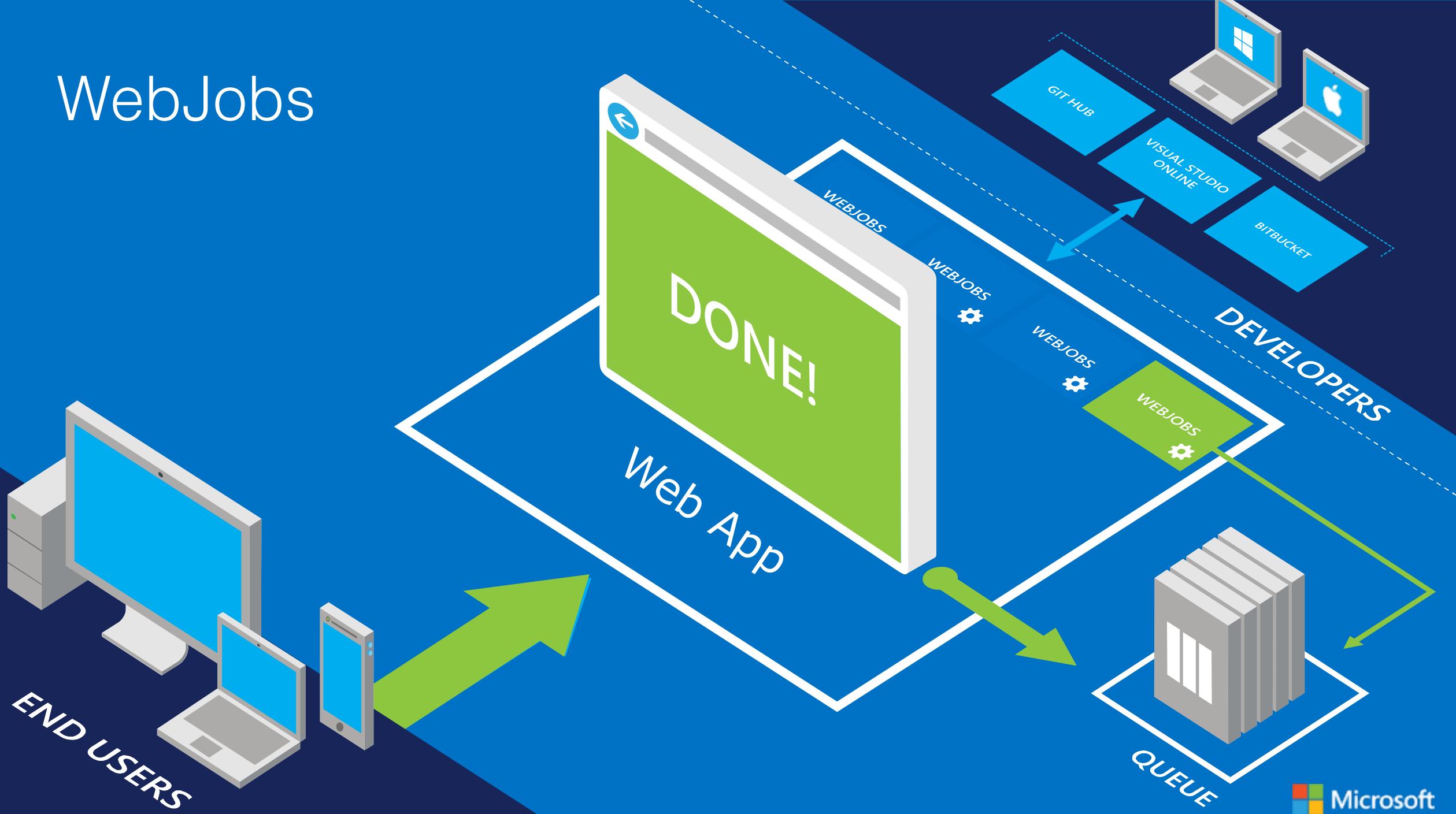
Deployment: Portal, Visual Studio, CLI, Git



WebJobs



WebJobs



Easily use cloud or custom APIs:

- Dozens of built-in APIs for popular SaaS
- An ecosystem of APIs for any need
- Create and publish custom, reusable APIs
- Visual Studio tooling with one click publish and remote debugging
- Automatic client SDK generation for many languages

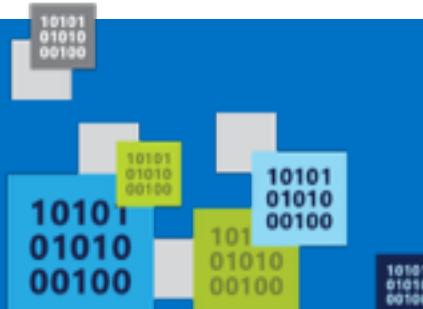


API APPS

Create, consume and host APIs more easily

Benefits of API Apps

- Bring your API as-is
 - .NET Web API
 - Node.js + Express
 - Java
 - PHP
 - Many other technologies
- Connect easily to SaaS platforms



API Apps addresses key pains around building and consuming APIs

Build your API

- Web Apps++: Bring your API as is in your language of choice
- Simple access control
- SSO
- Metadata contract
- Microservice style
- Expose enterprise APIs

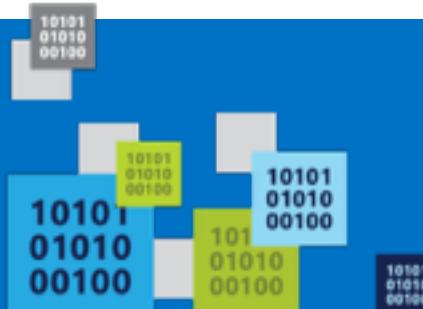


Consume APIs

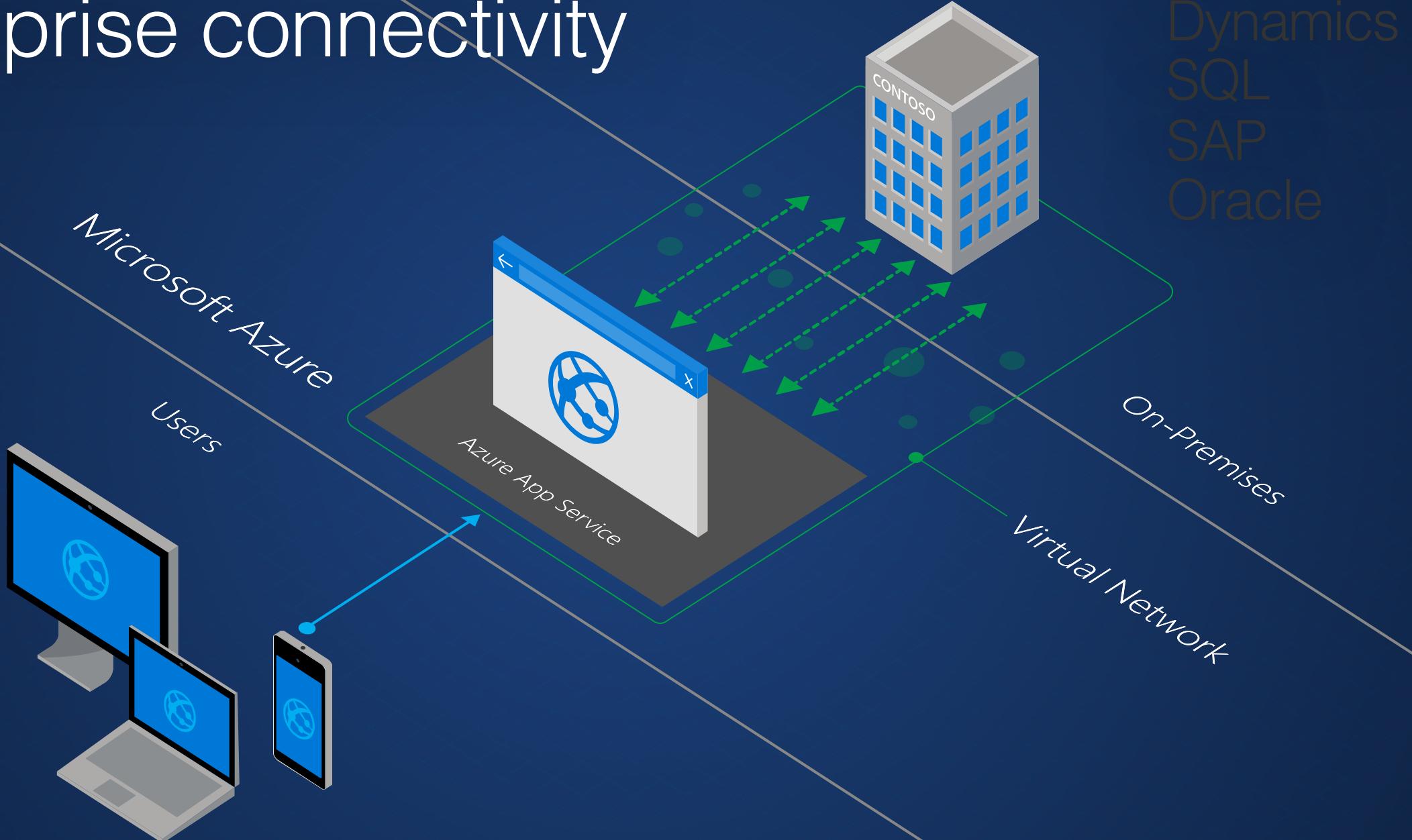
- Authentication,
built-in to mobile and web SDKs
- SSO,
handled by server
- SDK generation
- API discovery
- Gallery – public & organization

Consuming API Apps

- API Apps expose HTTP services
- Metadata is exposed using Swagger 2.0 metadata
 - JSON file
 - Widely supported
- Client applications



Enterprise connectivity



Managed Middle Tier

On Premise Applications



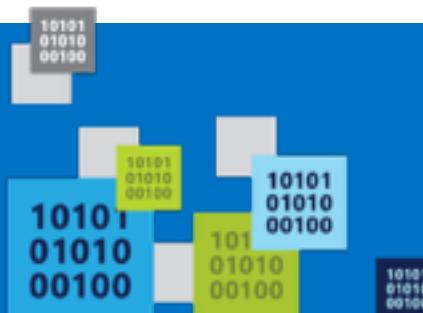
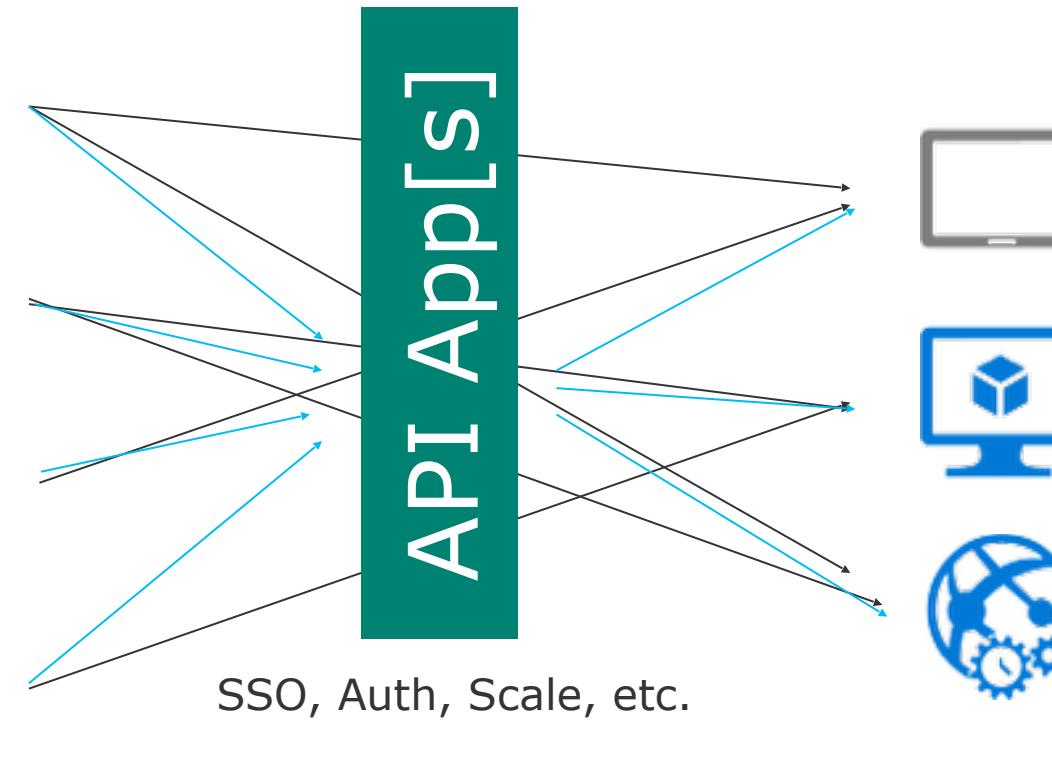
Databases in Azure VMs



SharePoint Online



Cloud-Hosted Web Apps



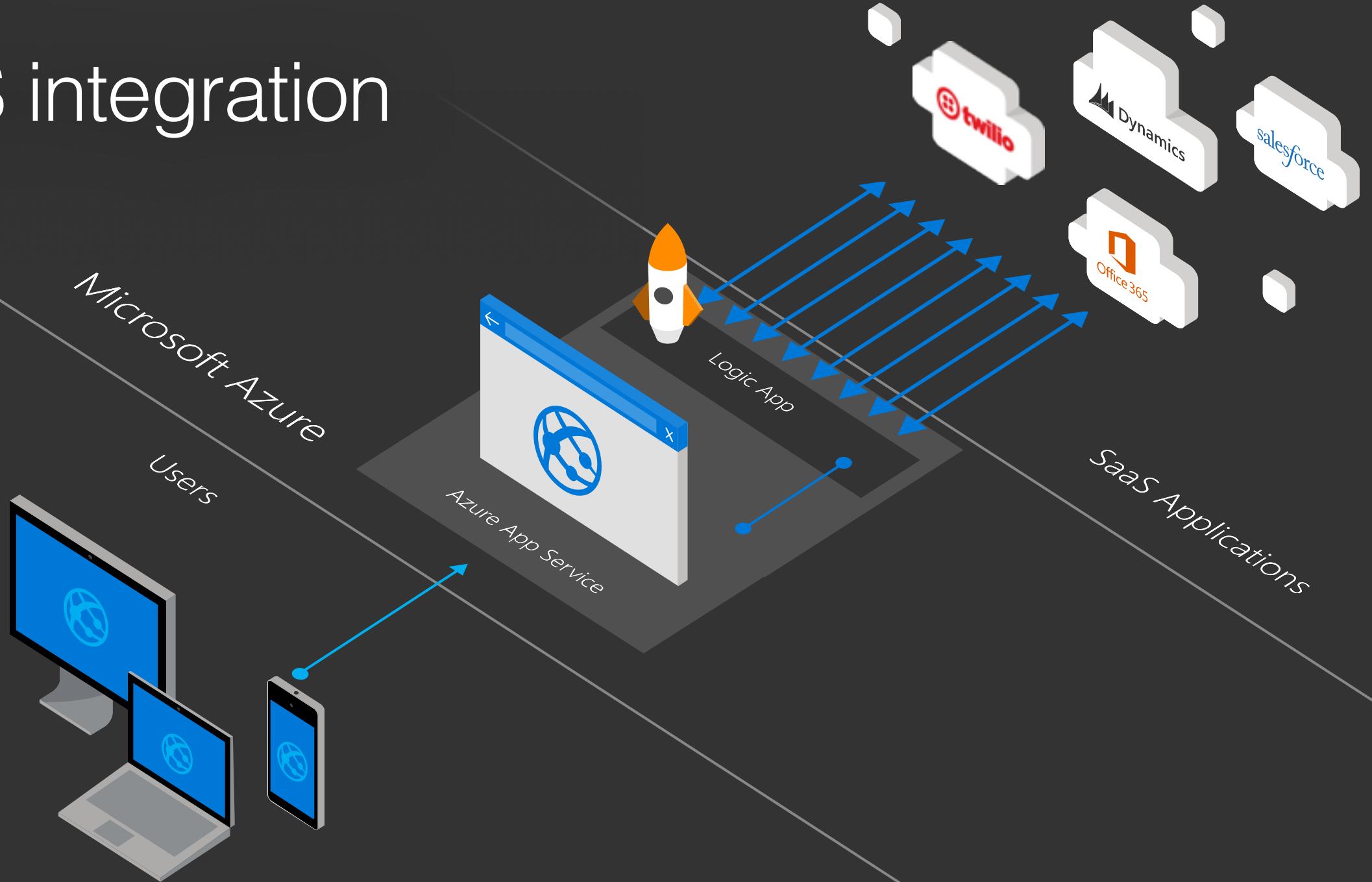
New Logic Apps for easy automation



Automate SaaS and
on-premises systems

- No code designer for rapid creation
- Dozens of pre-built templates to get started
- Out of box support for popular SaaS and on-premises apps
- Use with custom API apps of your own
- Biztalk APIs for expert integration scenarios

SaaS integration



Built-in API Connectors



Connectors

- Box
- Chatter
- Delay
- Dropbox
- Azure HD Insight
- Marketo
- Azure Media Services
- OneDrive
- SharePoint
- SQL Server
- Office 365
- Oracle
- QuickBooks
- SalesForce
- Sugar CRM
- SAP

Protocols

- Service Bus
- Azure Storage
- HTTP, HTTPS
- Timer, Recurrence
- File
- Flat File
- FTP, SFTP
- POP3, IMAP
- SMTP
- Sphere MQ
- SOAP, WCF
- Azure WebJobs
- Yammer
- Dynamics CRM
- Dynamics AX
- Hybrid Connectivity

BizTalk Services

- Batching / Debatching
- Validate
- Extract (XPath)
- Transform (+Mapper)
- Convert (XML-JSON)
- Convert (XML-FF)
- X12
- EDIFACT
- AS2
- TPMOM
- Rules Engine

New capabilities for Mobile apps:

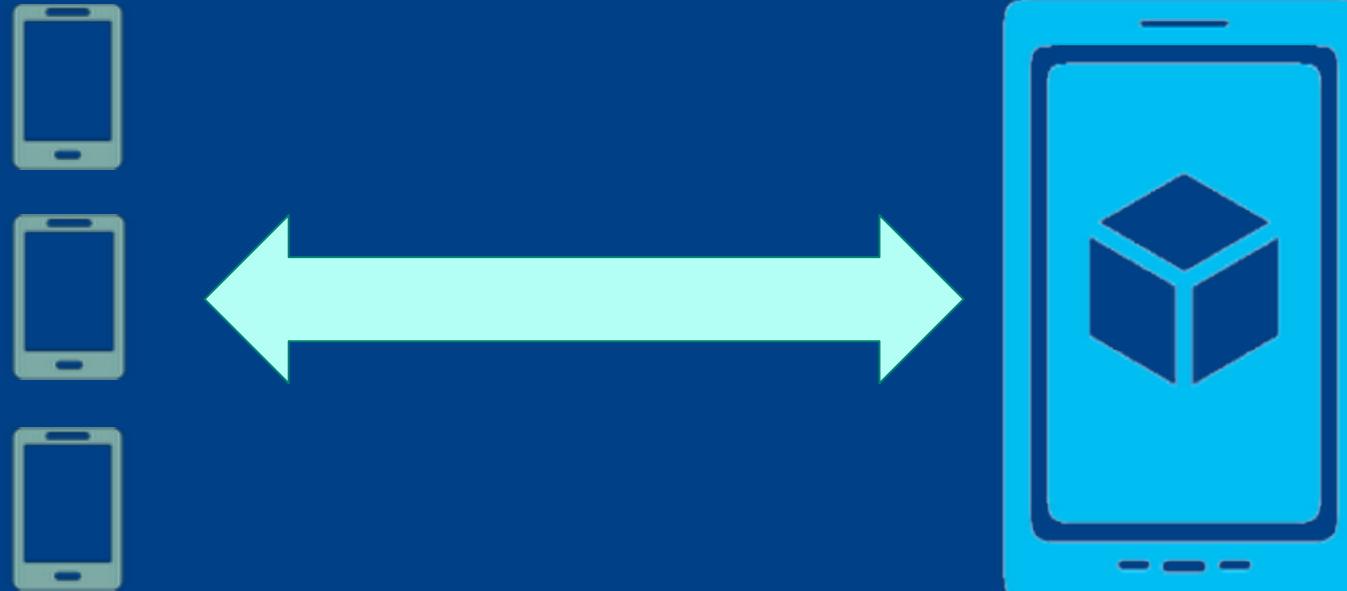
- Webjobs for long running tasks
- CI with GitHub, BitBucket, VSO
- Auto-load balance, Autoscale, Geo DR
- Virtual networking and hybrid connections
- Site slots for staged deployments



MOBILE APPS

Mobile services plus
a whole lot more

Azure Mobile Services



Storage



Authentication



Logic



Push



Scheduler

Structured Storage

- Powered by SQL Database
- Supports rich querying capabilities
- Dynamic Schematization
- Data management in:
 - Azure Portal
 - SQL Portal (Silverlight)
 - SQL Management Studio
 - REST API
 - Azure CLI Tools
 - SQL CLI



Node.js scripts

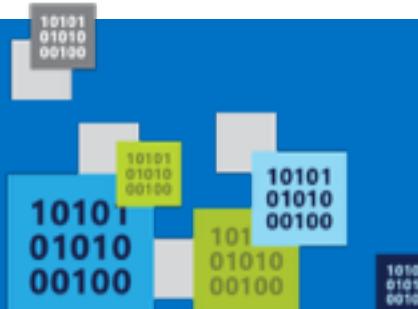
.NET Web API
backend in
Visual Studio

Passes through to SQL
by default

MongoDB, Table
Storage, SQL out of
the box

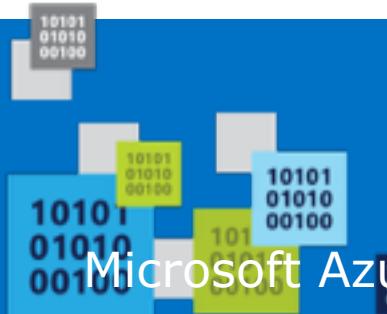
Intercept CRUD
requests to tables

Fully customizable



Custom API

- Non-table based endpoints
- Accessible from
 - GET
 - POST
 - PUT
 - PATCH
 - DELETE
- For node.js logic in scripts like table endpoints
- For .NET delivered through a WebAPI
- Expose any functionality you want



Scaling Up vs. Scaling Out

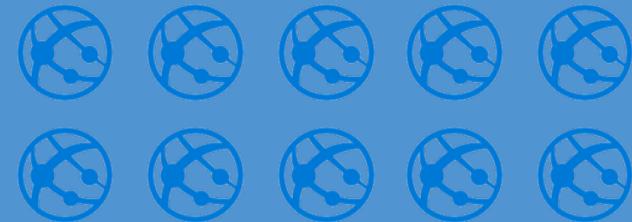
Scale Up



Vary the VM size

- 1 Core w/ 1.75 GB RAM
- 2 Cores w/ 3.5 GB RAM
- 4 Cores w/ 7 GB RAM

Scale Out



Vary the VM count

- Max 3* instances
- Max 10 instances
- Max 20/50** instances

Manual Scaling vs. Auto-Scaling

Manual – Scale via portal or scripts

* Scale by

Description Manual setup means that the number of instances you choose won't change, even if there are changes in load.

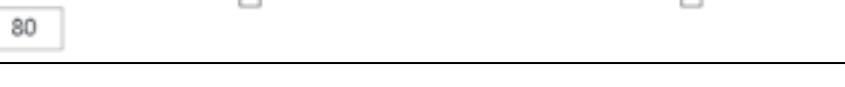
Instances 

Auto – CPU Percentage

* Scale by

Description Automatically scale up or down based on CPU Percentage. Choose an average value you want to target.

Instances 


Target range 

Auto – Schedule & Performance Rules

* Scale by

Description Create your own set of rules. Create a schedule that adjusts your instance counts based on time and performance metrics.

Monday-Friday Profile, scale 3 - 9

Settings

Azure Web Apps

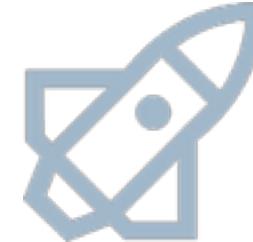
Azure App Service Family



Web Apps
Web apps that scale
with your business



Mobile Apps
Build mobile apps for
any device



Logic Apps
Automate business
processes across SaaS
and on-premises



API Apps
Build and consume APIs
in the cloud

Azure Web Apps

- Support a variety of languages and platforms
 - .NET, Java, Node.js, PHP, Python, and more
- Support scaling (manual or auto) and load balancing
- Support slots for staged deployments and A/B testing
- Support continuous integration

Familiar and Fast

Leverage existing skills,
plus languages,
frameworks, and tools
you're familiar with

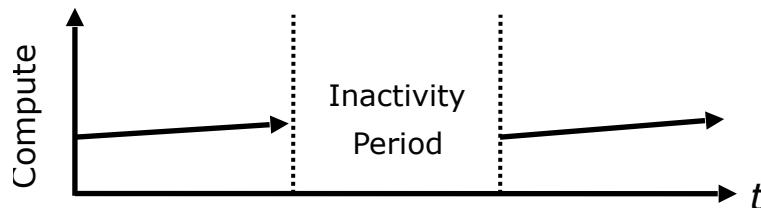
Enterprise Grade

ISO-, SOC2-, and PCI-compliant with enterprise-level SLAs

Global Scale

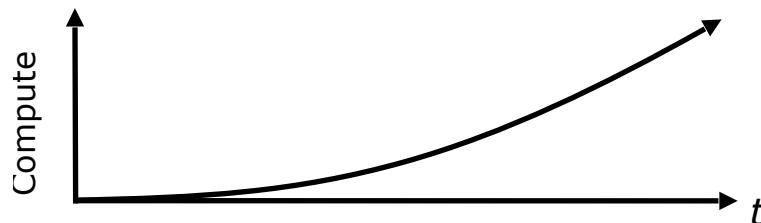
Scale up and down as needed, manually or automatically

Scaling - Cloud Computing Patterns



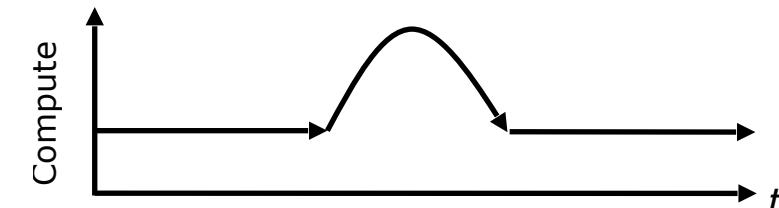
On and Off

On & off workloads (e.g. batch job)
Over provisioned capacity is wasted
Time to market can be cumbersome



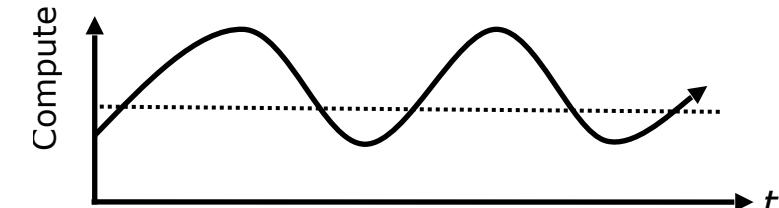
Growing Fast

Successful services need to grow/scale
Keeping up w/ growth is big IT challenge
Cannot provision hardware fast enough



Unpredictable Bursts

Unexpected/unplanned peak in demand
Sudden spike impacts performance
Can't over provision for extreme cases



Predictable Bursts

Services with micro seasonality trends
Peaks due to periodic increased demand
IT complexity and wasted capacity

Scaling Up vs. Scaling Out

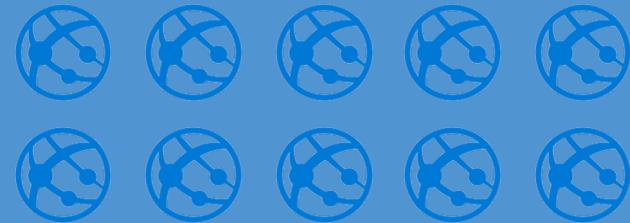
Scale Up



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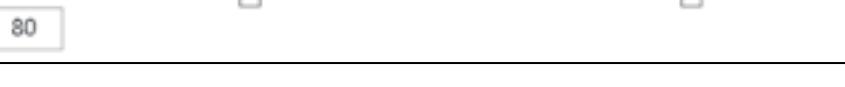
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Description Automatically scale up or down based on CPU Percentage. Choose an average value you want to target.

Instances 


Target range 

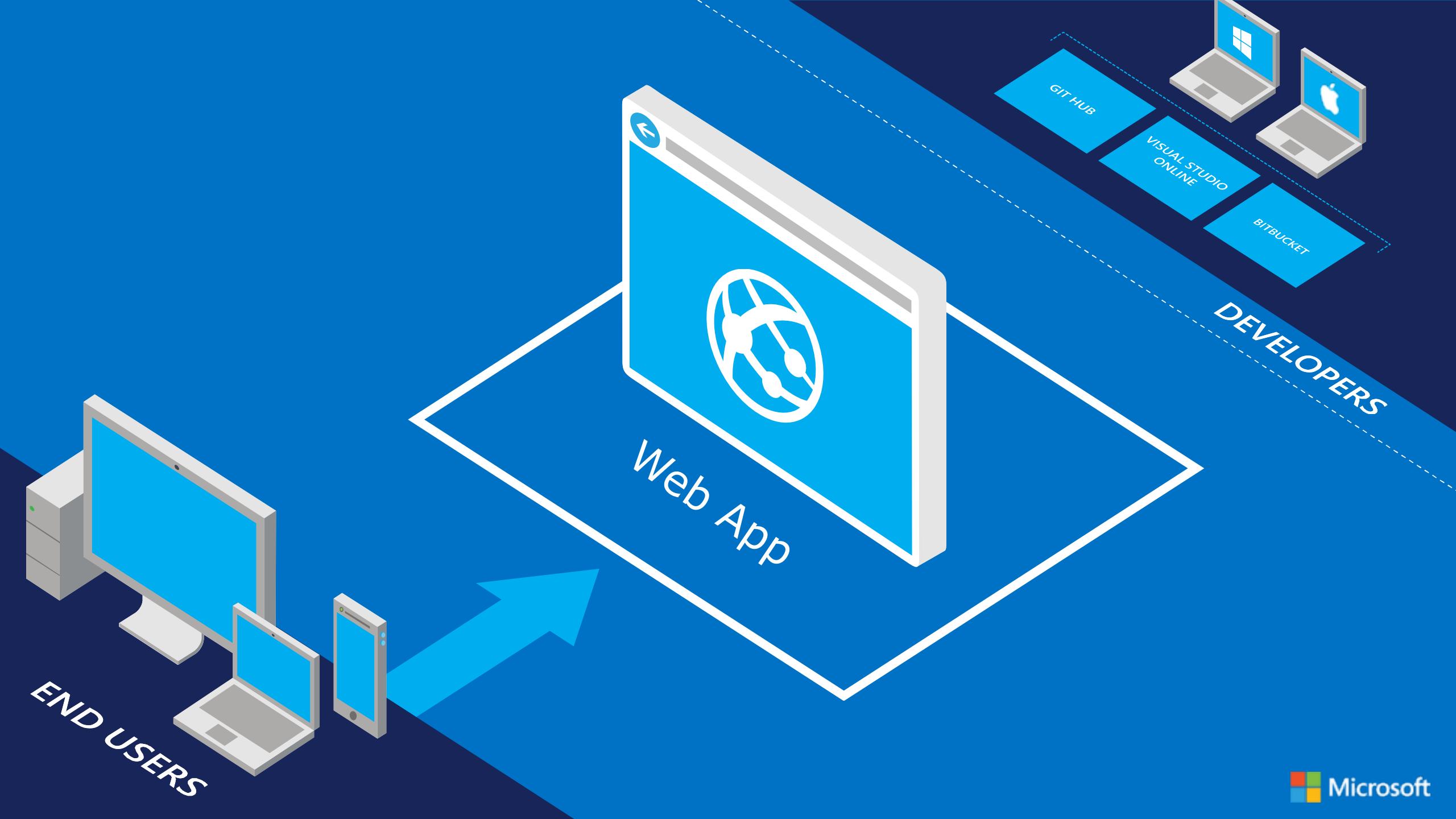
Auto – Schedule & Performance Rules

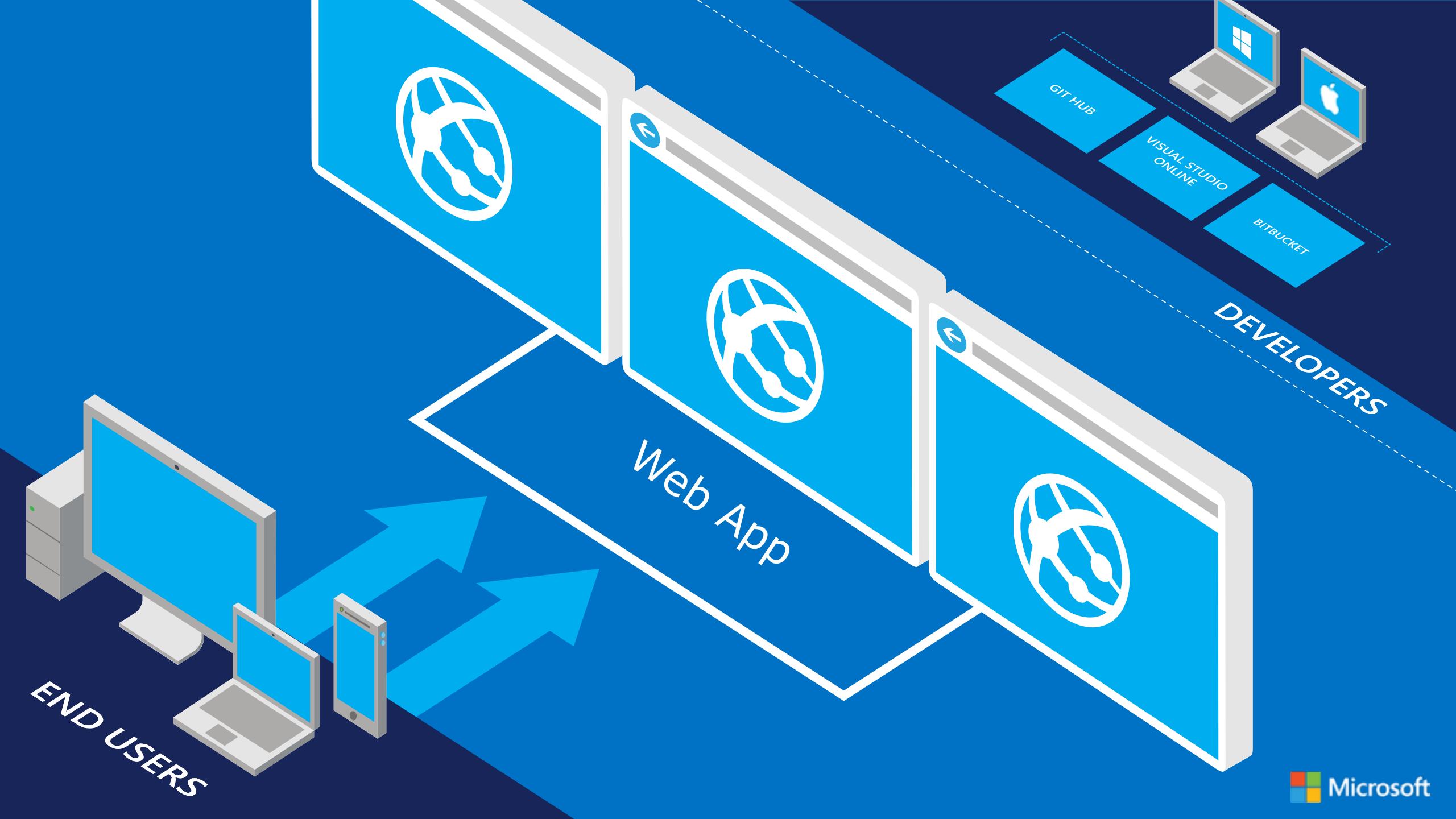
* Scale by

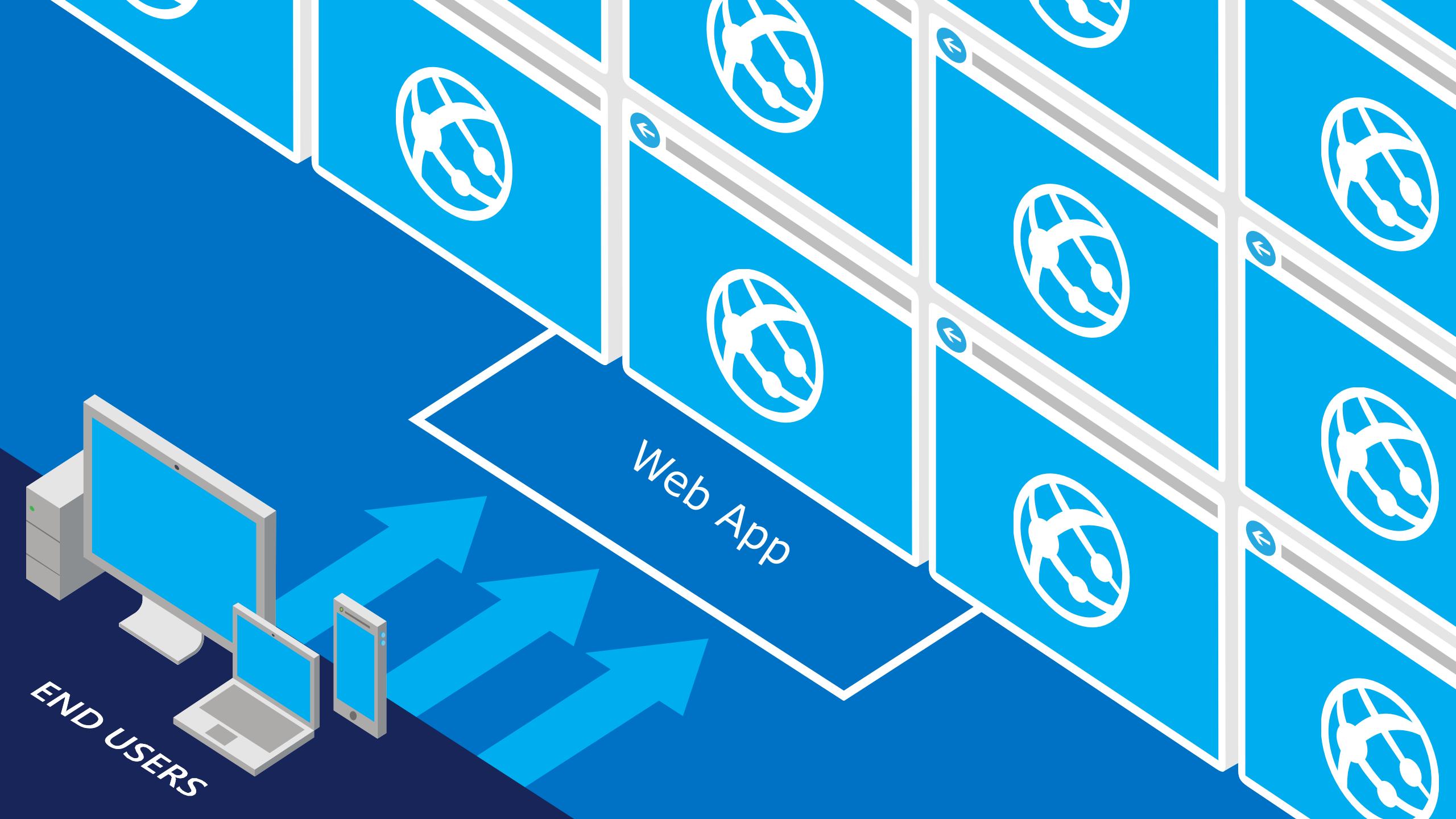
Description Create your own set of rules. Create a schedule that adjusts your instance counts based on time and performance metrics.

Monday-Friday Profile, scale 3 - 9

Settings

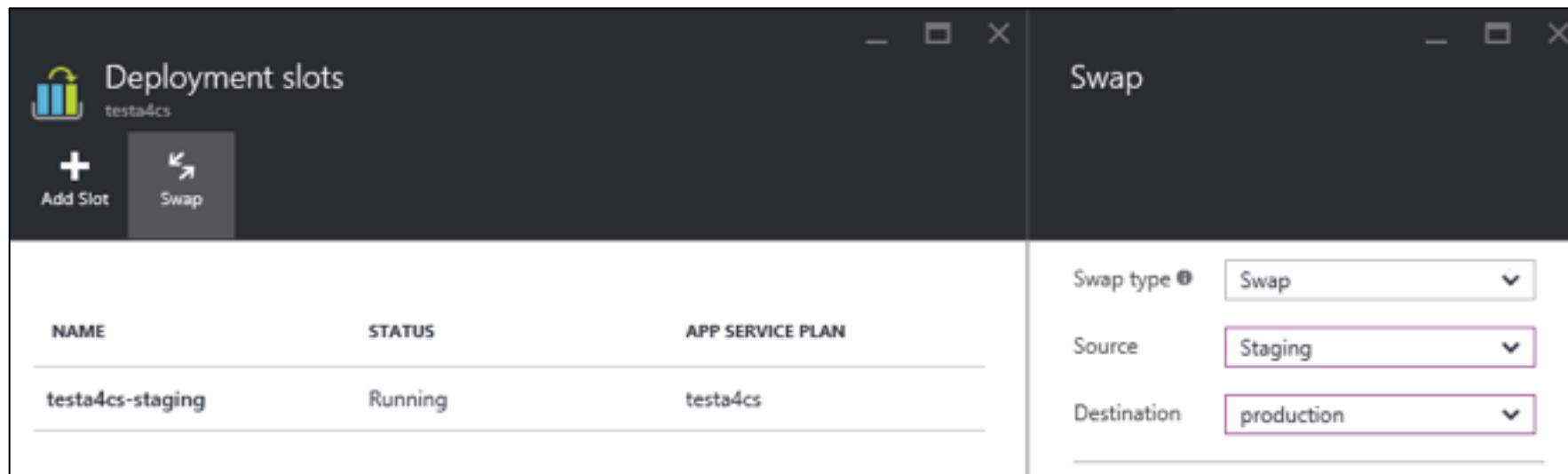






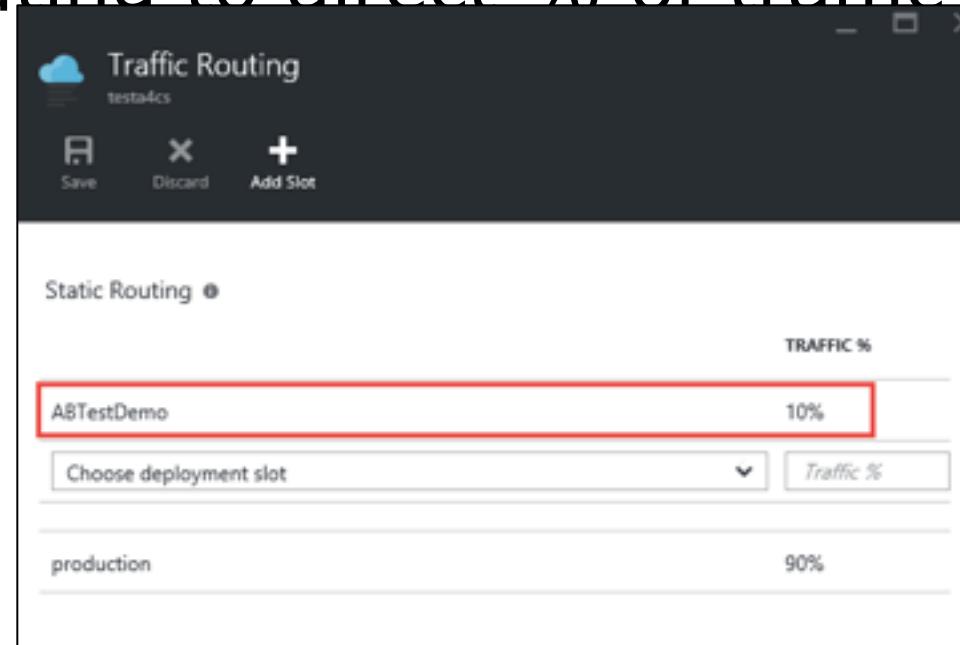
Deployment Slots

- Use a Deploy-Confirm-Promote workflow
 - Promote via “swap” through Azure portal
 - <http://sitename-slotname.azurewebsites.net>



A/B Testing

- Test changes by routing requests to different deployment slots
- Use Traffic Routing to direct % of traffic to alternate slots



Continuous Integration

- Web apps can be deployed manually via FTP or WebDeploy
- Automate deployment using 3rd party source-control providers
- Can also use a local Git repository from Azure Portal



Git



Visual Studio
Team Services



GitHub

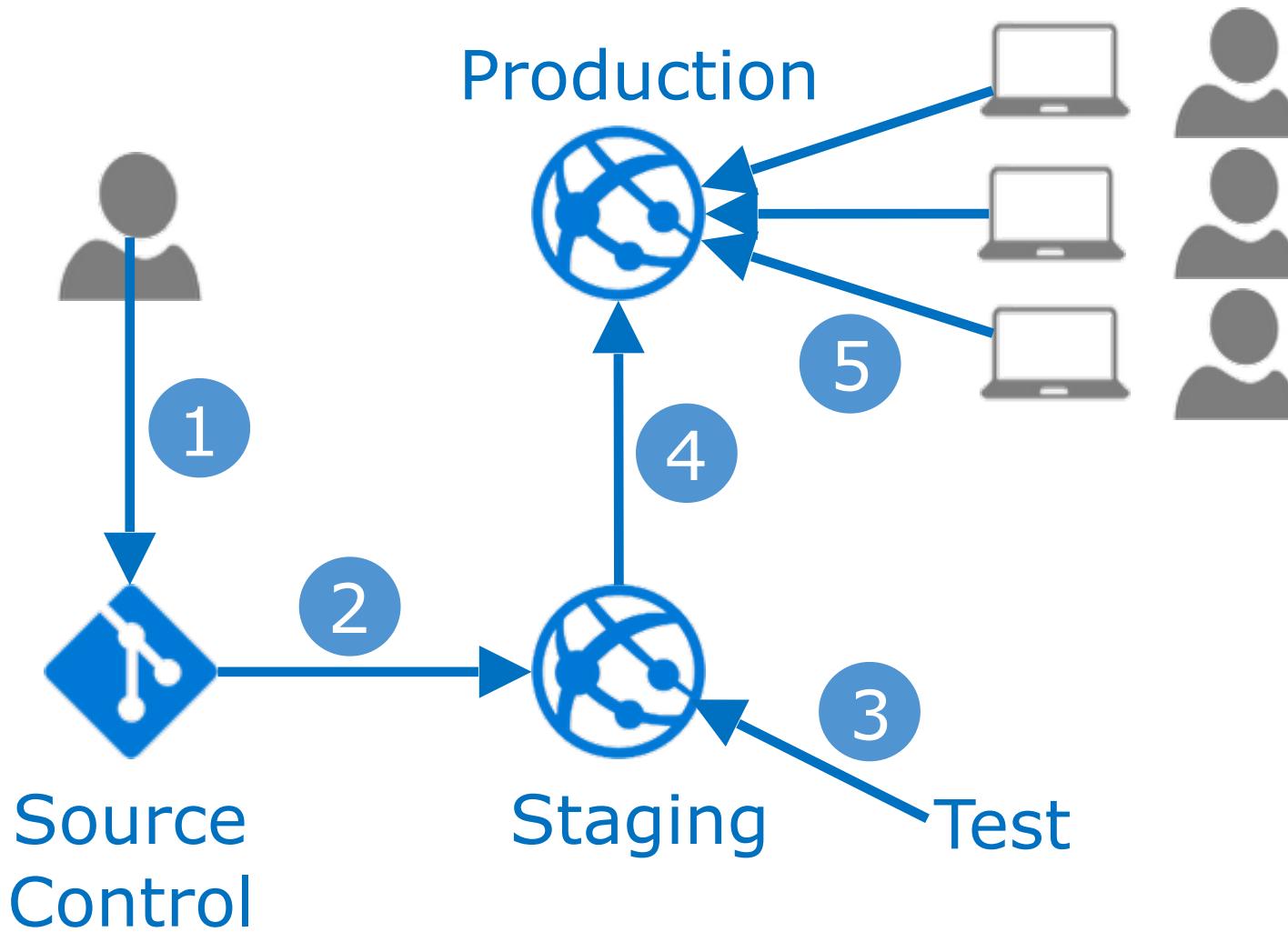


BitBucket



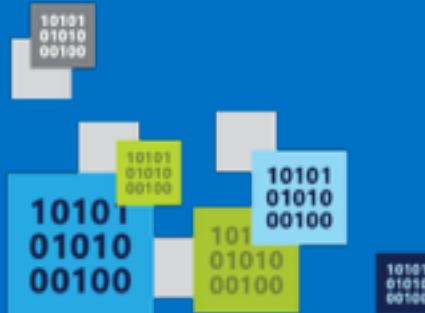
DropBox

Continuous Integration + Deployment Slots



1. Developer commits code
2. Automated process builds/compiles and deploys to staging slot
3. Automated and other tests validate content in staging slot
4. Staging content promoted to production
5. Users see updated site

Building End-to-End Video Experiences with Azure Media Services



Video contributes to
57% of internet traffic

Everyone can create videos



Long form content
over IP delivery

2013



Traditional TV
152 million



Connected TV
75 million

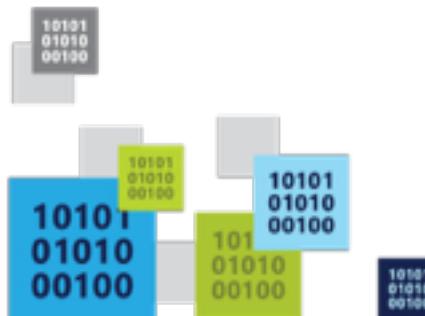


Streaming gadget
30 million



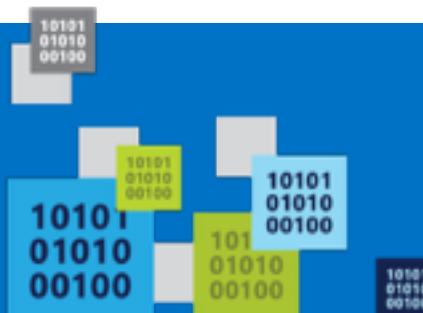
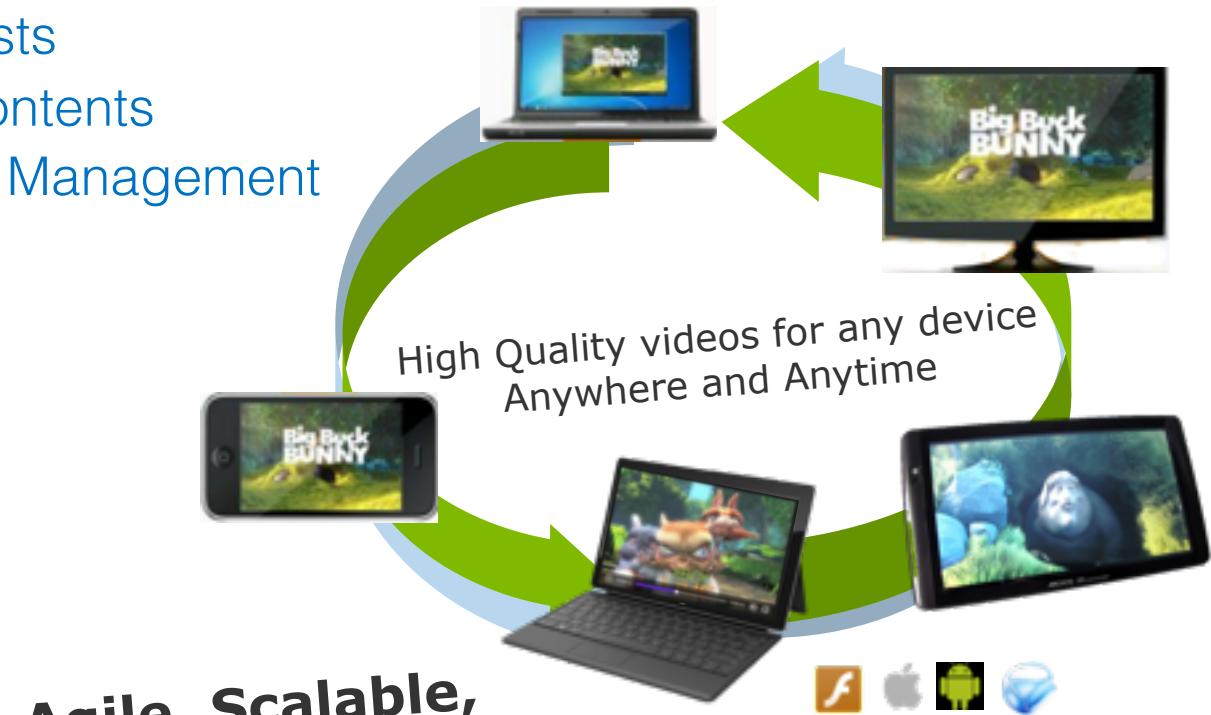
Viewers who consume on 4 devices WATCH 42% MORE television than those who only watch TV only

More Screens = More Viewership

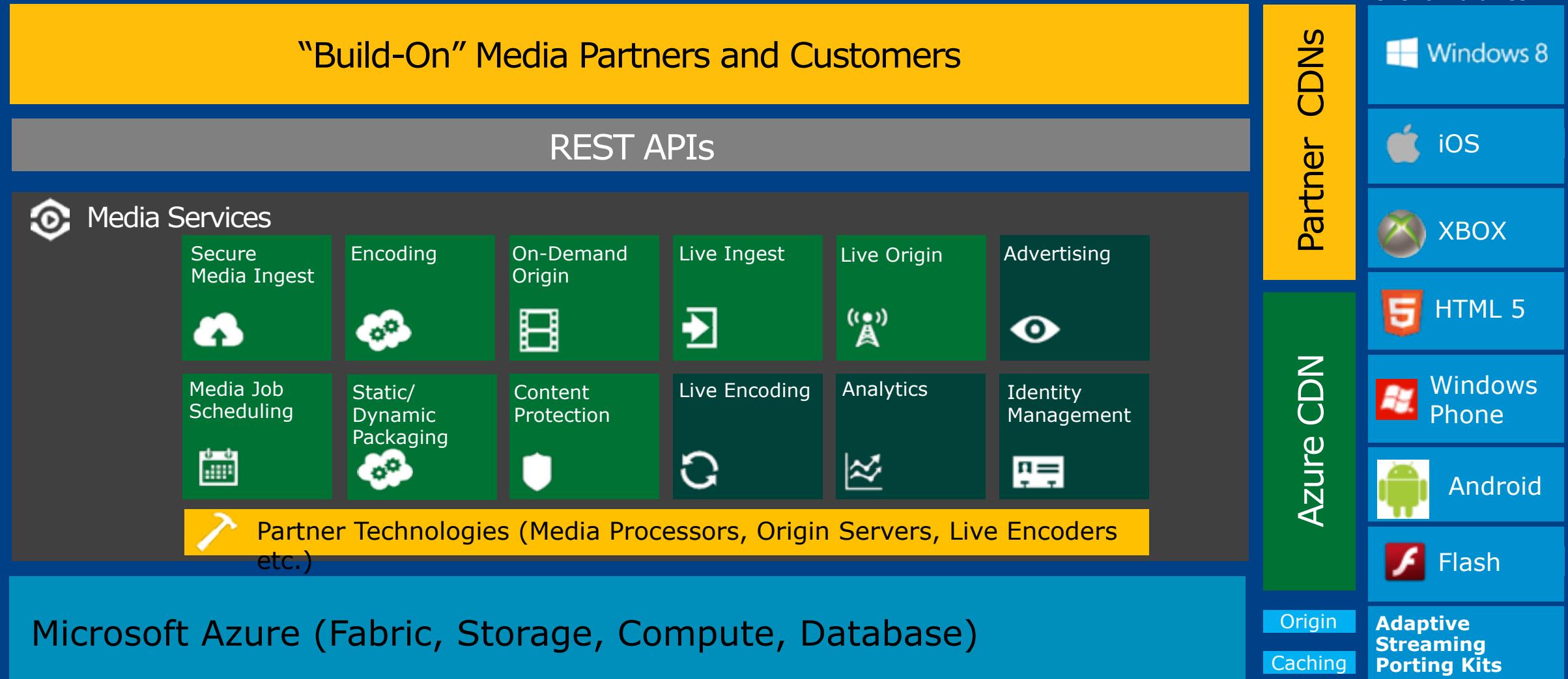


Challenges

- Infrastructure costs
- Managing costs
- Monetizing contents
- Digital Rights Management
- Security



Media Services Architecture



Released



Coming Soon



Partners

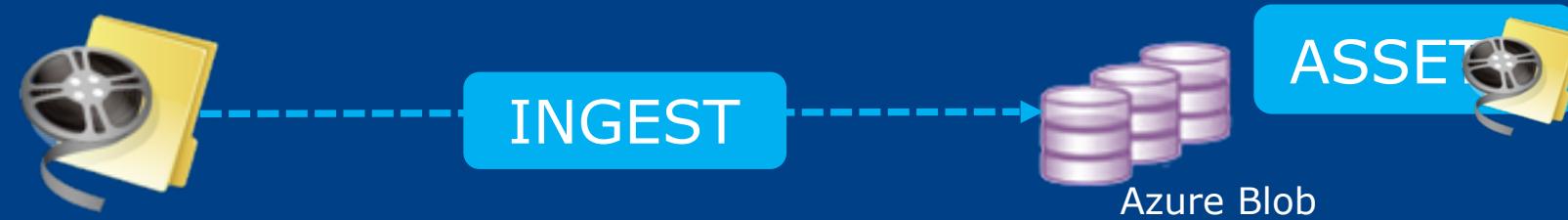


Microsoft

Video-on-demand Services

-  Ingest
-  Encode
-  Package
-  Encrypt
-  Deliver

Step 1: Ingest Content

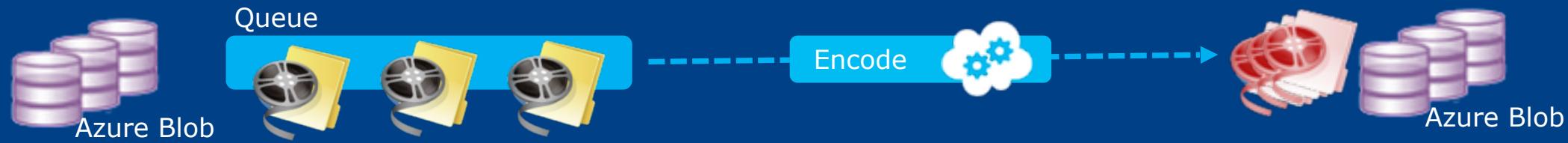


Different options of Ingesting a Mezzanine Asset

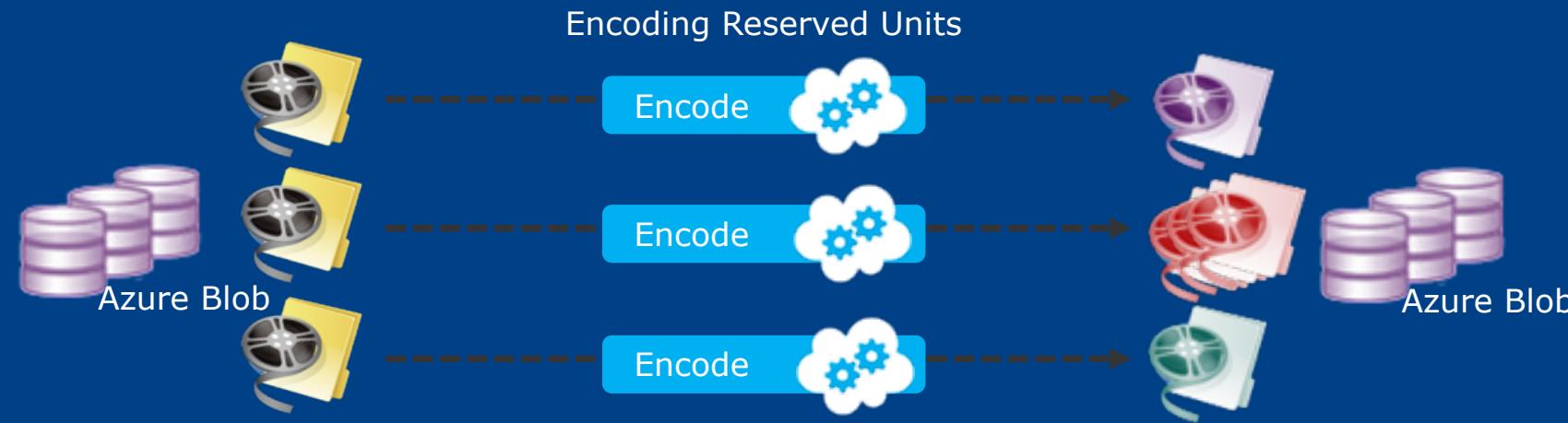
- Pre-encrypt files prior to uploading (AES 256)
- Secure HTTPS upload
- Network level peering for fast HTTP into Azure
- Fast upload using UDP with Aspera
- Storage Import/Export service to ship large amounts of media to DC

Multiple storage accounts enabled to manage your media asset

Step 2: Encode, Package or Encrypt



Step 2: Encode, Package or Encrypt



Microsoft Azure Media Encoder

- Supports encoding to H.264 or VC-1 video
- Encodes audio to AAC-LC, HE-AAC, Dolby DD+, WMA
- Packages to MP4, Smooth Streaming, Http-Live-Streaming
- Encrypts with PlayReady, Common Encryption, AES

Encoding with third-parties

- Partner SDK for enabling 'build-in' encoders

Step 3: Deliver Content



Managed streaming service... it just works!

- Guaranteed bandwidth
- Auto recovery, redundancy and failover
- Multiple origins support and scale independently

Azure and 3rd party CDN support

IP Whitelisting

REST API for all platforms

Reference: <http://msdn.microsoft.com/en-us/library/windowsazure/hh973617.aspx>



.NET library

Nuget package: <https://nuget.org/packages/windowsazure.mediaservices>

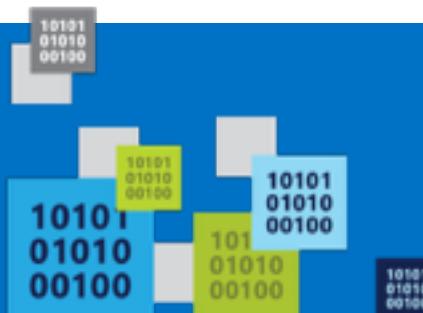
GitHub: <https://github.com/Azure/azure-sdk-for-media-services>

Extensions for .NET SDK: <https://github.com/sazure/azure-sdk-for-media-services-extensions>

PHP Library

GitHub: <https://github.com/windowsazure/azure-sdk-for-php>

Open Tech blog with demo: <http://msopentech.com/blog/2014/01/23/ms-open-technologies-enhances-open-source-php-sdk-windows-azure/>





JAVA library

Windows / Mac / Linux: <http://www.windowsazure.com/en-us/develop/java/java-home>

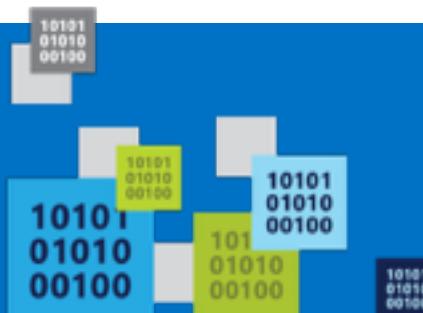
GitHub: <https://github.com/windowsazure/azure-sdk-for-java/>

PowerShell cmdlets

How to use: <http://www.gtrifonov.com/2013/08/24/how-to-use-windows-azure-powershell-for-media-services/>

Node.js library

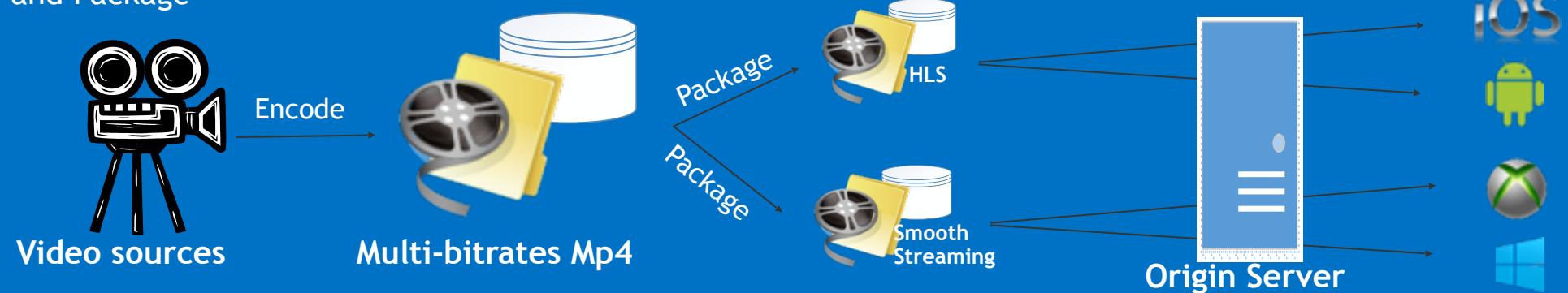
GitHub: <https://github.com/fritzy/node-azure-media>



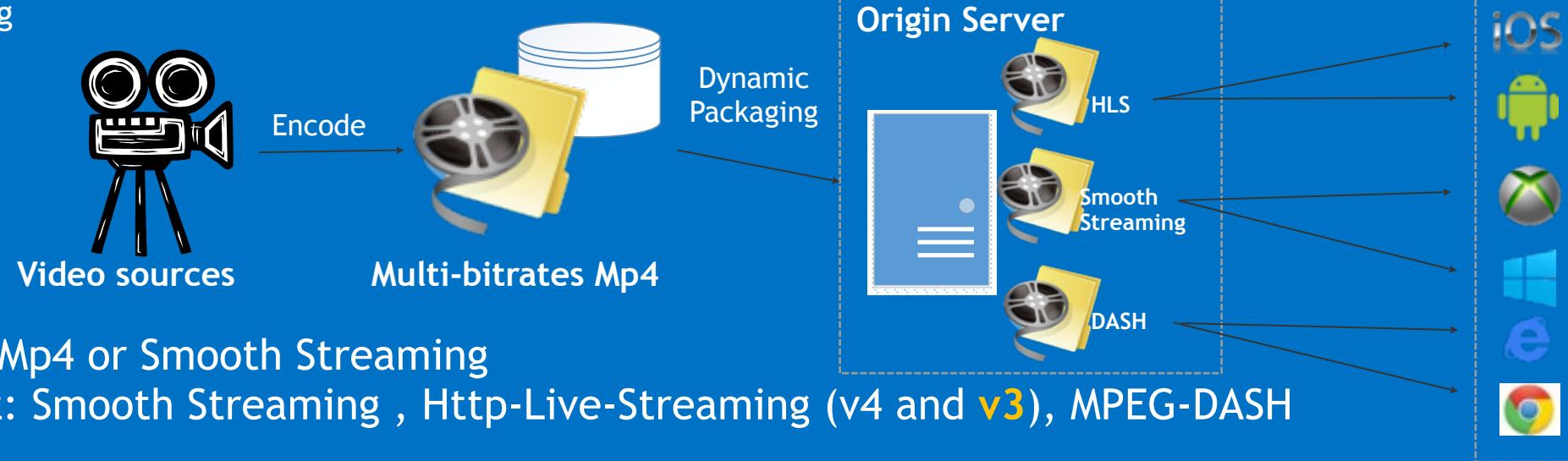
Dynamic packaging

Allows you to re-use your encoded content and bring it to various streaming formats without repackaging the content.

Traditional Encode and Package



Dynamic Packaging



Input format: Mp4 or Smooth Streaming

Output format: Smooth Streaming , Http-Live-Streaming (v4 and v3), MPEG-DASH



You need to have at least 1 reserved streaming unit to enable dynamic packaging!

Useful information - Dynamic Packaging

- Full demo code at:
 - [Introducing Extensions for Microsoft Azure Media Services .NET SDK](#)
 - [Demo – how to create HLS and Smooth Streaming assets using dynamic packaging](#)

By Mingfei Yan

- Other readings:
 - [Dynamic packaging and Encoding and Reserved units](#)

By Nick Drouin

Secure your content



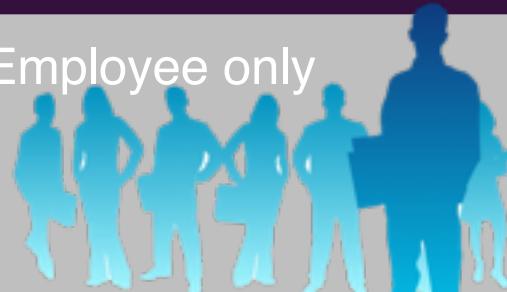
Subscription Fee
(User Authentication)



Ad-funded
(Player Authentication)



Employee only



Ad-funded
(Player Authentication)



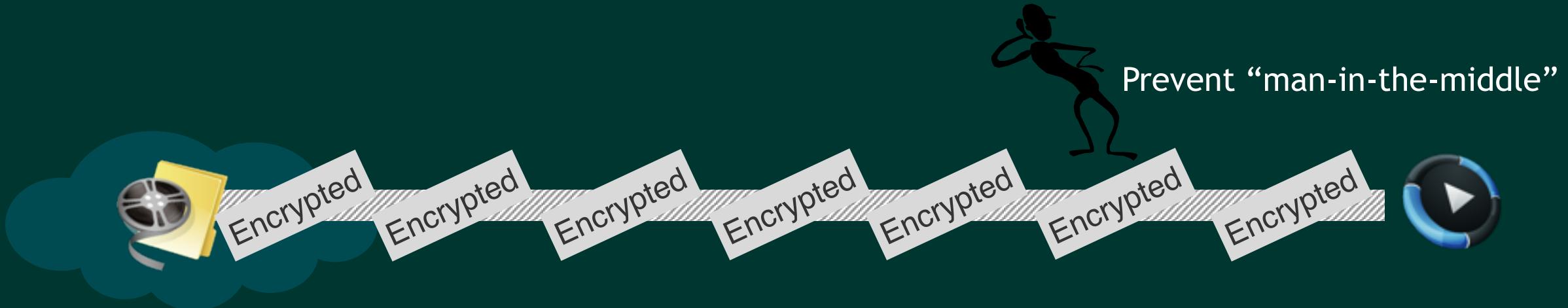
High-premium content provider:

- Prevent piracy
- Prevent Man-in-the-middle

Enterprise or Time-sensitive event:

- Piracy is not a major issue
- Prevent Man-in-the-middle

Options with Media Services



AES clear key
dynamic encryption



DRM technology



+ licensing agreement

Options with Media Services

AES Clear Key dynamic encryption

- Encrypt on-the-wire communication using the widely-known symmetric AES encryption algorithm.
- An authentication service for key is provided.

Who should use this feature:

- “Trust your client”: Key is stored in clear format so it requires you to trust your client not to pass key around
- “Light” encryption: prevent “man-in-the-middle” attack
- Lower cost compared to DRM solution

DRM technology (PlayReady)

- Encrypt Smooth Streaming content with PlayReady protection via common encryption scheme (CENC), and the option of packaging it into HLS or DASH.
- DRM technology allows you to define restrictive licensing agreement to manage user access rights to your media.

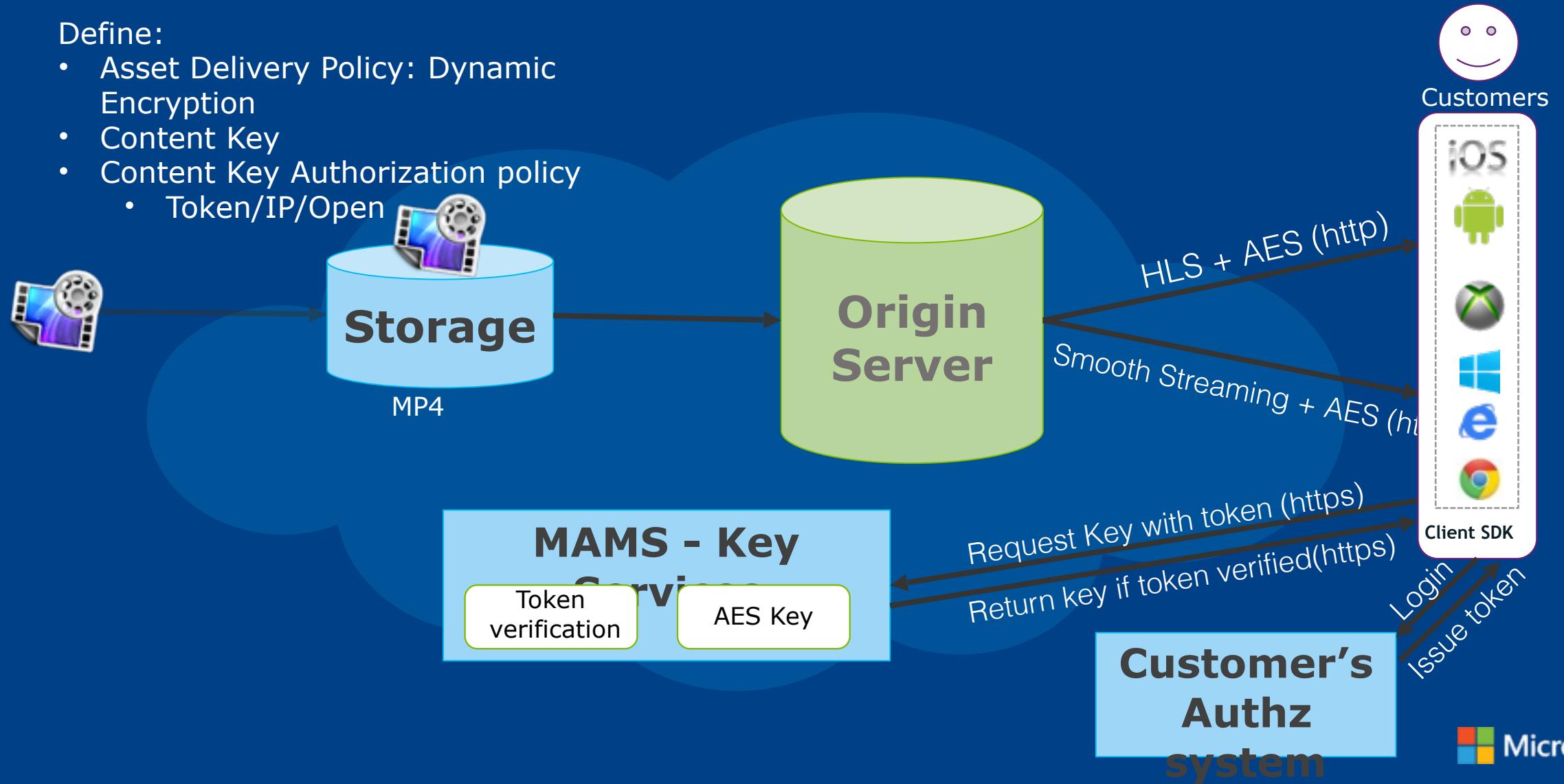
Who should use this feature:

- Premium content or high business impact content: decoding happens in a secure DRM decoder environment
- Prevent piracy and “man-in-the-middle” attack
- More business models enabled

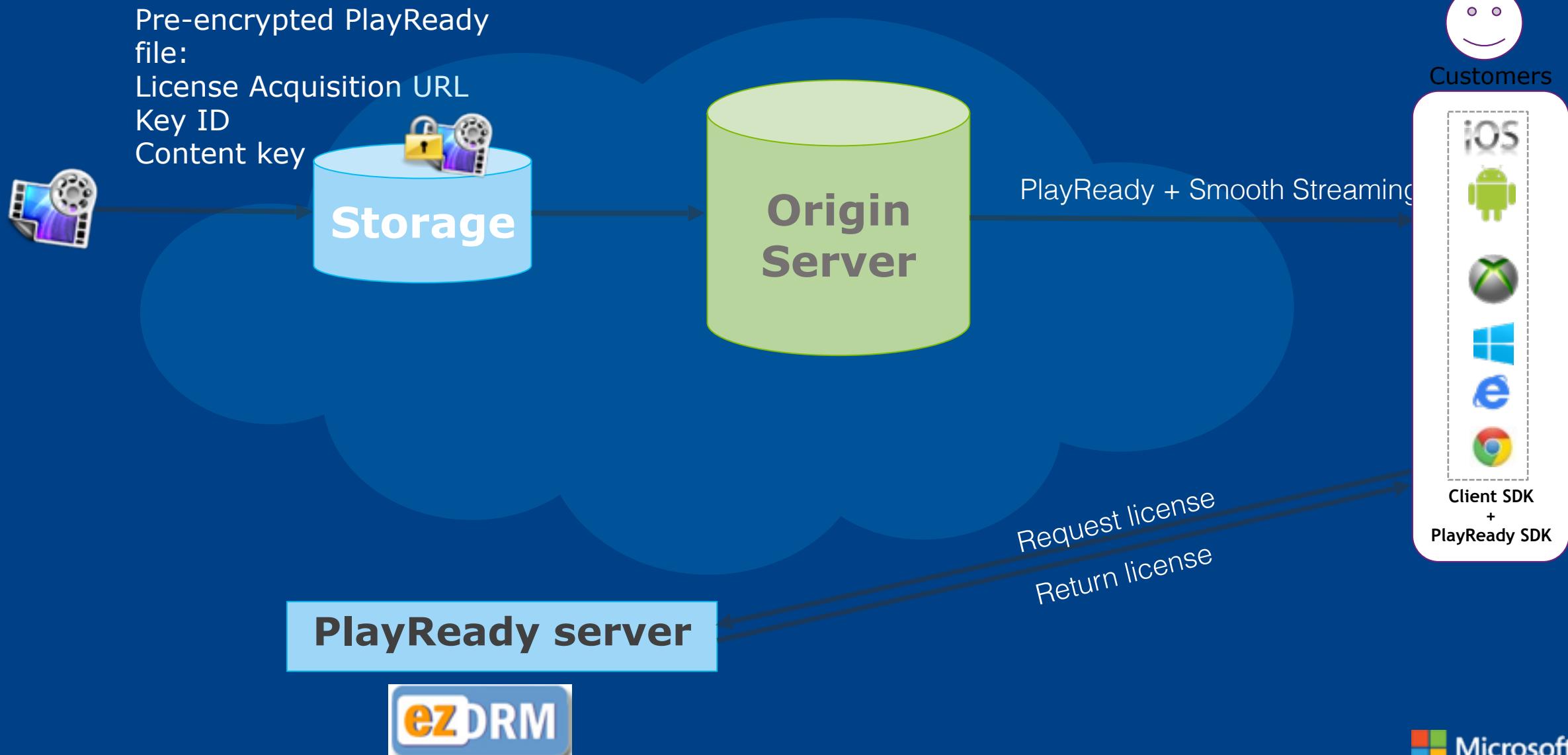
Architecture: AES Dynamic Encryption

Define:

- Asset Delivery Policy: Dynamic Encryption
- Content Key
- Content Key Authorization policy
 - Token/IP/Open

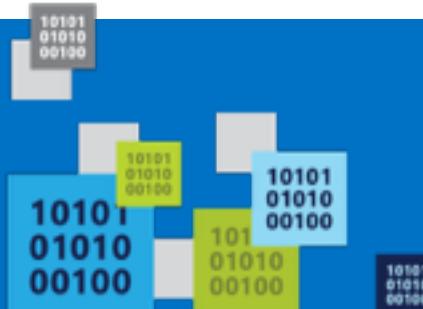


Architecture: PlayReady DRM solution



Useful information Secure delivery

- Overview:
 - [Secure your media with Azure Media Services via MSDN](#)
 - [Protecting Smooth Streaming and MPEG DASH with PlayReady via MSDN](#)
 - [How to Protect an asset with PlayReady protection via MSDN](#)
- Session video:
 - [Introducing the New Office 365 Video Experience](#)



Why do you need to secure your content



Subscription Fee
(User Authentication)



Ad-funded
(Player Authentication)



Employee only



Ad-funded
(Player Authentication)



High-premium content provider:

- Prevent piracy
- Prevent Man-in-the middle

DRM

Enterprise or Time-sensitive event:

- Piracy is not a major issue
- Prevent Man-in-the middle

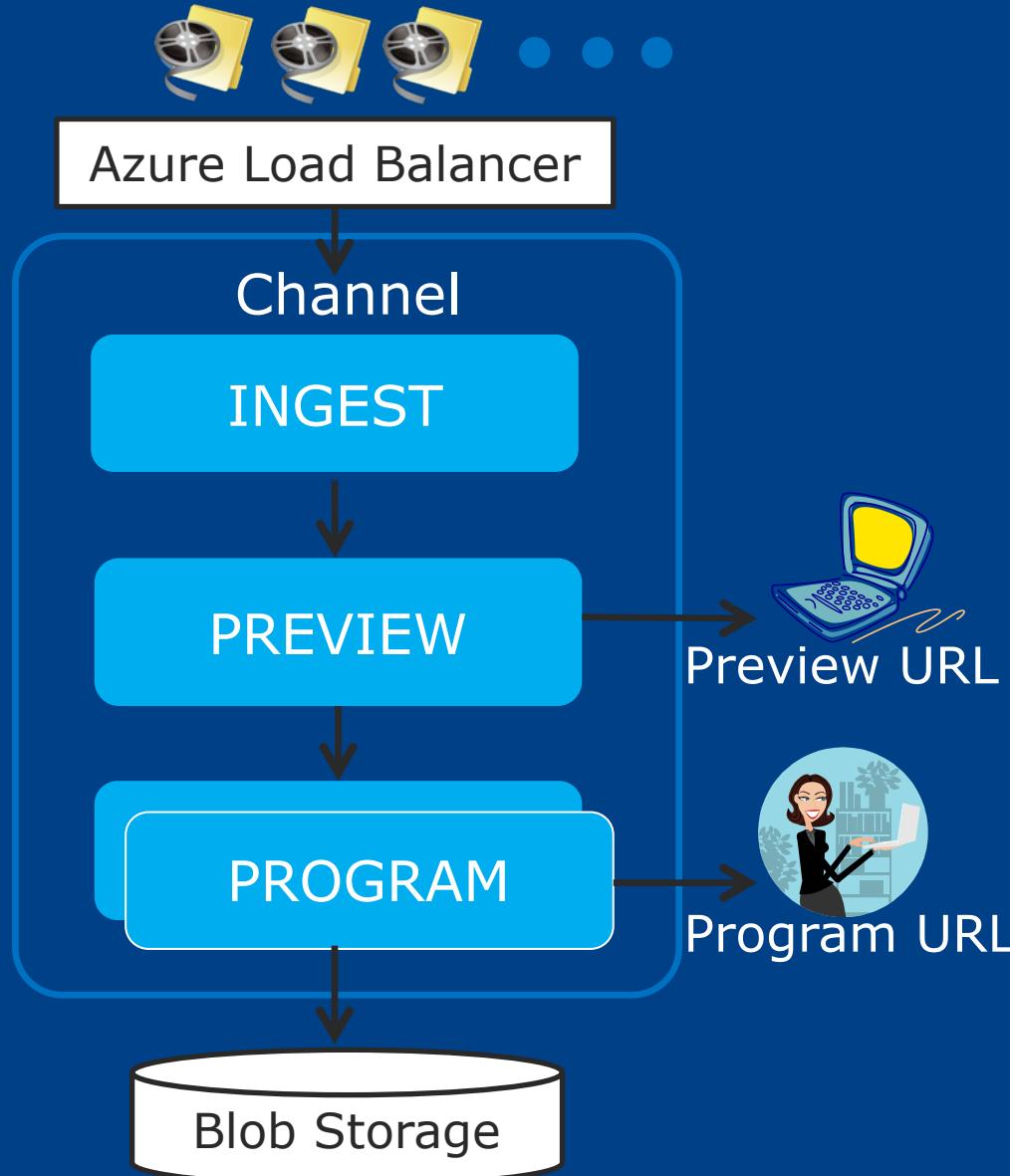
AES

Media Services Live

- Stream live content directly through public cloud
- Multi-format output (Smooth Streaming, HLS and DASH)
- Global reach – deploy anywhere quickly
- Cloud elasticity
- No capital expenses
- Ramp quickly to global scale
- Tear down immediately



How does live streaming work?



Ingest:

Ingest URL to accept Live streams with different bitrates (smooth streaming) through load balancer

Forwards the stream to all preview end-points

Preview:

Receives stream from Ingest

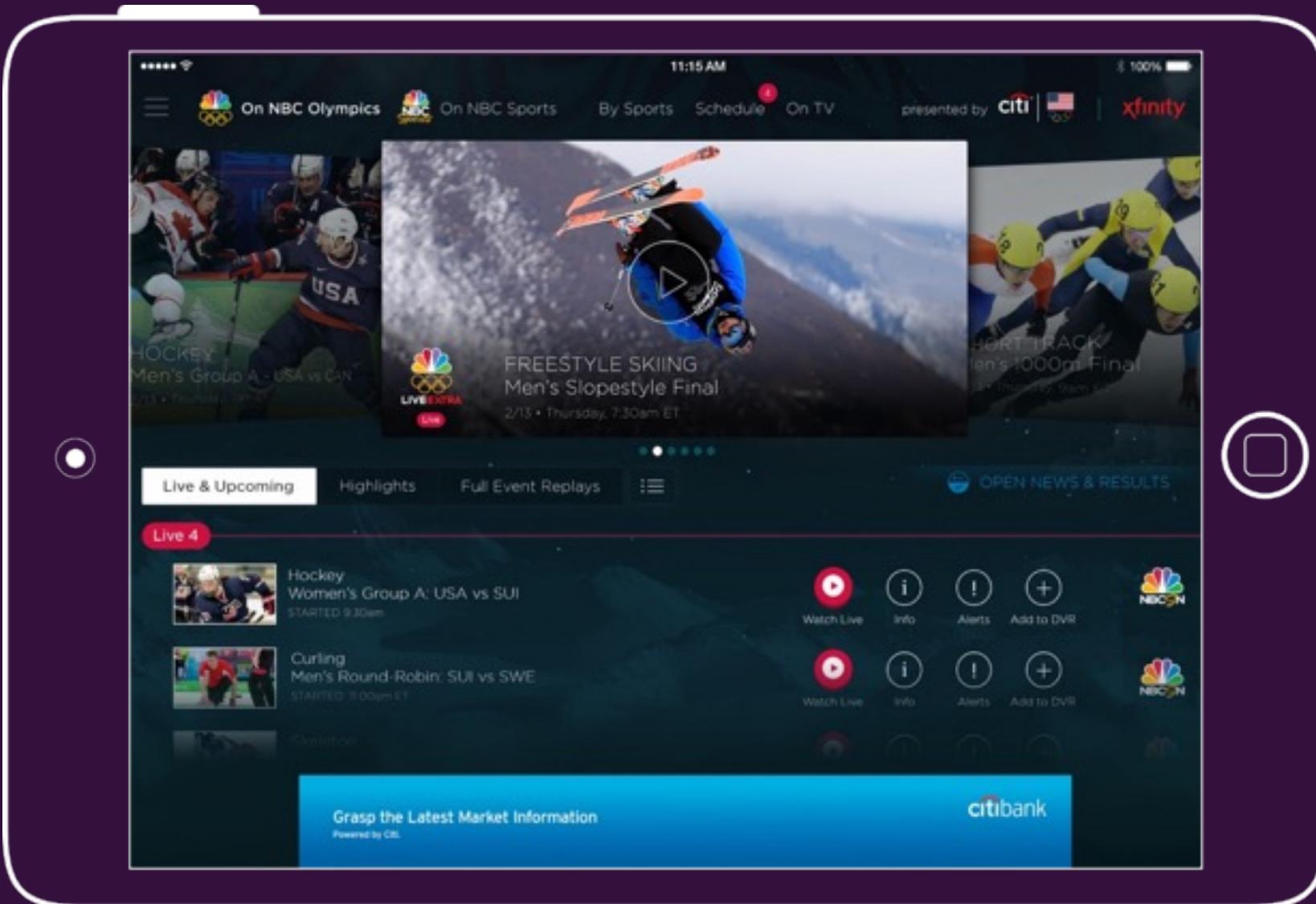
Forwards to Program

Exposes Preview URL (for monitoring and voice-over)

Program:

Writes it to Blob Storage for Live DVR and Archive

Dynamic package into HLS, Smooth and DASH



NBC Olympic Sports

Live video encoding and streaming

Web + Mobile

100 million viewers

2.1 million concurrent HD viewers during the USA vs. Canada hockey match

Old Player World



Flash Player



Silverlight
Player



Windows SDK



Android SDK

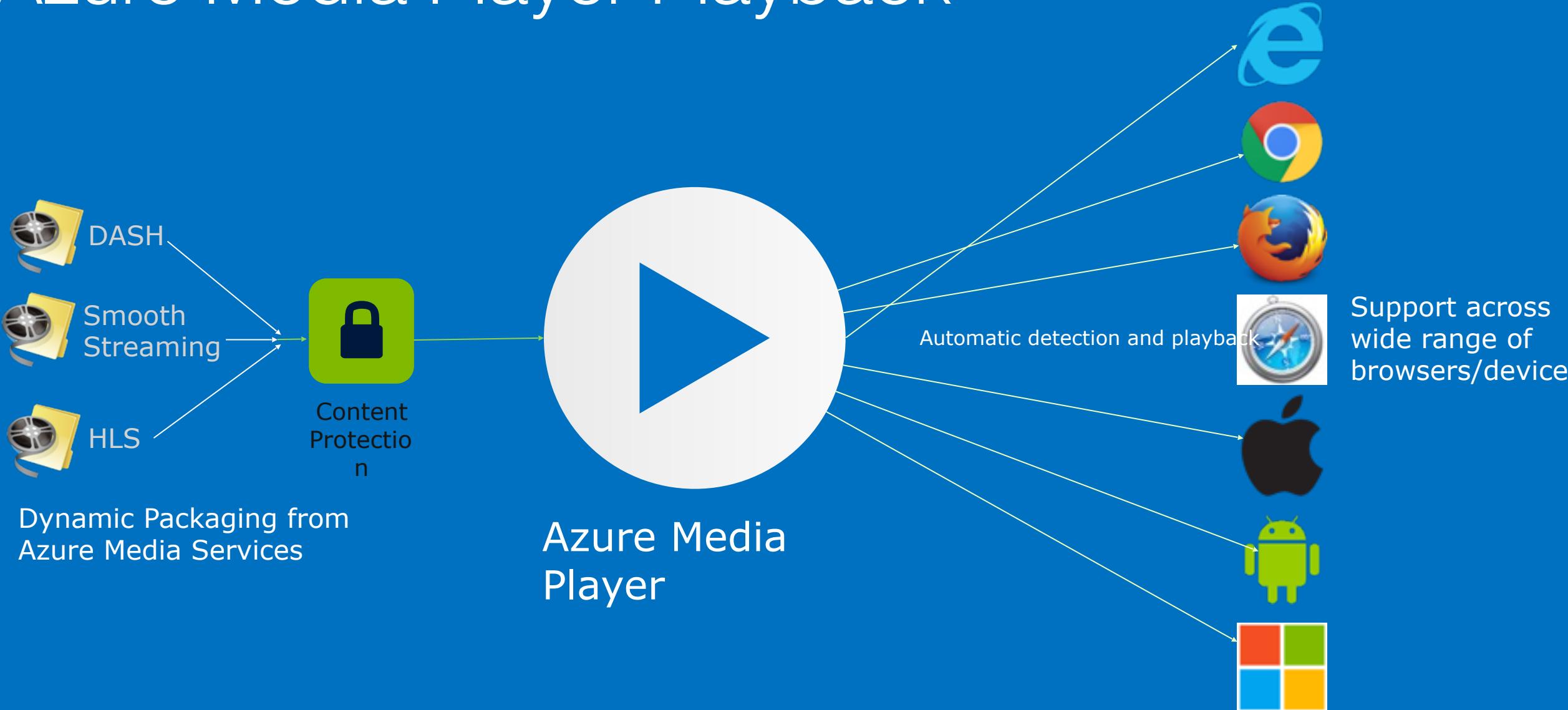


iOS SDK



HTML5

Azure Media Player Playback



Azure Media Player Features

Implemented Features

- Playback of Content from Azure Media Services
 - Clear On Demand
 - Clear Live
 - AES-128 Encrypted content
 - PlayReady Encrypted content
- Playback across a wide range of devices
- Simple setup with <video> or via JS
- Unified JavaScript APIs
- Basic Heuristics
- Unified Player UI

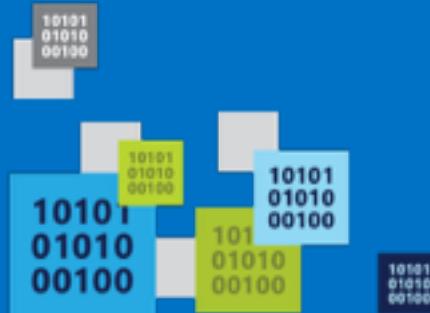
Coming Soon

- Full Subtitles/Captions support
- Discontinuities
- Trick-Play
- Audio Only
- Ads support
- Analytics
- Audio Track Selection
- Bitrate Selection
- Heuristics APIs
- Specific error messaging and across-tech error unification
- Multi-period presentations
- Multiple camera angles

Azure Media Player Reach

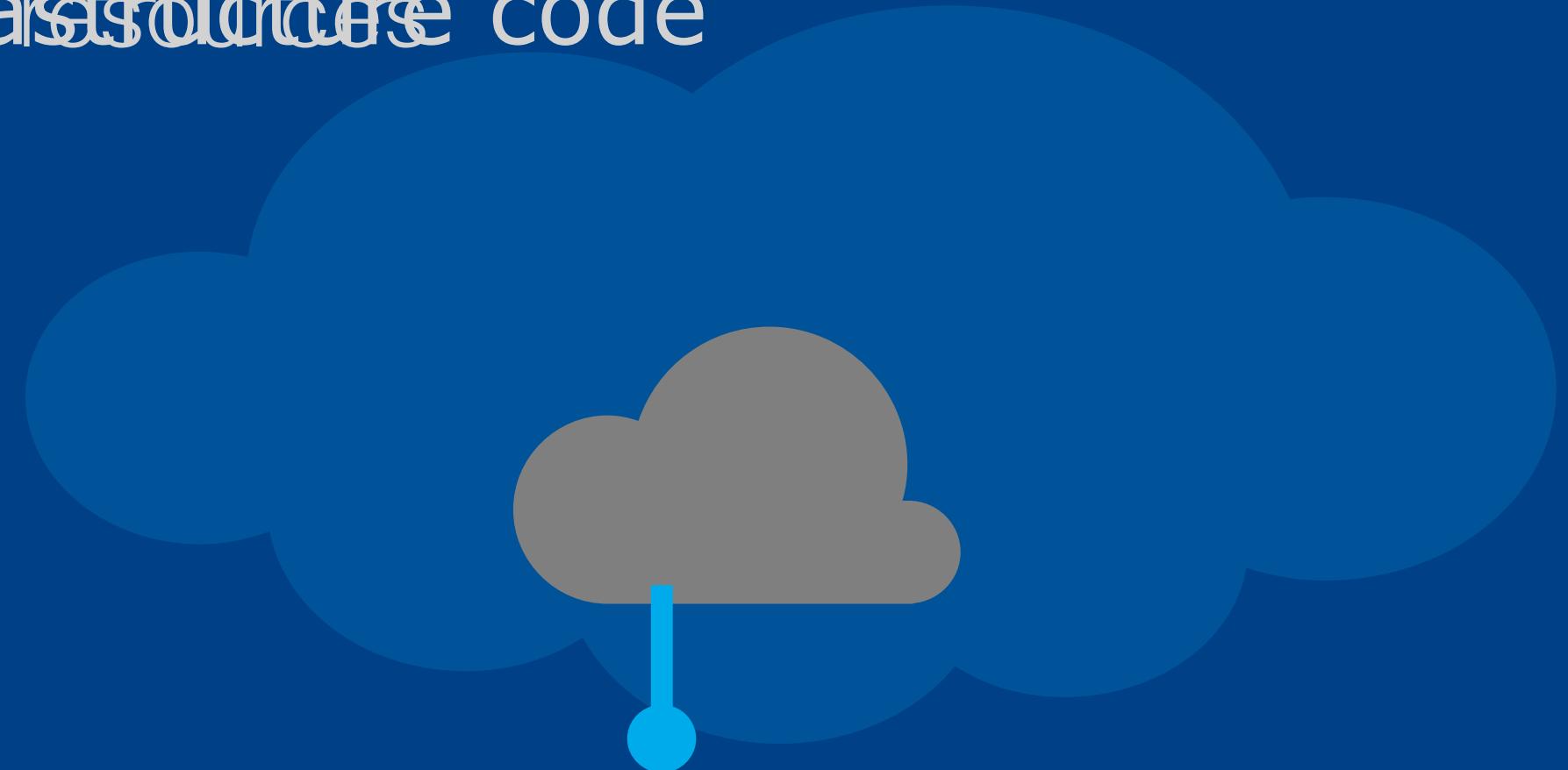
Browser	Clear Content	AES Content	PlayReady Content
IE 11	DASH	DASH	DASH
Chrome 37	DASH	DASH	Smooth
iOS Safari	HLS	HLS	n/a
Android 4.4 Chrome	DASH	DASH	n/a
Firefox	Smooth	Smooth	Smooth
IE 10-	Smooth	Smooth	Smooth
WP IE 11	DASH	DASH	n/a
Safari 8 on OSX Yosemite	Smooth	Smooth	Smooth
Safari on OSX Lion	Smooth	Smooth	Smooth

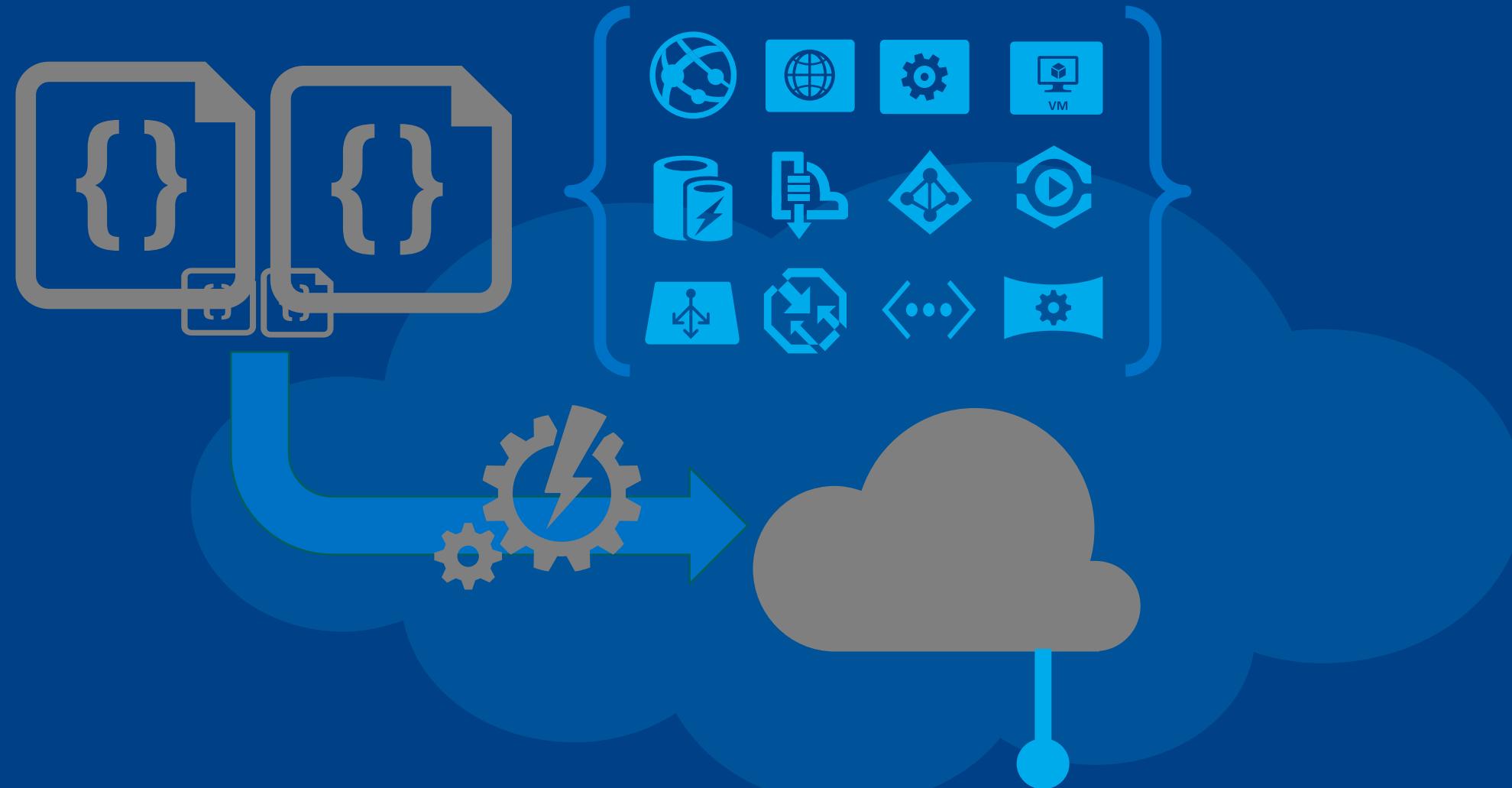
Azure IaaS



Your service

- Your application code
- Requirements for reuse code





You: Code (application, infrastructure)
Azure: Resources (IaaS, PaaS, SaaS)

Azure Virtual Machines



- à Launch Windows Server and Linux in minutes
- à Scale from 1 to 1000s of VM Instances
- à Save money with per-minute billing
- à Open and extensible

Announcing - redhat now on Azure



THE WAIT IS OVER

Use Red Hat products on Microsoft Azure

Security, consistency, reliability: These are why enterprises trust Red Hat® solutions. They're also why enterprises turn to a public cloud like Microsoft Azure. It's only natural that customers want to unite the 2.

Now you can. [Red Hat and Microsoft are teaming up](#) to offer open hybrid cloud solutions on Azure.

[READ THE PRESS RELEASE](#)

Microsoft Azure

“This partnership is a powerful win for enterprises, ISVs and developers. With this partnership, we are expanding our commitment to offering unmatched choice and flexibility in the cloud today, meeting customers where they are so they can do more with their hybrid cloud deployments – all while fulfilling the rigorous security and scalability requirements that enterprises demand.”

Provisioning VM

Getting Started



Management Portal



Scripting
(Windows, Linux and Mac)



REST API

Select Image and VM Size

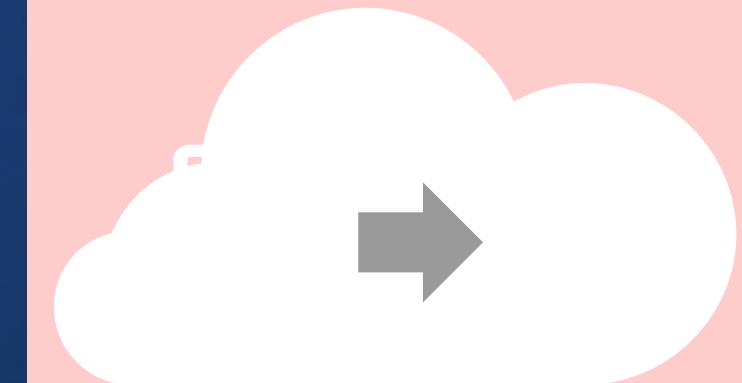


Windows Server
Linux

General Purpose
Basic
Standard
Optimized Compute
Performance
Optimized
Network Optimized

New Disk Persisted in Storage

Boot VM from New Disk



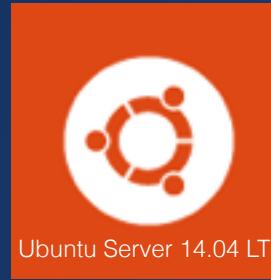
Cloud

VM Gallery

A COLLECTION OF PREBUILT IMAGES FOR VARIOUS WORKLOADS



Windows Server 2012 R2



Ubuntu Server 14.04 LTS



CentOS 6.5



SUSE Linux Enterprise Server



openSUSE 13.1



Oracle Linux 6.4.0.0.0



SQL Server 2014 Standard



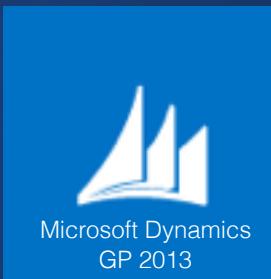
Oracle Database 11g R2



BizTalk Server 2013



SharePoint Server Farm



Microsoft Dynamics GP 2013



Zulu 8

SAP HANA
Developer Edition

Puppet Enterprise 3.2.3



Barracuda Web Application

Oracle WebLogic
Server 12.1.2

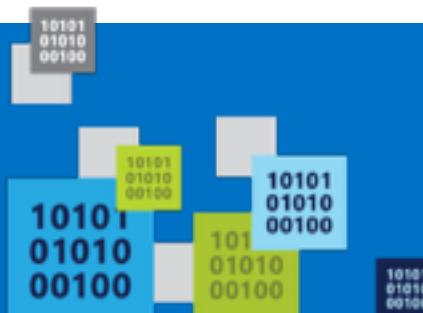
Visual Studio Ultimate 2013



Windows 8.1 Enterprise

Virtual Machine Sizes

- General Purpose compute: Basic
- General Purpose compute: Standard
- Optimized Compute
- Performance Optimized
- Network Optimized

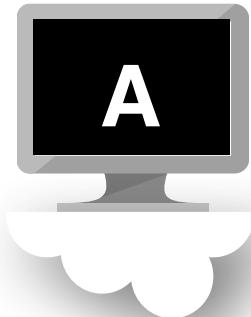


Scale-up options



Highest value

Largest scale-up



Highest value



35% faster than D
NVIDIA GPUs
Intel E5-2673 v3 CPUs



Most memory
fastest CPUs



NVIDIA GPUs
Remote visualization
Compute-intensive + RDMA



NVIDIA GPUs
Remote visualization
Compute-intensive + RDMA

The G family

Optimized for data workloads

Up to 32 CPU cores, 448 GB
RAM

6.5 TB local SSD

Latest generation Intel
processor

Up to 64 attached disks!!

Dell PowerEdge R930 Rack Server

Starting Price \$66,621.00
Instant Savings \$20,229.13

Subtotal **\$46,391.87**

As low as **\$1,392.00 /month[^]**

 [Dell Business Credit | Apply](#)

 [Discount Details](#)

 **Ships in 11 - 15 Business Days**

 [Print Summary](#)

Additional Processor	No 3rd/4th Processors	edit
Processor Thermal Configuration	2 CPU	edit
PCIe Riser	None	edit
Cooling	None	edit
Memory DIMM Type and Speed	2133MT/s RDIMMs	edit
Memory Configuration Type	Performance Optimized	edit
Memory Capacity	16GB RDIMM, 2133MT/s, Dual Rank, x4 Data Width	edit
RAID Configuration	No RAID for H330/H730P (1-24 HDDs)	edit
RAID Controller	PERC H730P Adapter RAID Controller, 2Gb NV Cache	edit
Hard Drives	800GB Solid State Drive SAS Read Intensive MLC 12Gbps 2.5in Hot-plug Drive	edit
Network Daughter Card	Broadcom 5720 Quad Port 1Gb Network Daughter Card	edit
Additional Network Cards	None	edit

General Purpose Compute

Basic Tier

An economical option for development workloads, test servers, and other applications that don't require load balancing, auto-scaling, or memory-intensive virtual machines.

Instance	Cores	RAM	Disk sizes
A0	1	0.75 GB	20 GB
A1	1	1.75 GB	40 GB
A2	2	3.5 GB	60 GB
A3	4	7 GB	120 GB
A4	8	14 GB	240 GB

General Purpose Compute

Standard Tier

Offers the most flexibility. Supports all virtual machine configurations and features

Size	CPU cores	Memory	NICs (Max)	Max. disk size	Max. data disks (1023 GB each)	Max. IOPS (500 per disk)
Standard_A0\ExtraSmall	1	768 MB	1	Temporary = 20 GB	1	1x500
Standard_A1\Small	1	1.75 GB	1	Temporary = 70 GB	2	2x500
Standard_A2\Medium	2	3.5 GB	1	Temporary = 135 GB	4	4x500
Standard_A3\Large	4	7 GB	2	Temporary = 285 GB	8	8x500
Standard_A4\ExtraLarge	8	14 GB	4	Temporary = 605 GB	16	16x500
Standard_A5	2	14 GB	1	Temporary = 135 GB	4	4X500
Standard_A6	4	28 GB	2	Temporary = 285 GB	8	8x500
Standard_A7	8	56 GB	4	Temporary = 605 GB	16	16x500

General Purpose Compute

Network optimized with Infiniband support

Adds a 40Gbit/s InfiniBand network with remote direct memory access (RDMA) technology.

Instance	Cores	RAM	Disk sizes
A8	8	56 GB	382 GB
A9	16	112 GB	382 GB

Adds a 40Gbit/s InfiniBand network with remote direct memory access (RDMA) technology. Ideal for Message Passing Interface (MPI) applications, high-performance clusters, modeling and simulations, video encoding, and other compute or network intensive scenarios.

Optimized Compute (D Tier)- 60% faster CPUs, more memory, and local SSD

Size	CPU cores	Memory	NICs (Max)	Max. disk size	Max. data disks (1023 GB each)	Max. IOPS (500 per disk)
Standard_D1	1	3.5 GB	1	Temporary (SSD) =50 GB	2	2x500
Standard_D2	2	7 GB	2	Temporary (SSD) =100 GB	4	4x500
Standard_D3	4	14 GB	4	Temporary (SSD) =200 GB	8	8x500
Standard_D4	8	28 GB	8	Temporary (SSD) =400 GB	16	16x500
Standard_D11	2	14 GB	2	Temporary (SSD) =100 GB	4	4x500
Standard_D12	4	28 GB	4	Temporary (SSD) =200 GB	8	8x500
Standard_D13	8	56 GB	8	Temporary (SSD) =400 GB	16	16x500
Standard_D14	16	112 GB	8	Temporary (SSD) =800 GB	32	32x500

Dv2 Series- 35% faster than D series, 2.4 GHz Intel Xeon® E5-2673 v3 (Haswell)

Size	CPU cores	Memory	NICs (Max)	Max. disk size	Max. data disks (1023 GB each)	Max. IOPS (500 per disk)
Standard_D1_v2	1	3.5 GB	1	Temporary (SSD) =50 GB	2	2x500
Standard_D2_v2	2	7 GB	2	Temporary (SSD) =100 GB	4	4x500
Standard_D3_v2	4	14 GB	4	Temporary (SSD) =200 GB	8	8x500
Standard_D4_v2	8	28 GB	8	Temporary (SSD) =400 GB	16	16x500
Standard_D5_v2	16	56 GB	8	Temporary (SSD) =800 GB	32	32x500
Standard_D11_v2	2	14 GB	2	Temporary (SSD) =100 GB	4	4x500
Standard_D12_v2	4	28 GB	4	Temporary (SSD) =200 GB	8	8x500
Standard_D13_v2	8	56 GB	8	Temporary (SSD) =400 GB	16	16x500
Standard_D14_v2	16	112 GB	8	Temporary (SSD) =800 GB	32	32x500

DS-series VMs can use Premium Storage- high-performance, low-latency storage.

Size	CPU cores	Memory	NICs (Max)	Max. disk size	Max. data disks (1023 GB each)	Cache size (GB)	Max. disk IOPS & bandwidth
Standard_DS1	1	3.5	1	Local SSD disk = 7 GB	2	43	3,200 32 MB per second
Standard_DS2	2	7	2	Local SSD disk = 14 GB	4	86	6,400 64 MB per second
Standard_DS3	4	14	4	Local SSD disk = 28 GB	8	172	12,800 128 MB per second
Standard_DS4	8	28	8	Local SSD disk = 56 GB	16	344	25,600 256 MB per second
Standard_DS11	2	14	2	Local SSD disk = 28 GB	4	72	6,400 64 MB per second



G-series VMs offer the most memory and run on hosts that have Intel Xeon E5 V3 family processors.

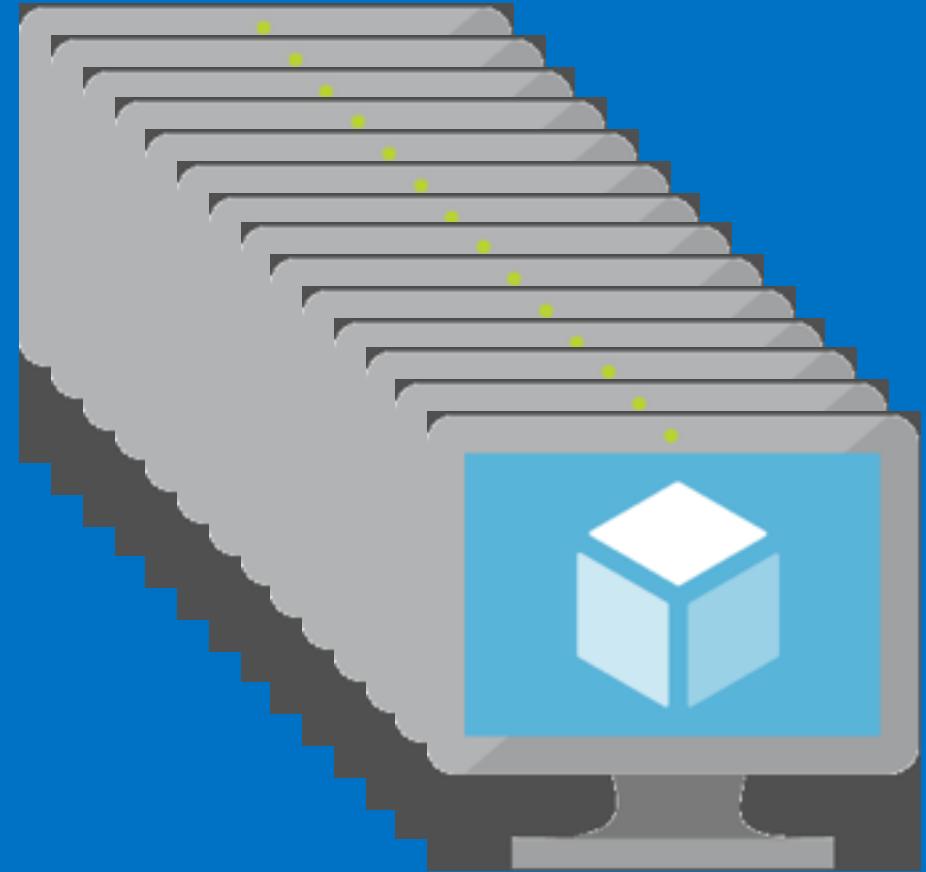
Size	CPU cores	Memory	NICs (Max)	Max. disk size	Max. data disks (1023 GB each)	Max. IOPS (500 per disk)
Standard_G1	2	28 GB	1	Local SSD disk = 384 GB	4	4 x 500
Standard_G2	4	56 GB	2	Local SSD disk = 768 GB	8	8 x 500
Standard_G3	8	112 GB	4	Local SSD disk = 1,536 GB	16	16 x 500
Standard_G4	16	224 GB	8	Local SSD disk = 3,072 GB	32	32 x 500
Standard_G5	32	448 GB	8	Local SSD disk = 6,144 GB	64	64 x 500

GS-series VMs , Godzilla ++ (Premium Storage- high-performance, low-latency storage)

Size	CPU cores	Memory	NICs (Max)	Max. disk size	Max. data disks (1023 GB each)	Cache size (GB)	Max. disk IOPS & bandwidth
Standard_GS1	2	28	1	Local SSD disk = 56 GB	4	264	5,000 125 MB per second
Standard_GS2	4	56	2	Local SSD disk = 112 GB	8	528	10,000 250 MB per second
Standard_GS3	8	112	4	Local SSD disk = 224 GB	16	1056	20,000 500 MB per second
Standard_GS4	16	224	8	Local SSD disk = 448 GB	32	2112	40,000 1,000 MB per second
Standard_GS5	32	448	8	Local SSD disk = 896 GB	64	4224	80,000 2,000 MB per second

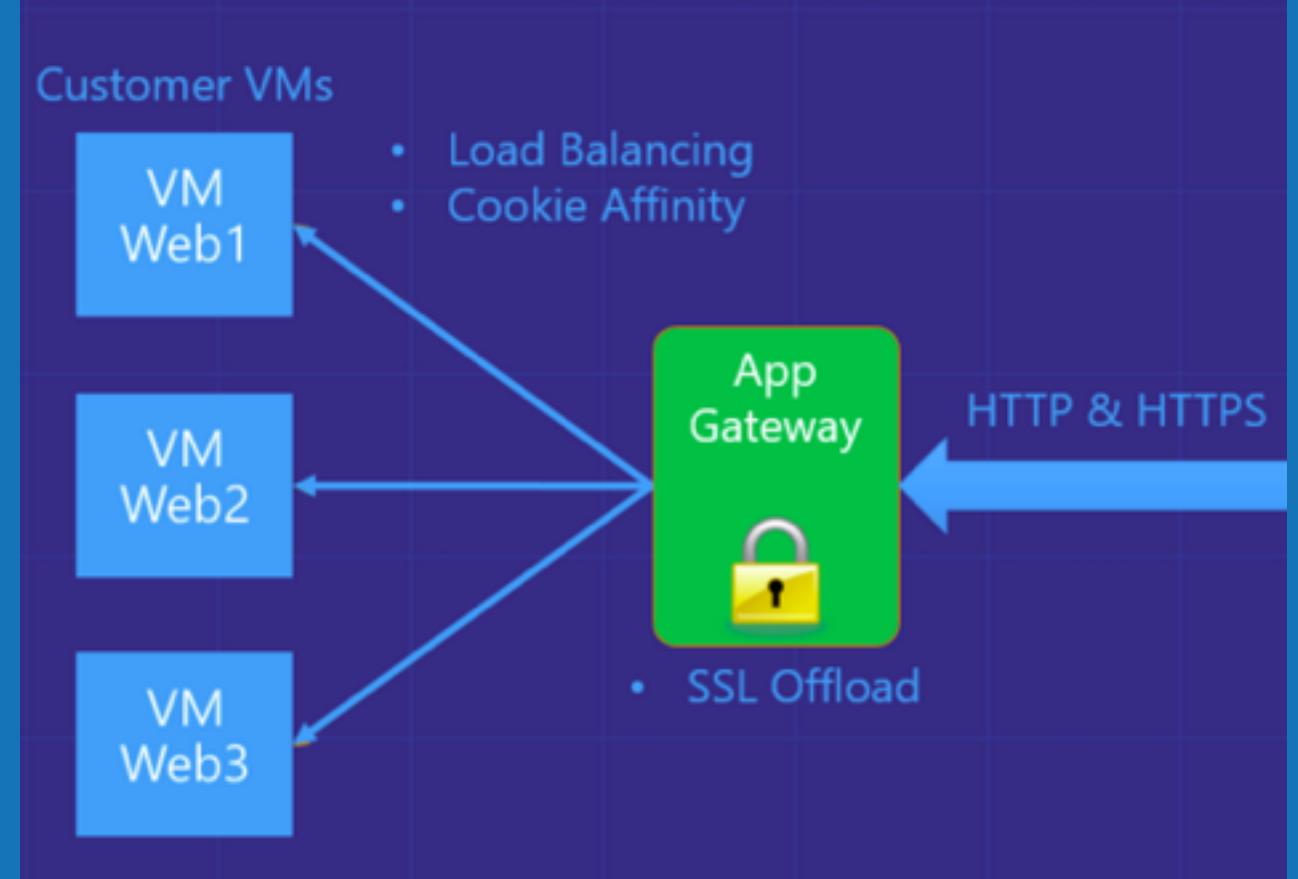
Key Improvements: Azure Virtual Machines (v2)

- Massive and parallel deployment of Virtual Machines
- 3 Fault Domains in Availability Sets
- Custom URLs for Custom Script VM Extensions for VMs



<https://azure.microsoft.com/en-us/documentation/articles/virtual-machines-app-frameworks/>

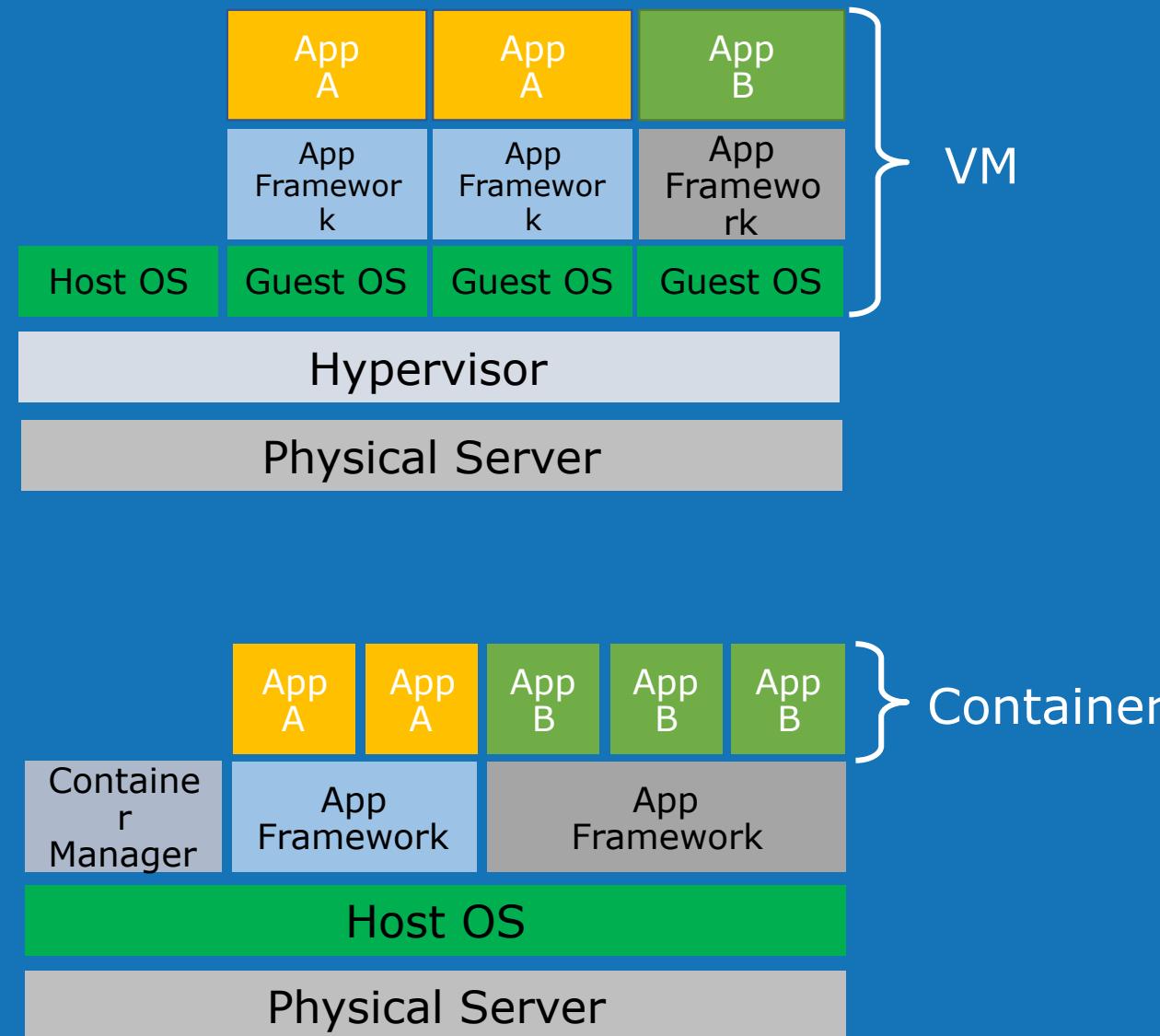
Virtual Machine Scale Sets



VMs + Containers

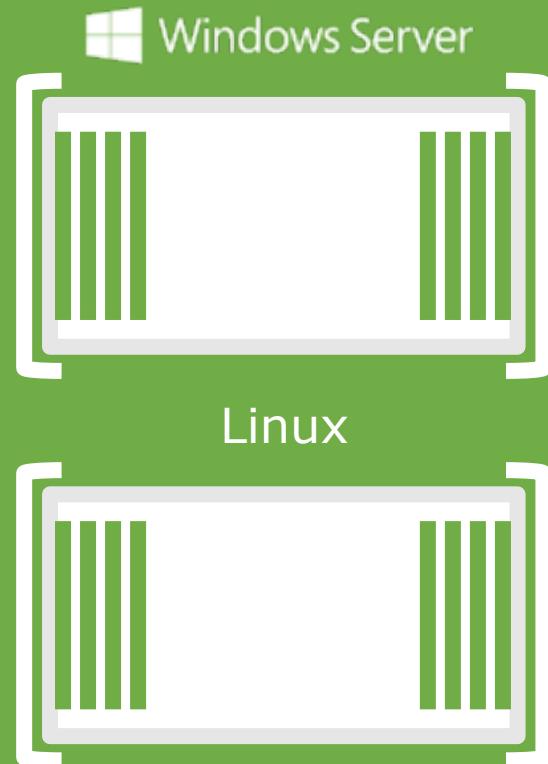
Containers

- What are they?
 - Unit of deployment
 - Isolated environment
 - Isolated collection of resources
- What are the benefits?
 - Instant startup
 - Repeatable and reliable execution
- Scenarios
 - Dev/Test
 - Great for micro-services



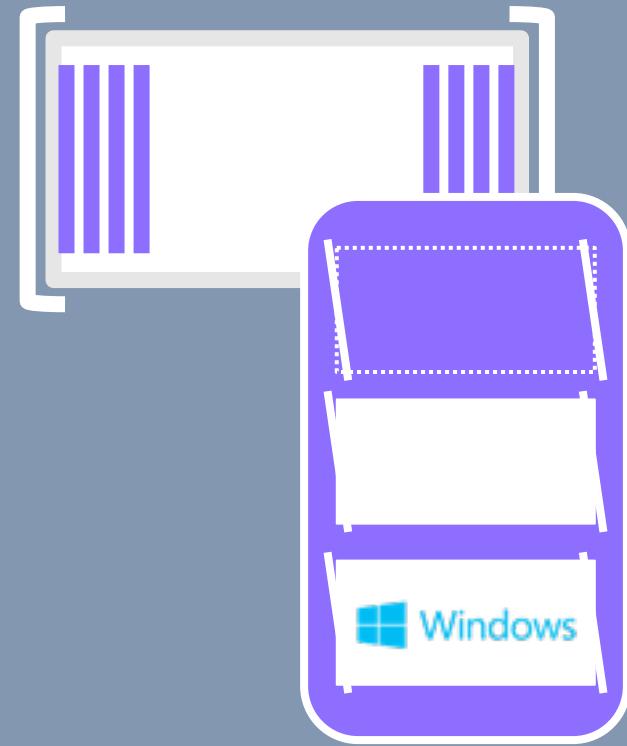
Container Ecosystem via Docker

Container Run-Time



Docker API / Client

Container Images



Docker images

Image Repository

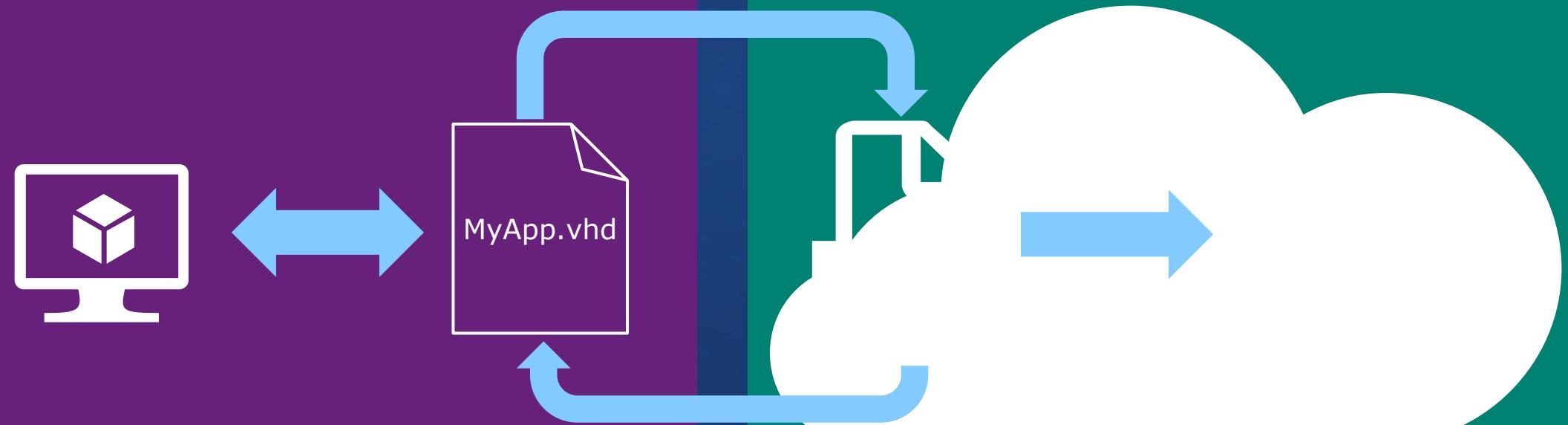


Docker Hub
(trusted
repositories)

Image Mobility

On-Premises

Cloud



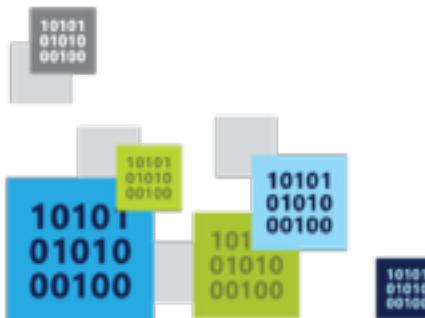
VM Extensions

- Installable components to customize VM instances
- Enable various DevOps scenarios
- Can be added, updated, disabled or removed at any time
- Managed via portal, PowerShell and Management APIs



Data Persistence

- à OS Disks
- à Data Disks



OS Images

- Microsoft
- Partner
- User



Base OS image for new Virtual Machines

Sys-Prepped/Generalized/Read Only
Created by uploading or by capture

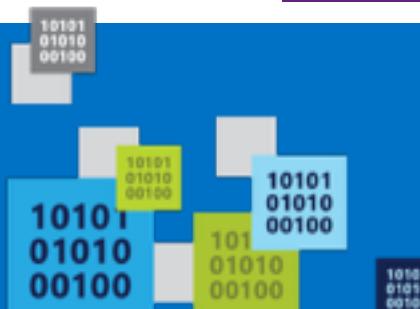
Disks

- OS Disks
- Data Disks



Writable Disks for Virtual Machines

Created during VM creation or during upload of existing VHDs.



VM disk layout

OS Disk

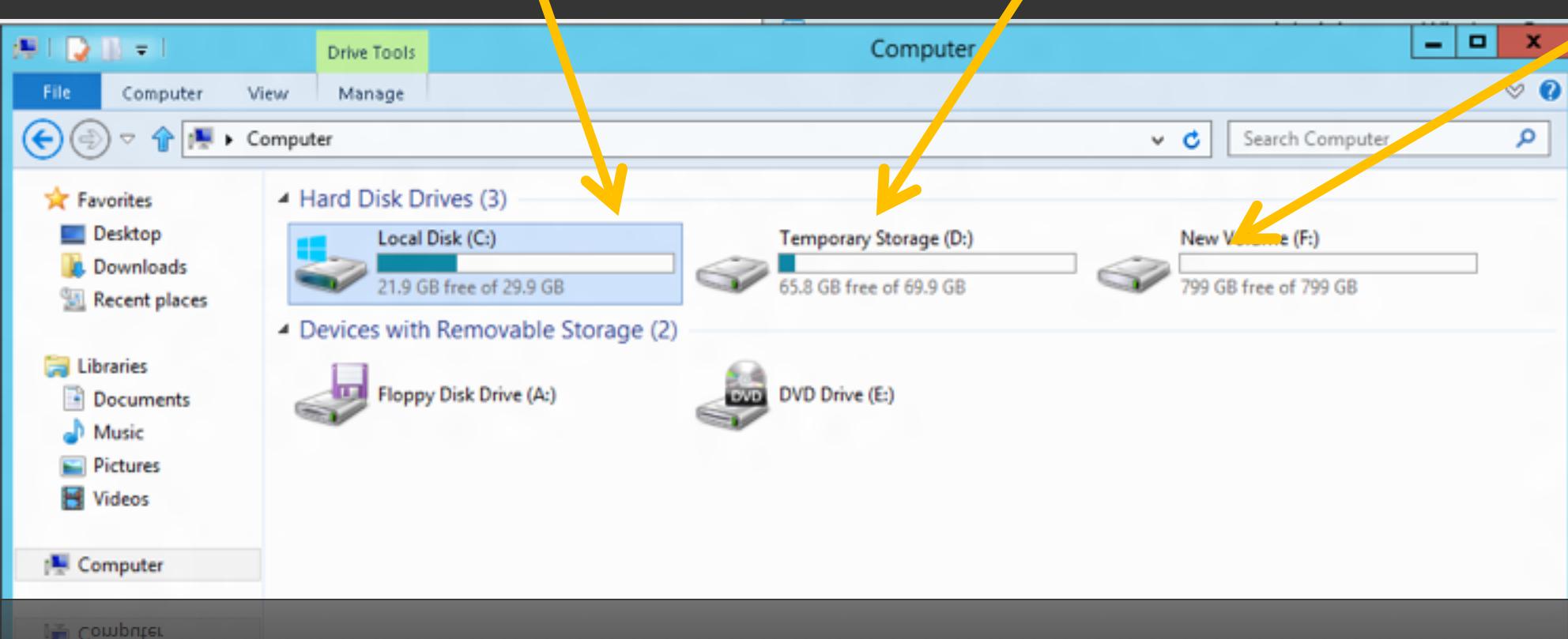
- Persistent
- SATA
- **Drive C:**

Temporary Storage Disk

- Local (Not Persistent)
- SATA
- **Drive D:**

Data Disk(s)

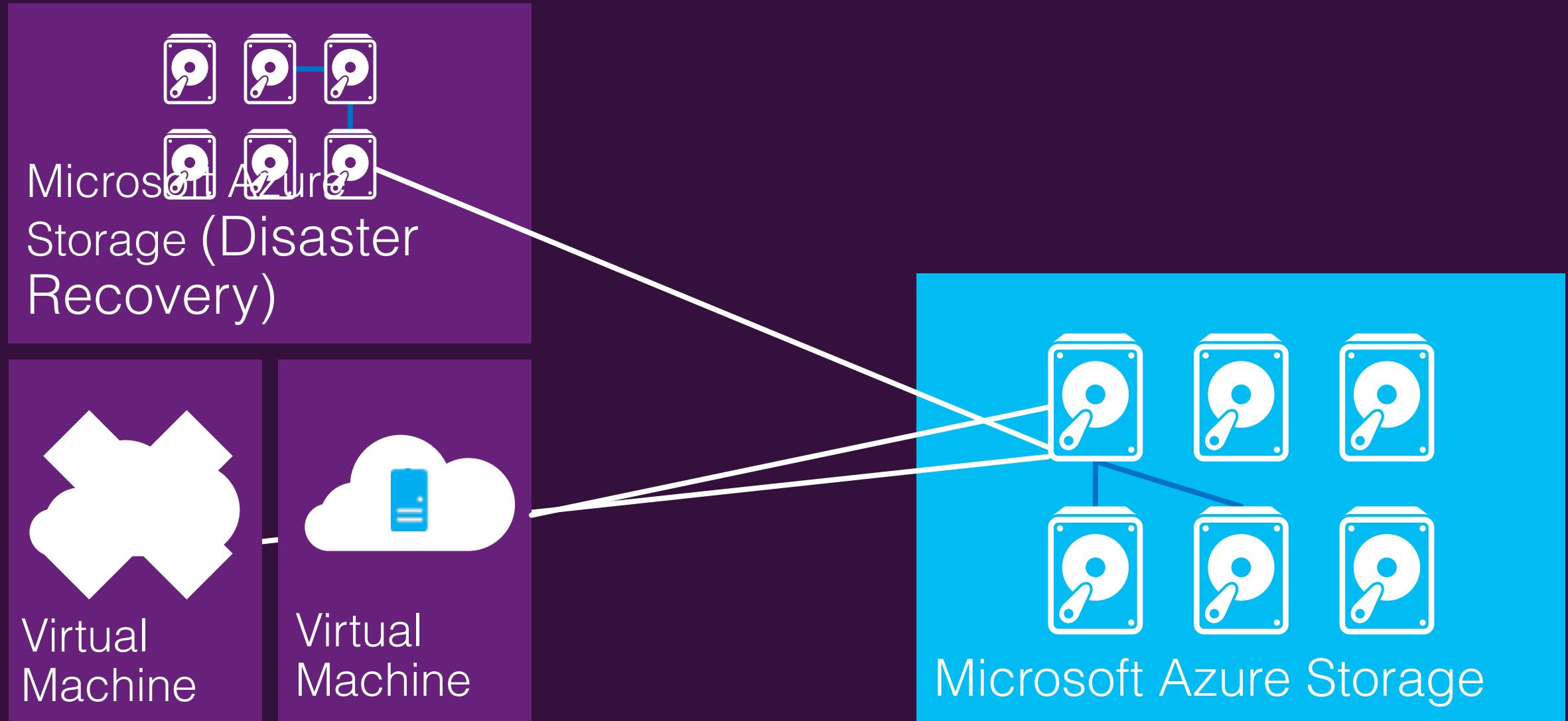
- Persistent
- SCSI
- **Customer Defined Letter**



Temporary Drive Guidance

- Never Place Critical Unreplicated Data on Temp Drive!!
- Use for SQL TempDB and Buffer Pool Extension on D-Series and G-Series VM Sizes Only (SSD Temp Disks)
 - Detailed instructions: <http://blogs.technet.com/b/dataplatforminsider/archive/2014/09/25/using-ssds-in-azure-vms-to-store-sql-server-tempdb-and-buffer-pool-extensions.aspx>
- Use Scheduled Tasks to Configure Temporary Disk
- Test Scheduled Tasks via Resize VM Operation

Persistent Disks and Highly Durable



Linux on the Microsoft Cloud Platform

DATA CENTRE SOFTWARE NETWORKS SECURITY BUSINESS HARDWARE SCIENCE BOOTNOTES

Redmond top man Satya Nadella: 'Microsoft LOVES Linux'

Open-source 'love' fairly runneth over at cloud event



Val Bercovici
@valb00

Has hell frozen over or was that a pig I just saw flying overhead? 😊

Kudos to @Microsoft for getting your mojo back!



Open at Microsoft @OpenAtMicrosoft

"We love #Linux, we love #Docker, we love #Mesosphere..."
@markruassinovich & @benh talking containers at #AzureCon

RETWEETS

3

11:28

AI Gillen
@algillen

@Scottgu blew thru #AzureCon container news; if not obvious, it's Linux based containers. #MSFT loves Linux more each month.

RETWEETS

11

FAVORITES

7



8:33 AM - 29 Sep 2015

Microsoft adds Linux monitoring to Azure in continued open-source push

by Maria Deutscher | Jun 11, 2015 | 0 comments



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Craig Sheppard
@craigsheppard



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Virtual Machine Availability

- à Meaning of 9's
- à Fault domains, update domains and availability sets
- à Load balancing

Meaning of 9's

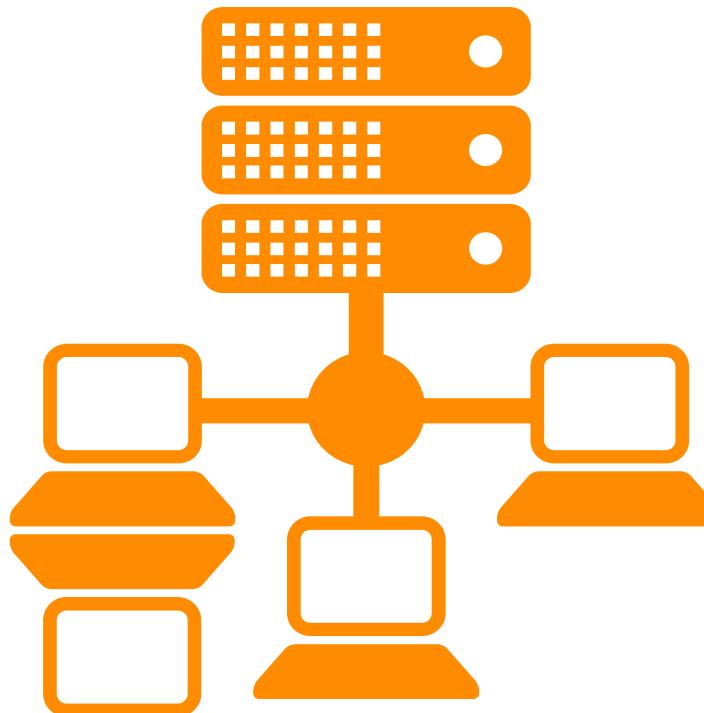
Service Availability(%)	System Type	Annualized Down Minutes	Quarterly Down Minutes	Monthly Down Minutes	Practical Meaning	FAA rating
90	Unmanaged	52,596.00	13,149.00	4,383.00	Down 5 weeks per year	
99	Managed	5,259.60	1,314.90	438.30	Down 4 days per year	ROUTINE
99.9	Well managed	525.96	131.49	43.83	Down 9 hours per year	ESSENTIAL
99.99	Fault tolerant	52.60	13.15	4.38	Down 1 hour per year	

From Generic Requirements for Operation Systems Platform Reliability, Telcordia Technologies System Documentation, GR-2841-CORE and Federation Aviation Administration Handbook: Reliability, Maintainability, and Availability (RMA) Handbook, FAA-HDBK-006A, Jan 7, 2008.

Meaning of 9's

Service Availability(%)	System Type	Annualized Down Minutes	Quarterly Down Minutes	Monthly Down Minutes	Practical Meaning	FAA rating
99.999	High availability	5.26	1.31	0.44	Down 5 minutes per year	CRITICAL
99.9999	Very high availability	0.53	0.13	0.04	Down 30 seconds per year	
99.99999	Ultra availability	0.05	0.01	-	Down 3 seconds per year	SAFETY CRITICAL

From Generic Requirements for Operation Systems Platform Reliability, Telcordia Technologies System Documentation, GR-2841-CORE and Federation Aviation Administration Handbook: Reliability, Maintainability, and Availability (RMA) Handbook, FAA-HDBK-006A, Jan 7, 2008.



99.95% for multiple role instances

4.38 hours of downtime per year

What's included

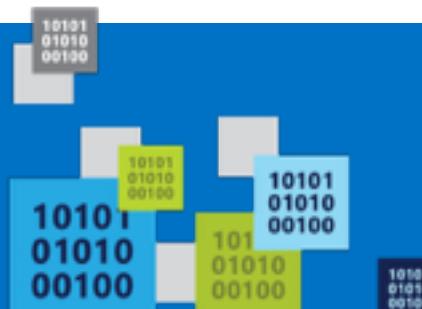
Compute Hardware failure (disk, CPU, memory)

Datacenter failures - Network failure, power failure

Hardware upgrades, Software maintenance – Host OS Updates

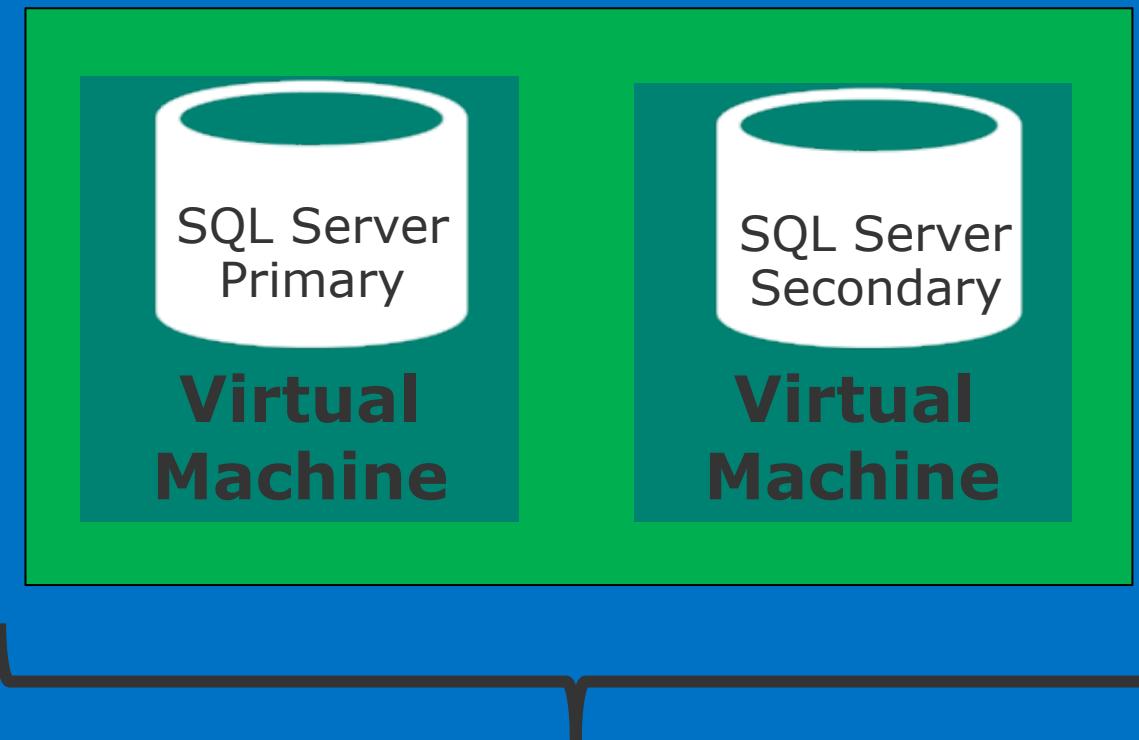
What is not included

VM Container crashes, Guest OS Updates



Availability Sets

Availability set



SLA 99.95

SLA High Availability
Hardware and Software
Windows and Linux

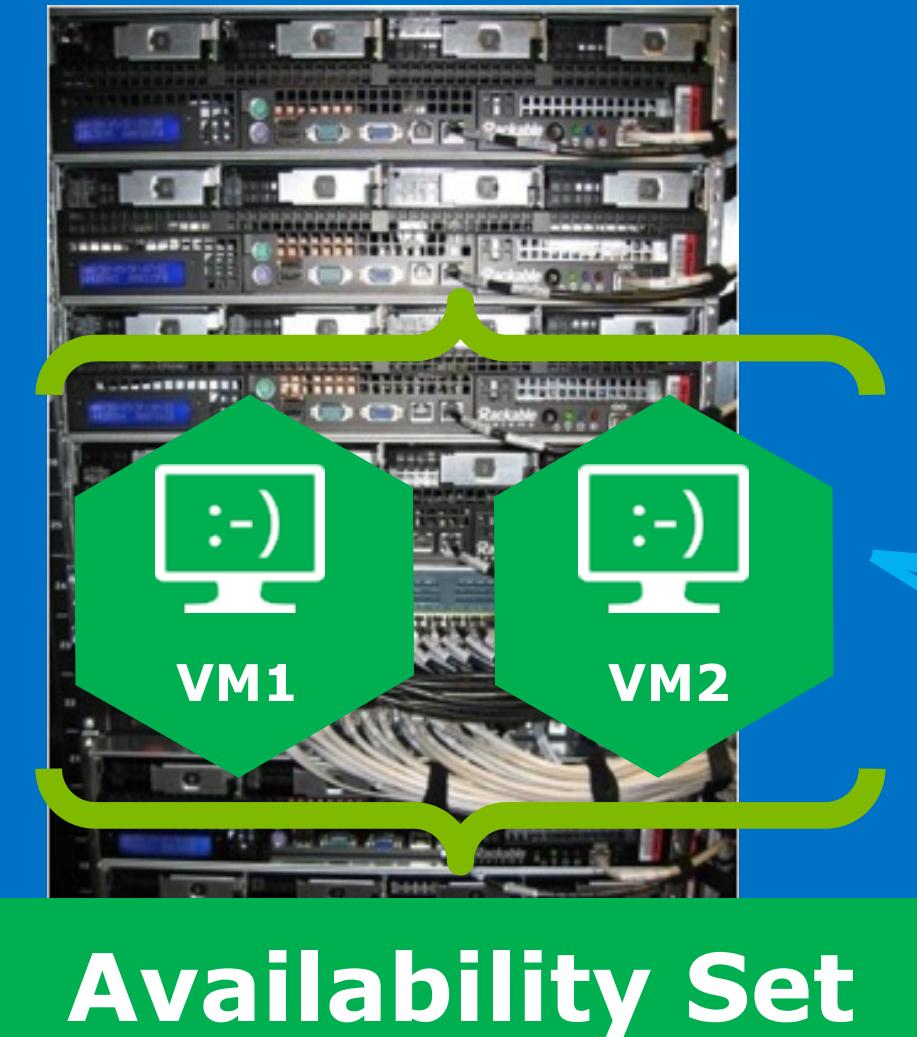
Availability Sets



**Physical
Machines**

**Power Unit
Rack Switch**

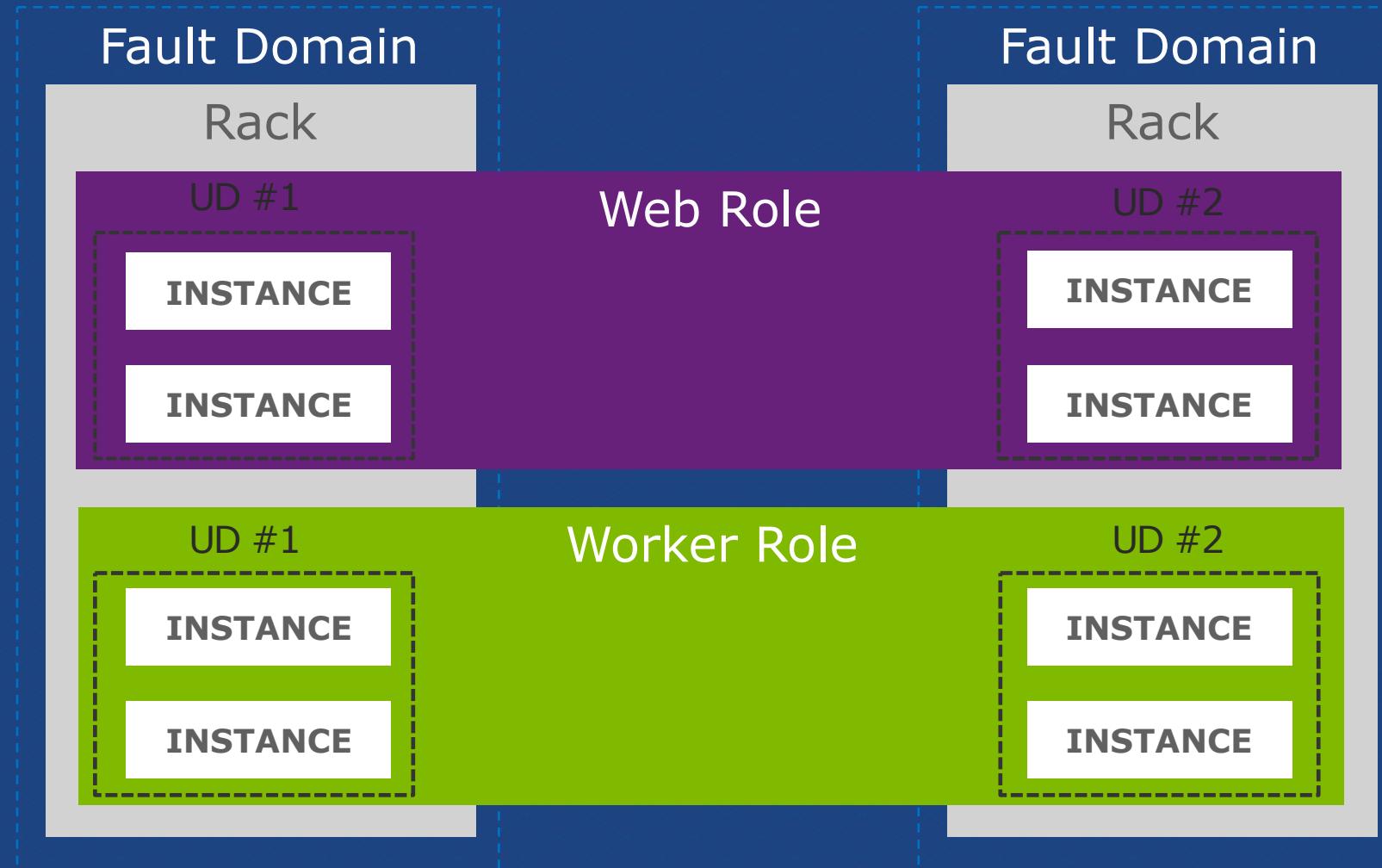
Availability Sets



Physical
Machines

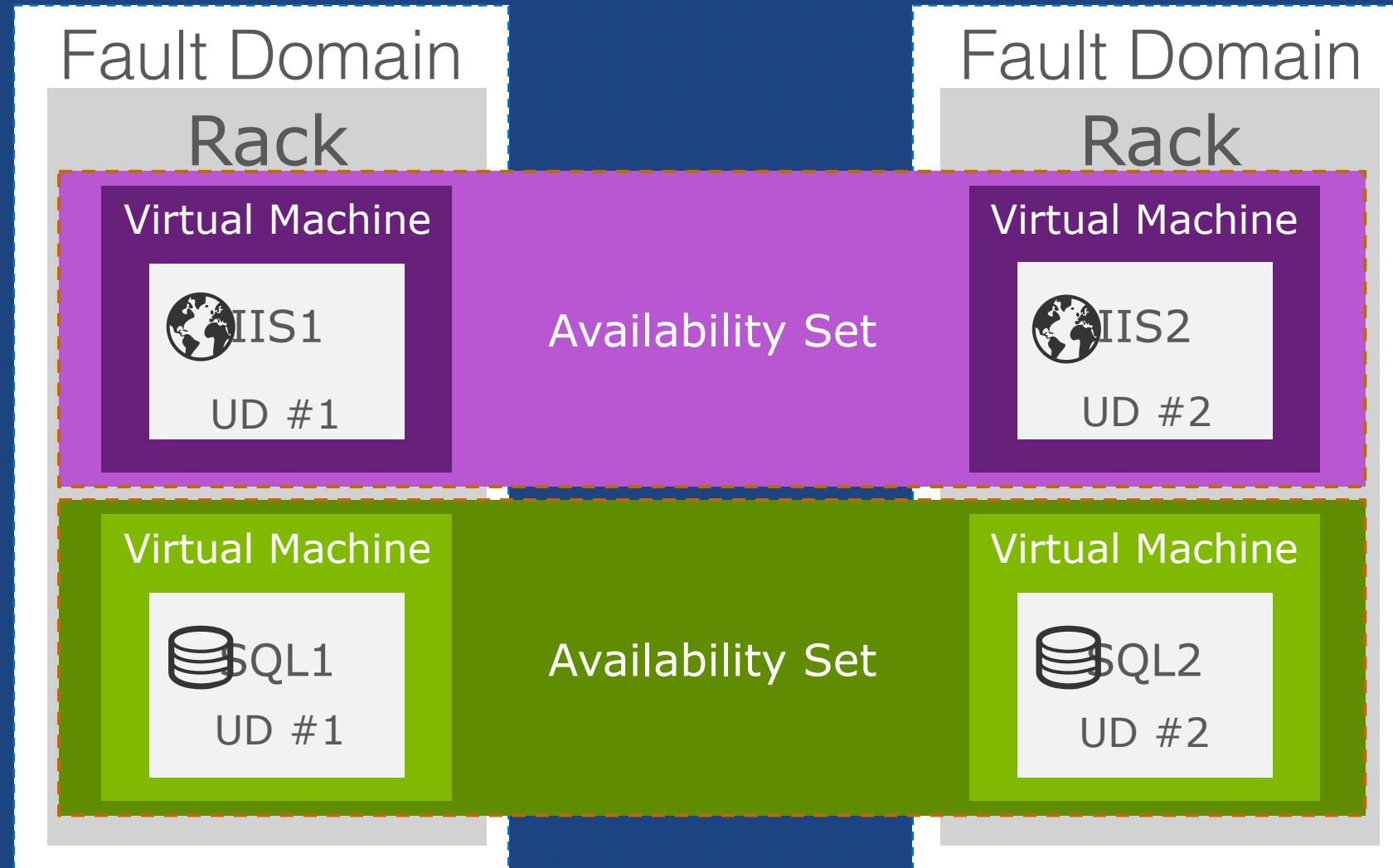
Power Unit
Rack Switch

Fault and Update Domains



Virtual Machine Availability Sets

UPDATE DOMAINS ARE HONORED BY HOST OS UPDATES

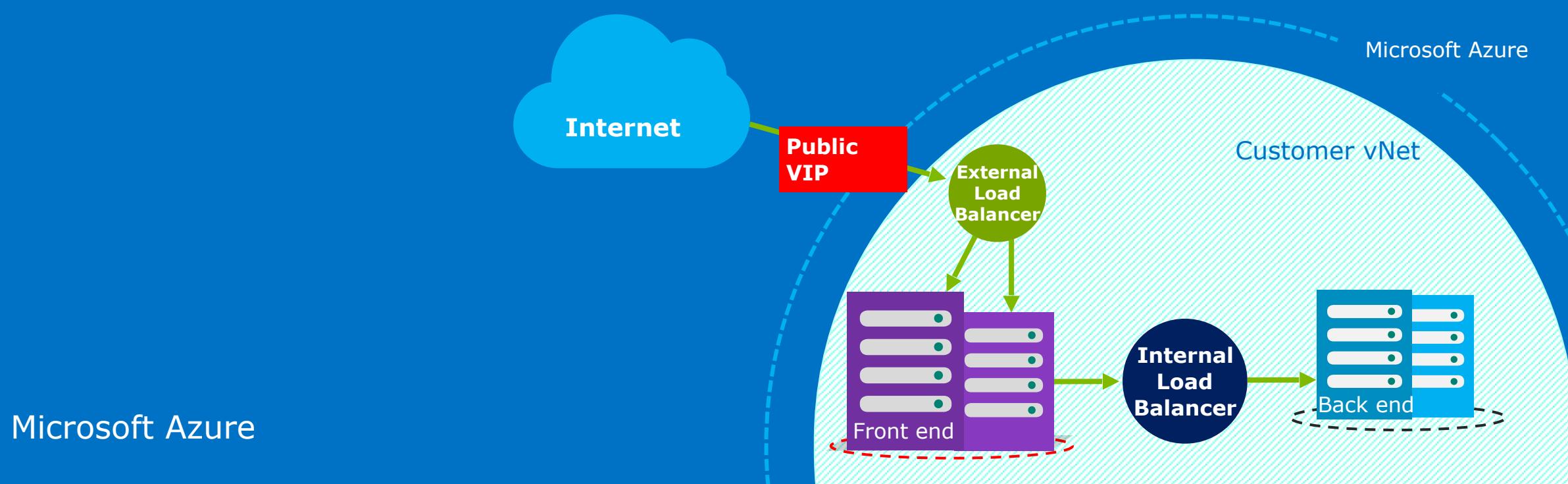


Availability Set Guidance

- VMs in Availability Set Must Be in Same Resource Group
- **Availability Set: 5 Update Domains, 3 Fault Domains**
 - Update Domain – Host Maintenance
 - Fault Domain – Isolation from component failure in rack unit
- Maximum of 100 VMs in a Availability Set
- **Avoid Availability Sets with Single VM**
 - This eliminates notification for host maintenance operations

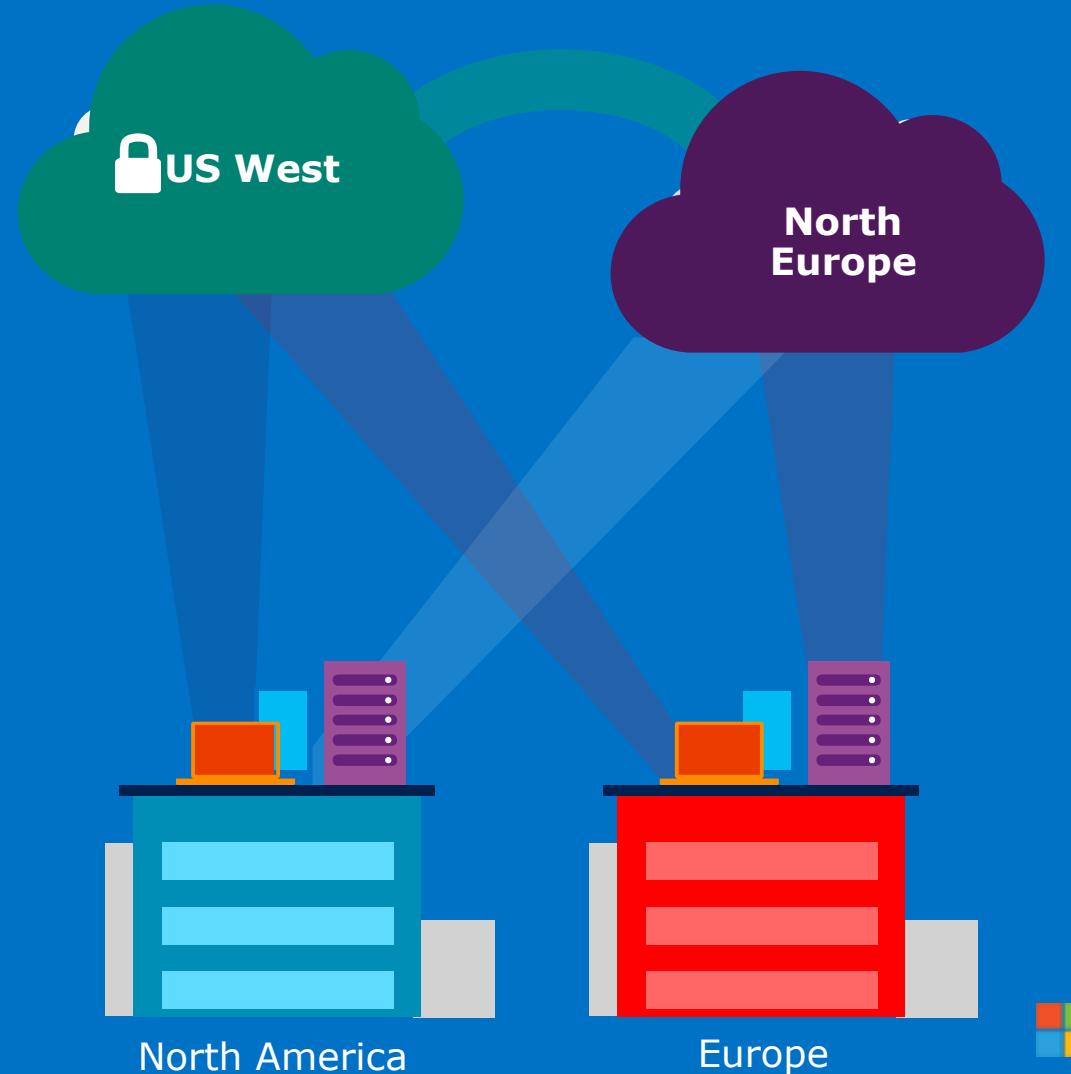
Load balancing

- Load balancing
Multiple VMs share the workload via public facing endpoints
- Internal Load balancing
Load balancing between VMs that don't have public facing endpoints



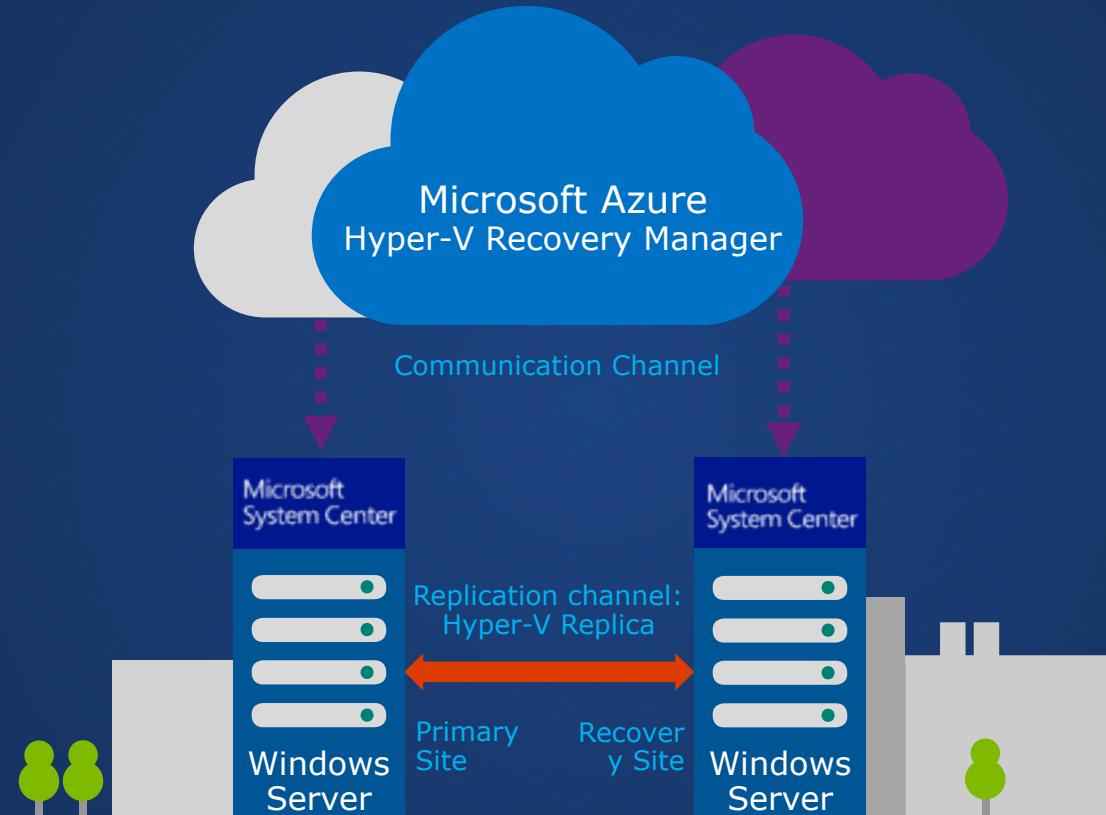
Traffic Manager

- Load balancing
- Failover



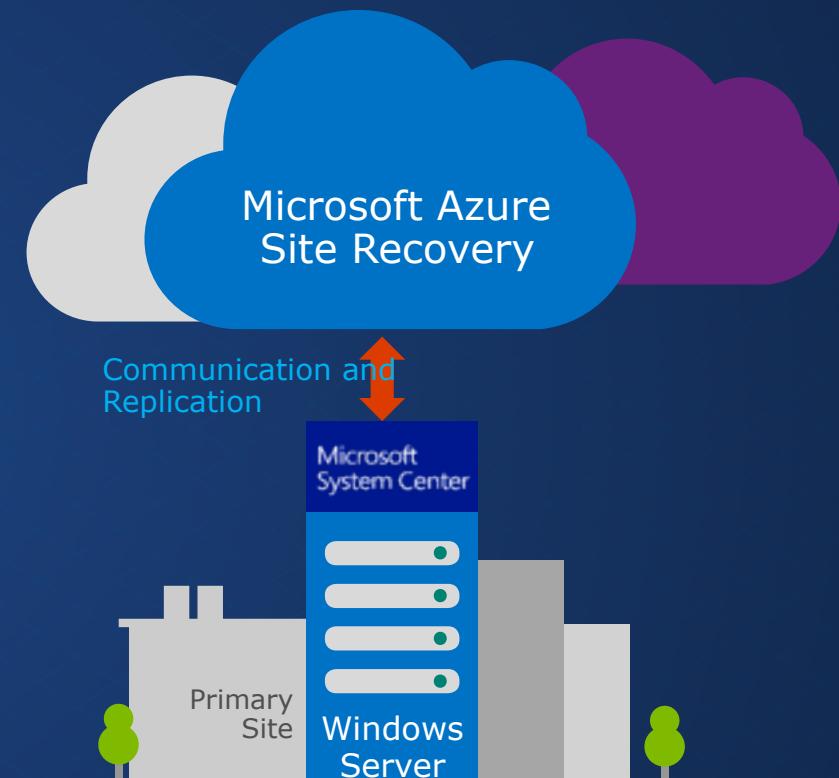
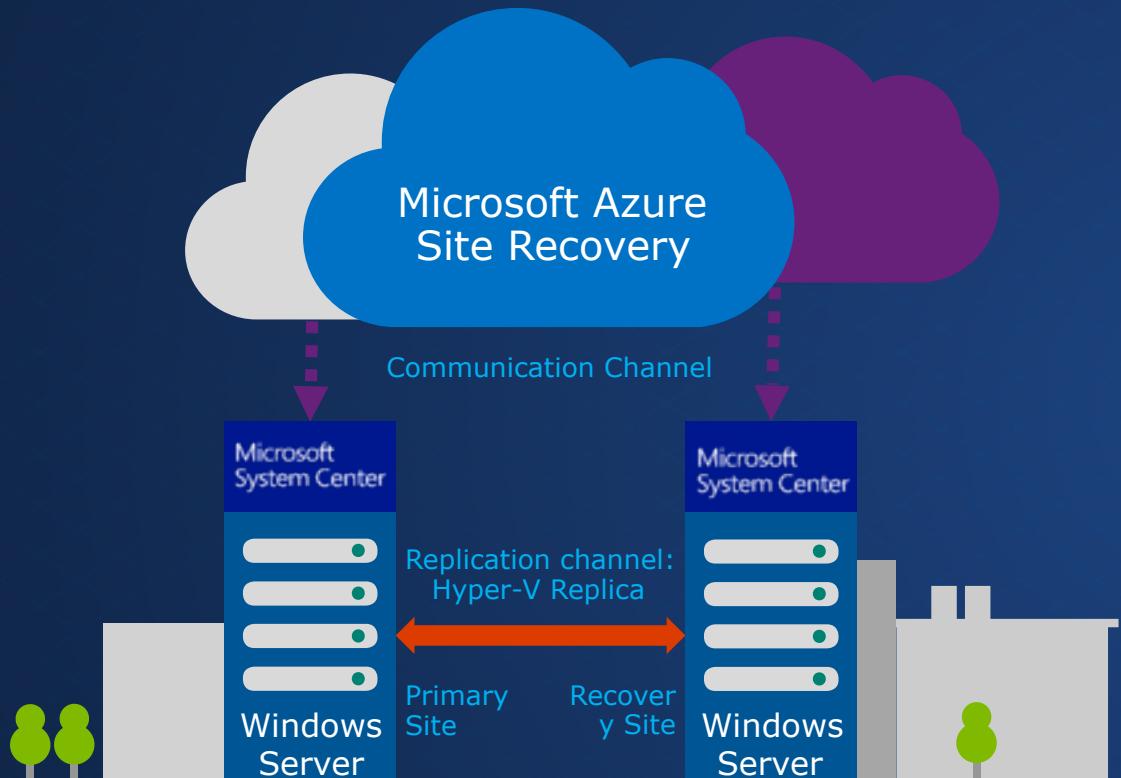
Transform the datacenter

Orchestrated disaster recovery to a second site



Transform the datacenter

Orchestrated disaster recovery to a second site or to Azure



Key features include:

- Automated VM protection and replication
- Remote health monitoring
- Customizable recovery plans

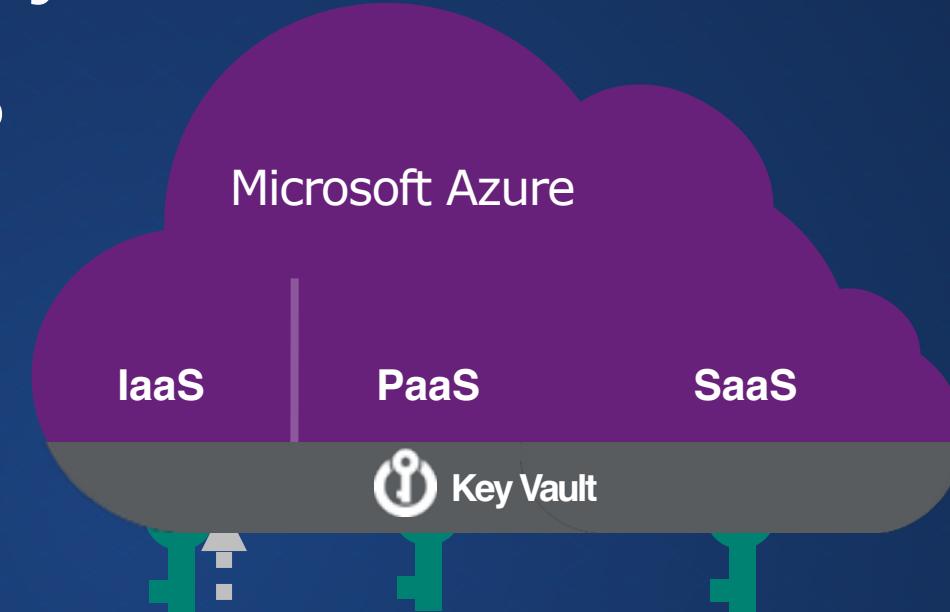
- No-impact recovery plan testing
- Orchestrated recovery when needed

Microsoft Azure Key Vault

Key Vault offers an easy, cost-effective way to safeguard keys and other secrets used by cloud apps and services using HSMs.

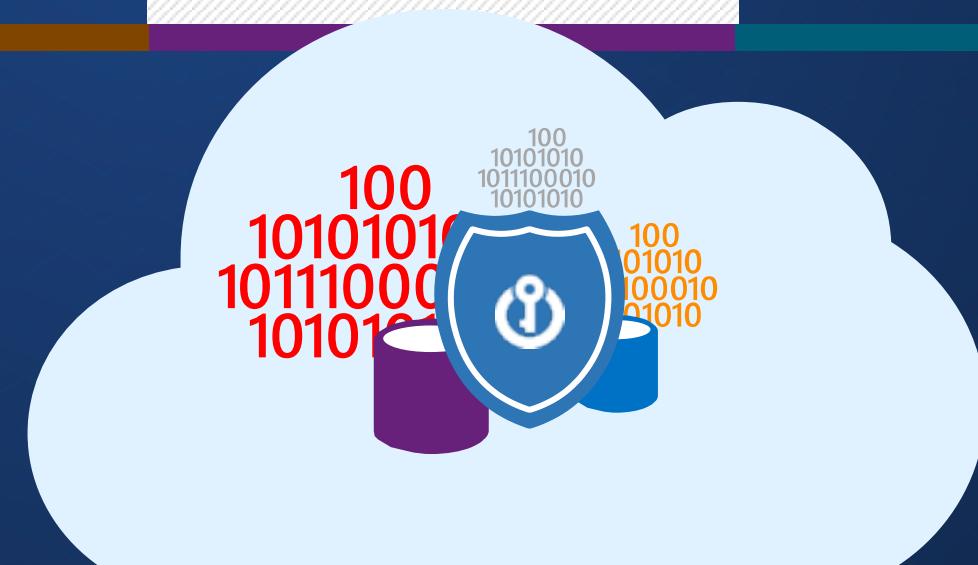
You manage your keys and secrets

Applications get high performance access to your keys and secrets... on your terms



Enhance data protection and compliance

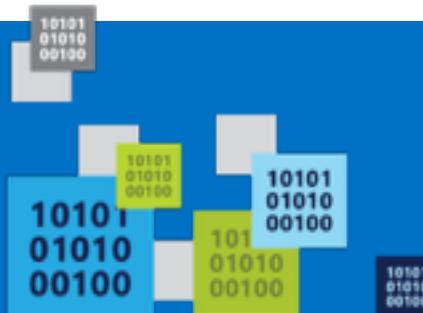
Increased security	HSM protected keys	Compliance	Monitoring
Encrypt keys and small secrets like passwords using keys protected by tightly controlled and monitored Hardware Security Modules (HSMs)	Import or generate your keys in HSMs for added assurance – so that keys stay within the HSM boundary	Comply with regulatory standards for secure key management, including the US Government FIPS 140-2 Level 2 and Common Criteria EAL 4+	Monitor and audit key use through Azure logging – pipe logs into HDInsight or your SIEM for additional analysis (coming soon)



Virtual Networks

Azure Virtual Networks

- à A protected private virtual network in cloud
- à Extend enterprise networks into Azure
- à Cross-premises connectivity



Virtual Network Scenarios

- Hybrid Public/Private Cloud
Enterprise app in Microsoft Azure requiring connectivity to on-premise resources
- Enterprise Identity and Access Control
Manage identity and access control with on-premise resources (on-premises Active Directory)
- Monitoring and Management
Remote monitoring and trouble-shooting of resources running in Azure
- Advanced Connectivity Requirements
Cloud deployments requiring IP addresses and direct connectivity across services

Cross-premises Connectivity

- Site-to-site

Create a secure connection between your on-premises site and your virtual network

- Point-to-site

Create a secure connection via VPN to your virtual network

- ExpressRoute™

Create a private connection between Azure data centers and infrastructures on your premises or in a co-location environment.

- Connect at an ExpressRoute location (Exchange Provider facility)

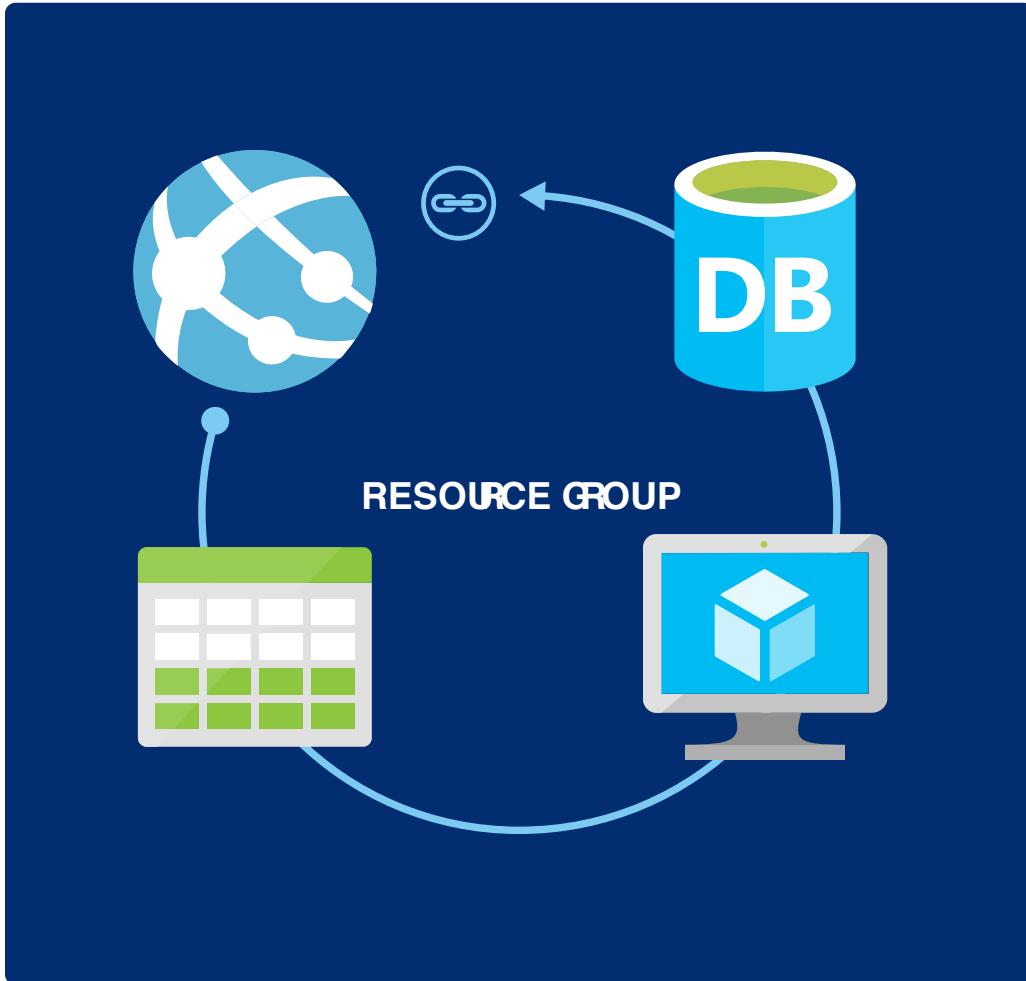
- Direct connect via a Network Service Provider

Microsoft Azure



Azure Resource Manager

Azure Resource Manager & Resource Groups



- Manage resources as a single unit
- Role based access and control (RBAC) on groups or resources
- Billing integrated tagging on groups or resources

Azure Resource Manager (ARM)

Consistent
management
layer

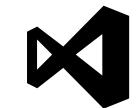
Tools



Microsoft Azure

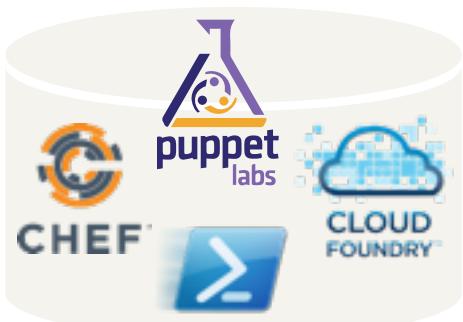


Command line

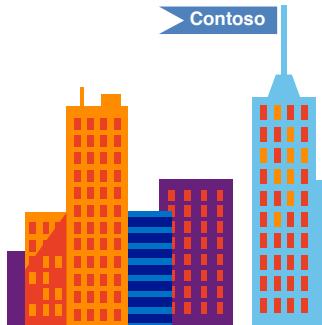


Visual Studio

Curated
extensions



Provider
rest points



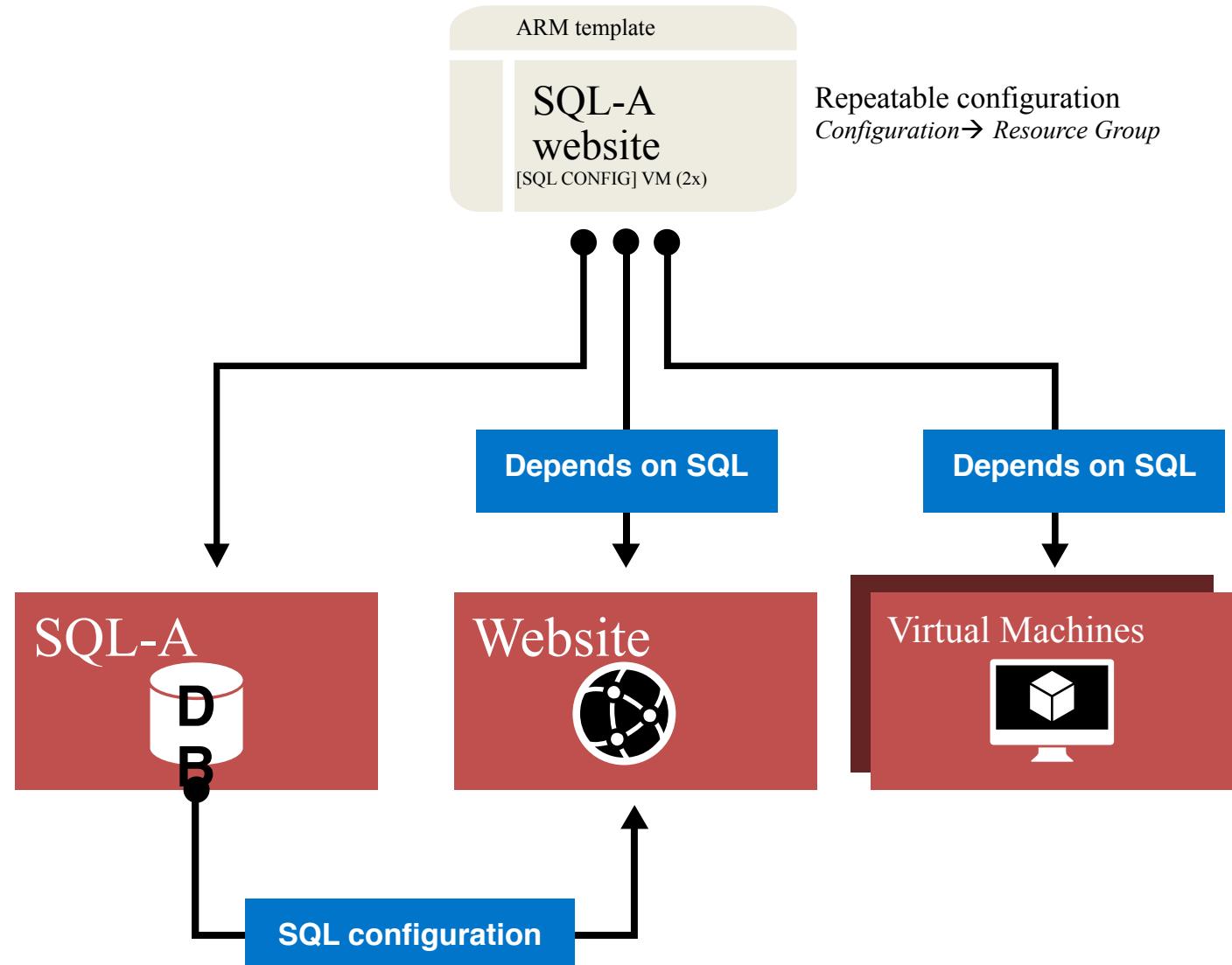
Azure Resource Manager templates

ARM templates can:

- Simplify deployment
- Simplify roll-back
- Provide cross-resource configuration and update support
- Be used as a learning tool to build to suit

Azure templates are:

- Source file, checked-in
- Specifies resources and dependencies (VMs, websites, DBs) and connections (configuration, LB sets)
- Configurable parameters for input/output



JSON files—simpler than they look

Schema, content version, parameters, variables, resources, and outputs

The screenshot shows a JSON editor interface with a large JSON document on the left and a preview pane on the right.

Left Panel (JSON Editor):

```
Branch: main
"resources": [
  {
    "type": "Microsoft.Storage/storageAccounts",
    "name": "[parameters('newStorageAccountName')]",
    "apiVersion": "2015-05-01-preview",
    "location": "[variables('location')]",
    "properties": {
      "accountType": "[variables('storageAccountType')]"
    }
  },
  {
    "apiVersion": "2015-05-01-preview",
    "type": "Microsoft.Network/publicIPAddresses",
    "name": "[variables('publicIPAddressName')]",
    "location": "[variables('location')]",
    "properties": {
      "publicIPAllocationMethod": "[variables('publicIPAddressType')]",
      "dnsSettings": {
        "domainNameLabel": "[parameters('dnsNameForPublicIP')]"
      }
    }
  }
],
```

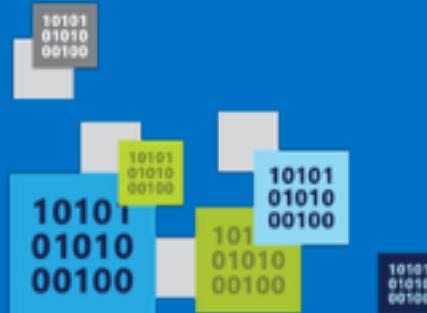
Right Panel (Preview):

A preview of the JSON structure is shown in the right panel, indicating the state of the resources after deployment.

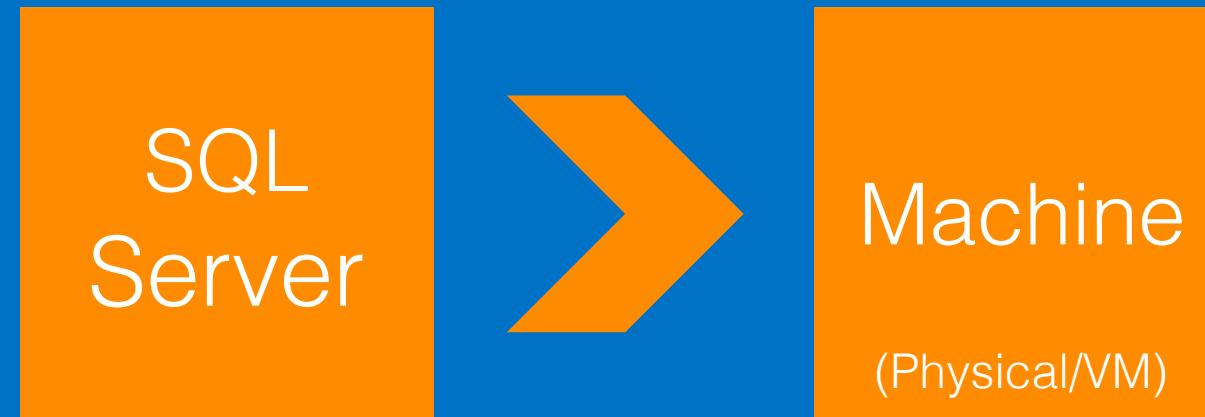
Annotations:

- A large black rectangle highlights the entire JSON structure in the editor.
- A smaller black rectangle highlights the "resources" array in the JSON structure.
- A third black rectangle highlights the "name" field within one of the resource objects.
- A fourth black rectangle highlights the "accountType" field within the first resource object.
- A fifth black rectangle highlights the "publicIPAllocationMethod" field within the second resource object.
- A sixth black rectangle highlights the "domainNameLabel" field within the "dnsSettings" object of the second resource object.

Azure Data Overview

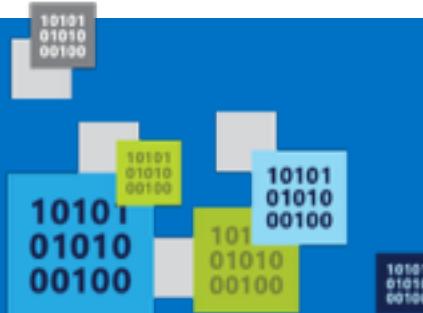


A Server is not a machine



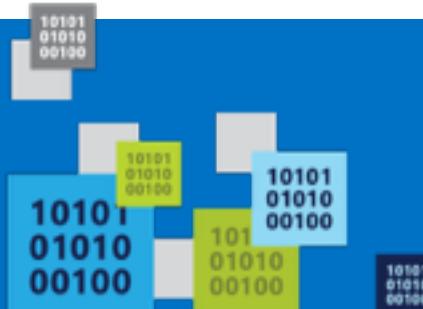
SQL Database The Basics

- SQL Server database technology “as a Service”
- Fully Managed
- Enterprise-ready with automatic support for HA, DR, Backups, replication and more



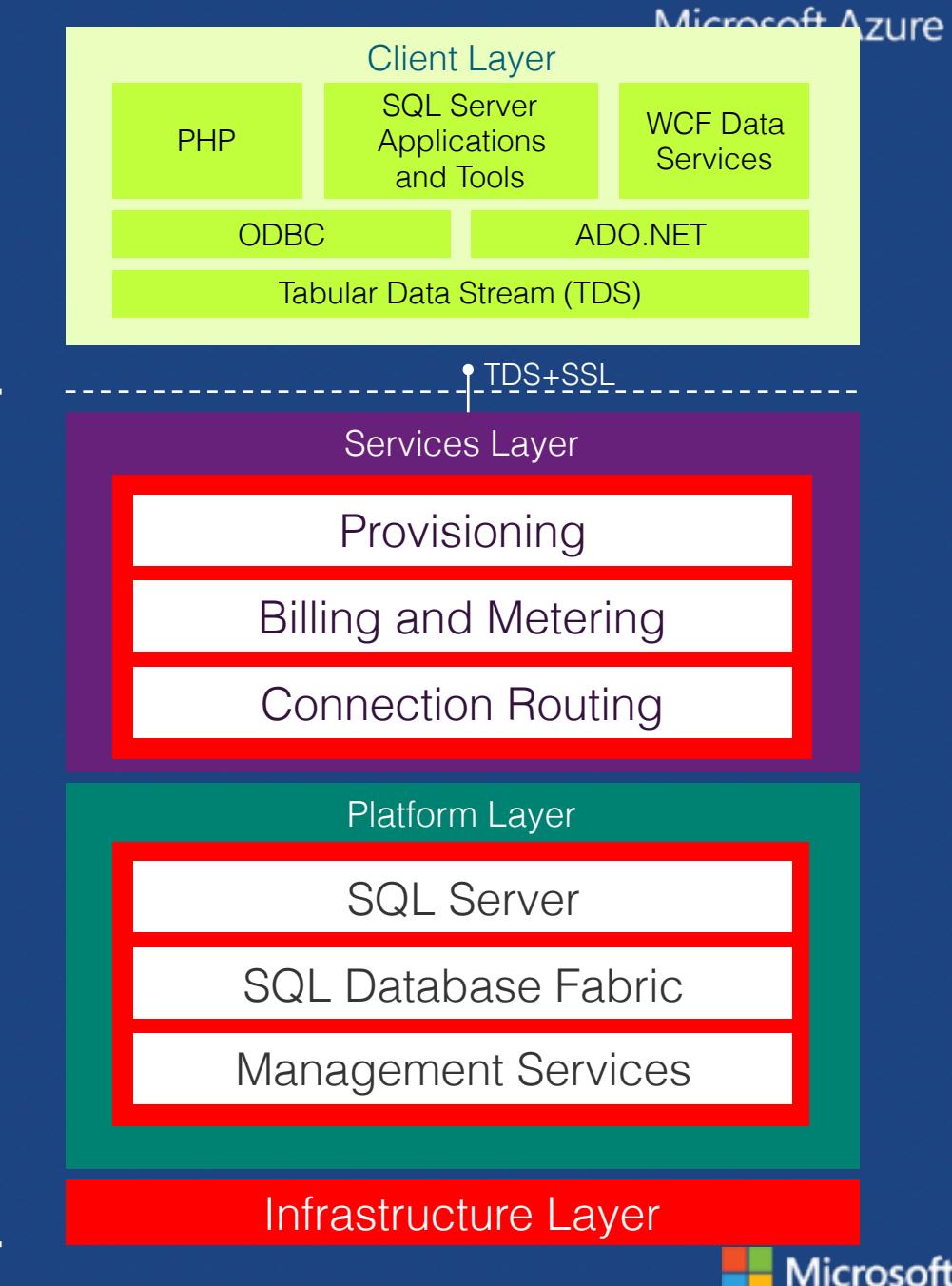
SQL Database The Basics

- Scale out with ElasticScale
- Built-in regional database replicas for additional protection
- Uptime SLA of 99.99%



How It Works – Architecture of the Service

Microsoft Azure
SQL Database
PaaS



SQL Database Server

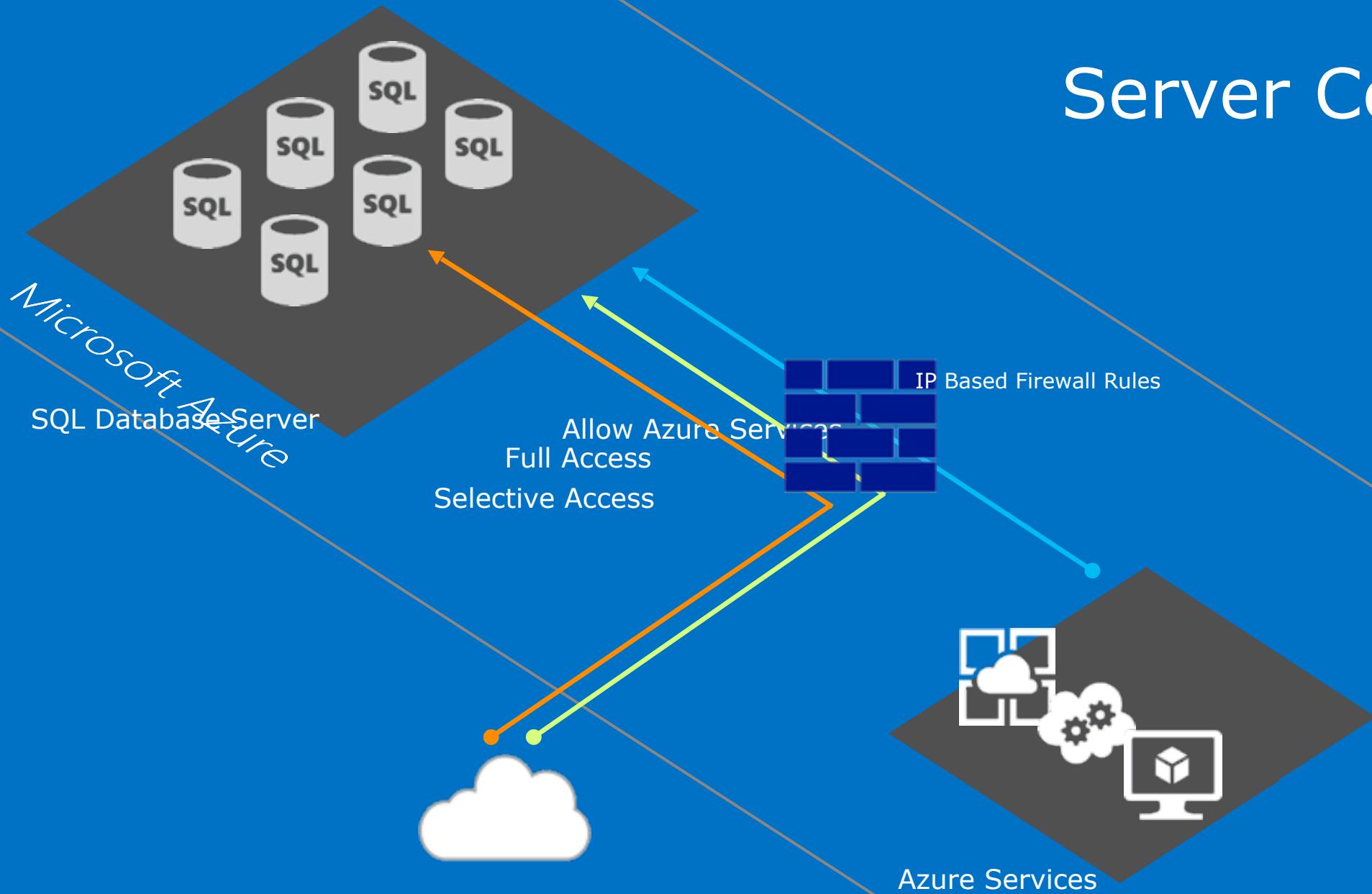
The Service head contains databases

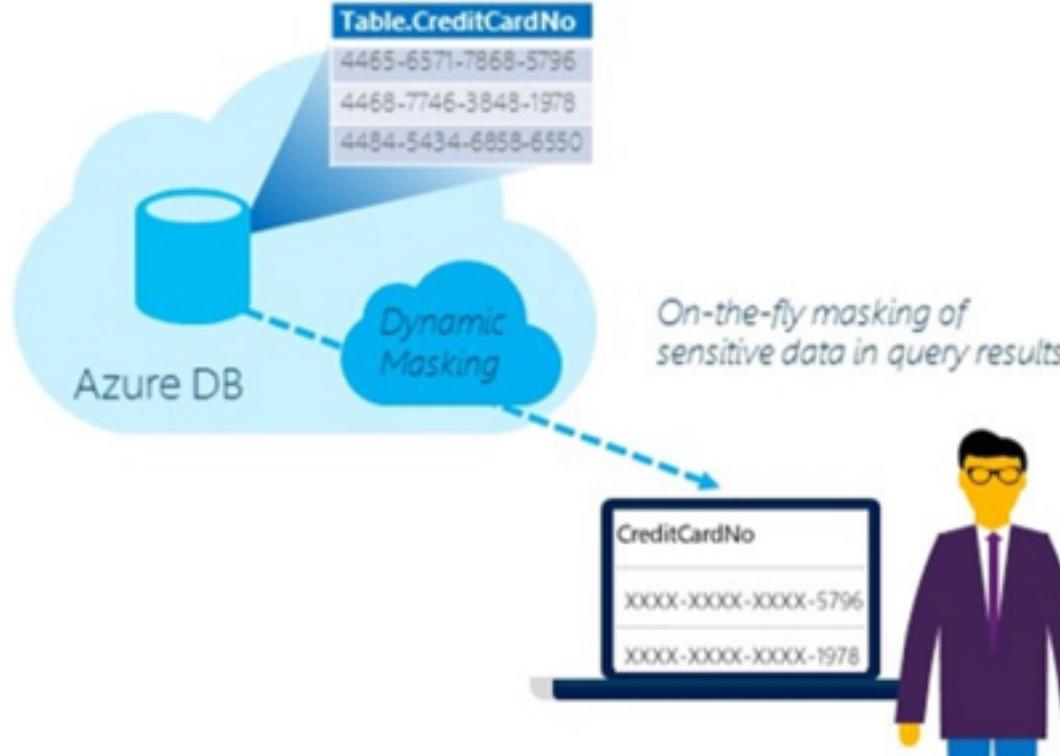
Connect via automatically generated FQDN:

{name}.database.windows.net

Initially contains only a master database

Server Connectivity

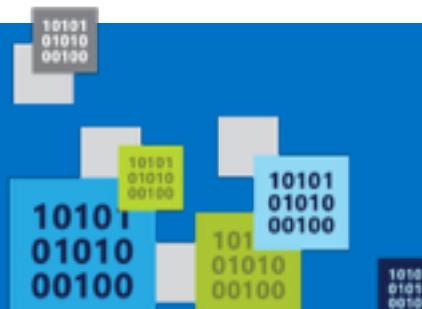




- Limits sensitive data exposure
- Prevents unauthorized access to data
- Policy-based security – no changes to data or application
- Meet regulatory compliance
- Dev/Test production data without compromising data

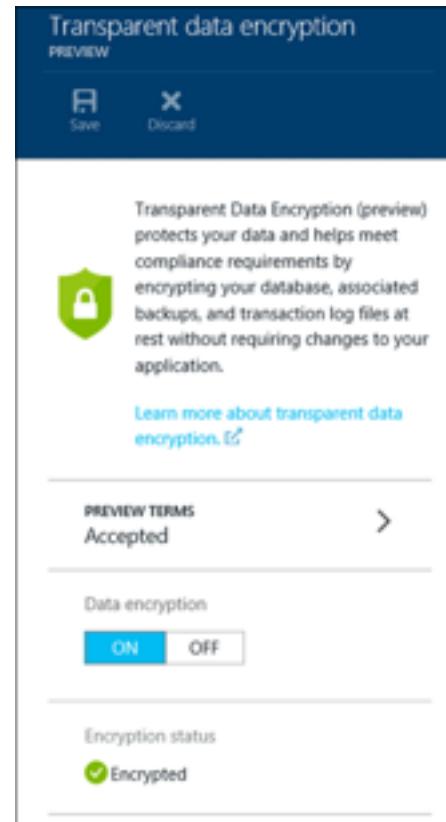
Protect Sensitive Data

Limit Exposure of Sensitive Data



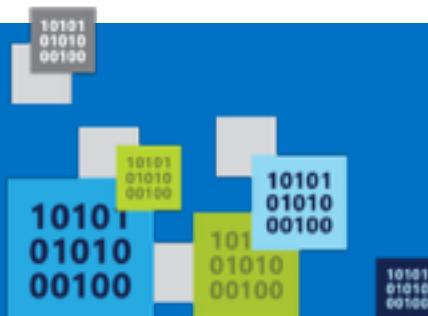
Transparent Data Encryption (TDE)

Microsoft Azure

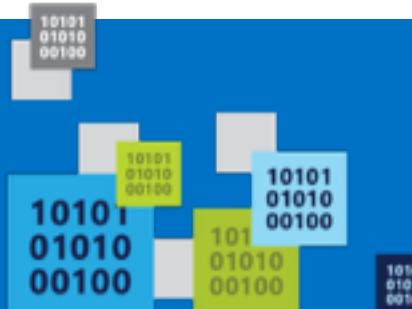


- Encrypted database, backups, and transaction log at rest
- 2-click provisioning
- Reduced attack surface area
- No code changes to existing applications
- Database encryption key - AES-256
- Meet regulatory compliance
- Accelerated hardware encryption

Encrypt and Protect Database

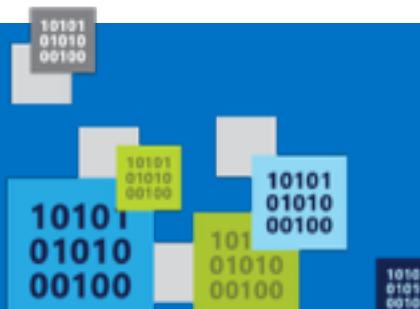


- Fine-grained access over rows
- Access restrictions logic contained in database
- Simplified design and coding of security
- Meet regulatory compliance
- Reduced surface area of your security system



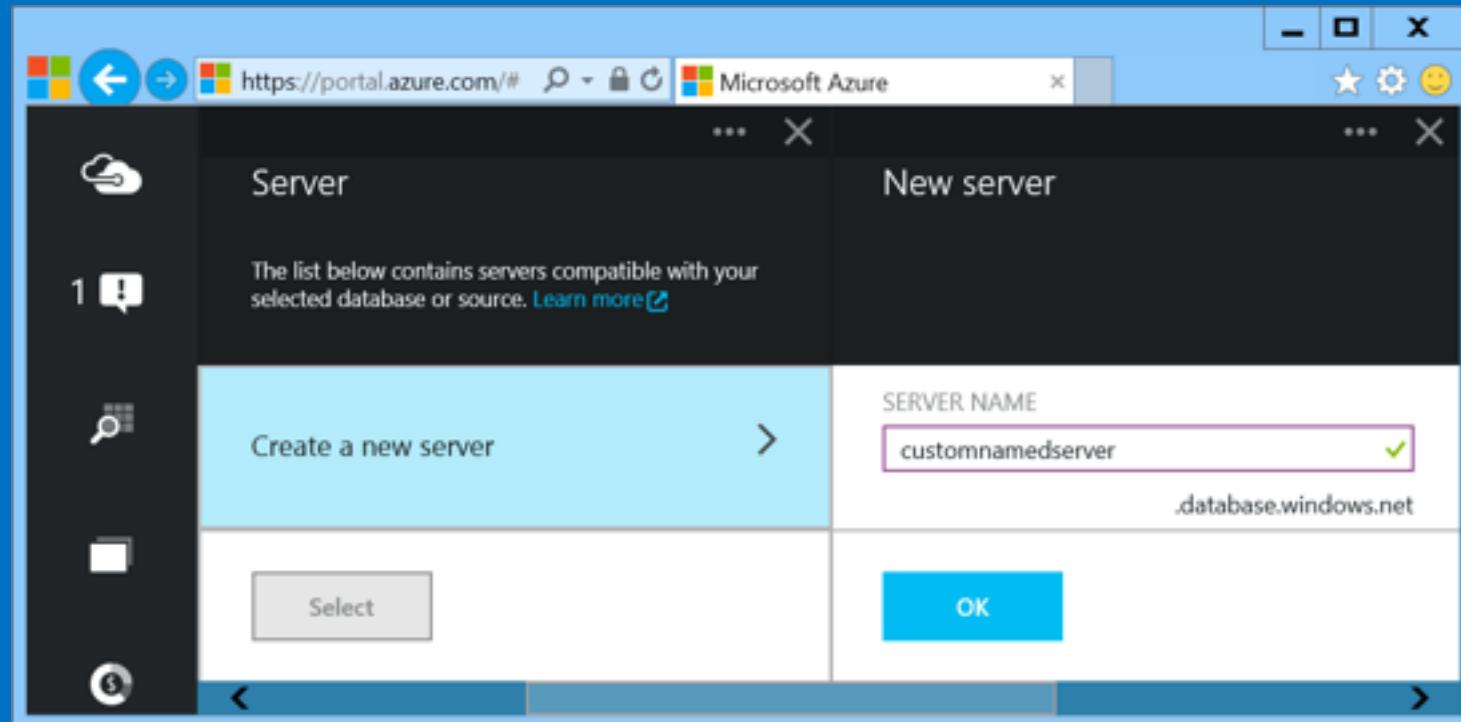
Fine-grained Access Over Rows

- Contained Database Users
- Parallel Queries
- Common Language Runtime (CLR) assemblies



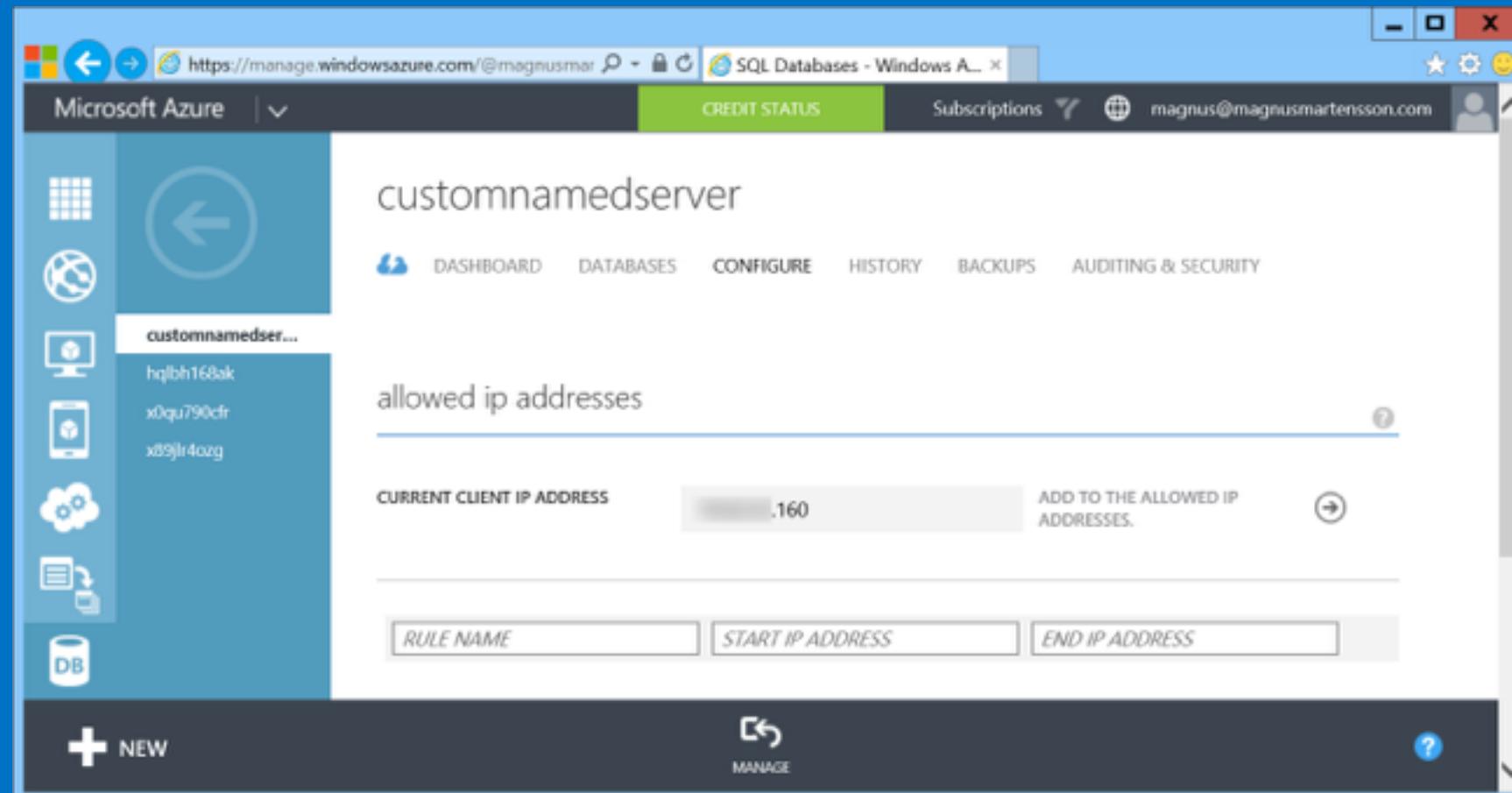
Fine-grained Access Over Rows

In the Preview Management Portal create a SQL Database server



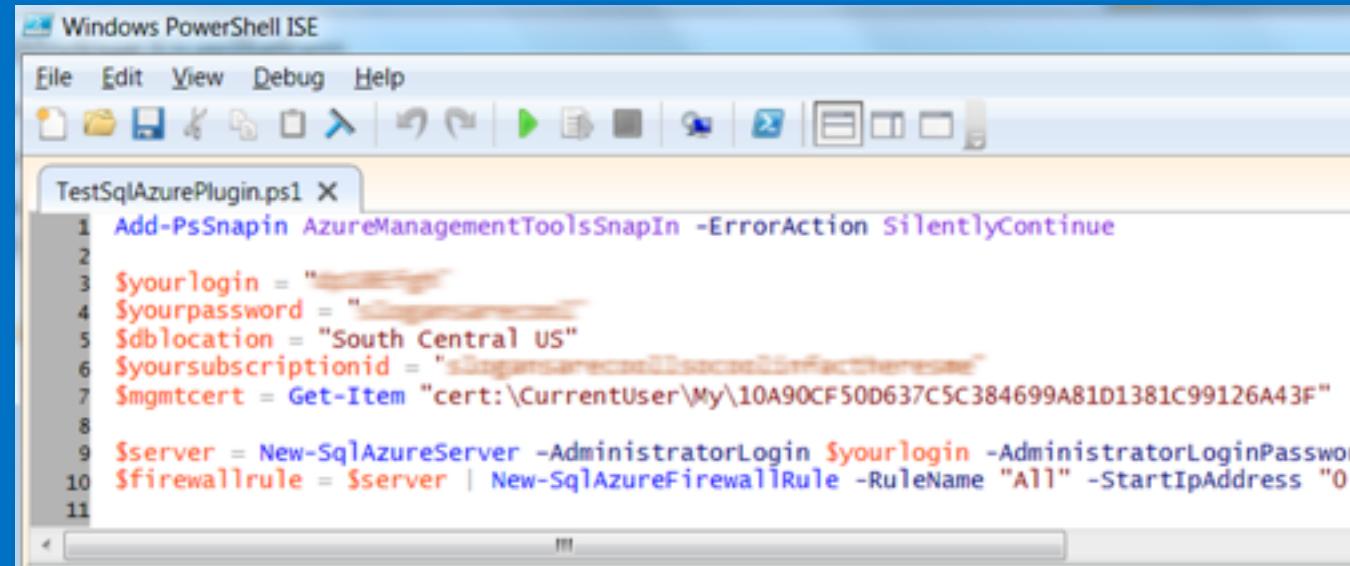
Provision Servers Interactively

In the Management Portal add firewall rules



Automate Server Provisioning

Microsoft Azure Platform PowerShell cmdlets



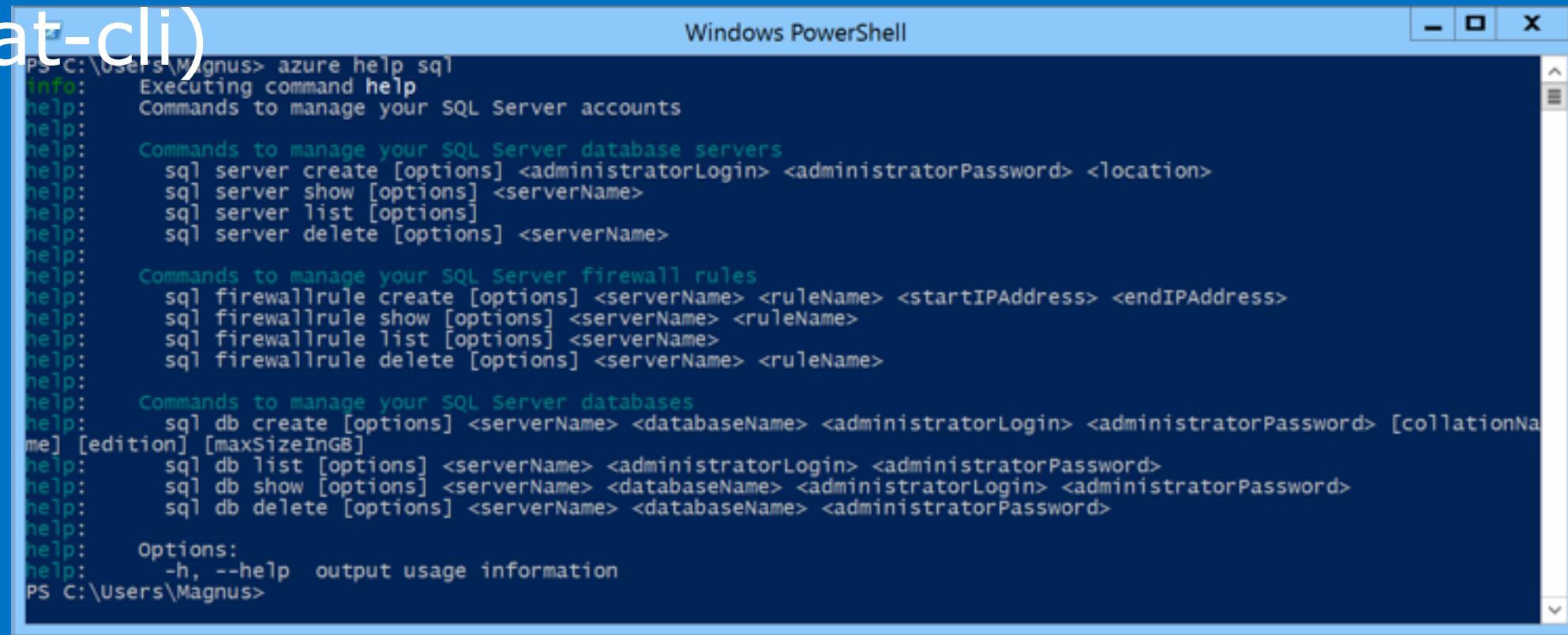
The screenshot shows a Windows PowerShell ISE window titled "Windows PowerShell ISE". The menu bar includes File, Edit, View, Debug, Help. The toolbar has various icons for file operations and navigation. A script named "TestSqlAzurePlugin.ps1" is open in the editor. The code is as follows:

```
1 Add-PsSnapin AzureManagementToolsSnapIn -ErrorAction SilentlyContinue
2
3 $yourlogin = "████████"
4 $yourpassword = "████████"
5 $dblocation = "South Central US"
6 $yoursubscriptionid = "████████████████████████████████████████"
7 $mgmtcert = Get-Item "cert:\CurrentUser\My\10A90CF50D637C5C384699A81D1381C99126A43F"
8
9 $server = New-SqlAzureServer -AdministratorLogin $yourlogin -AdministratorLoginPassword $yourpassword
10 $firewallrule = $server | New-SqlAzureFirewallRule -RuleName "All" -StartIpAddress "0.
```

<http://bit.ly/azurepowershell>

Automate Server Provisioning

Azure Cross-Platform Command-Line Interface (xplat-cli)



The image shows a Windows PowerShell window titled "Windows PowerShell". The command entered is "PS C:\Users\Magnus> azure help sql". The output provides detailed help for managing SQL Server resources, including commands for accounts, servers, firewall rules, databases, and options.

```
PS C:\Users\Magnus> azure help sql
info:  Executing command help
help:    Commands to manage your SQL Server accounts
help:    Commands to manage your SQL Server database servers
help:      sql server create [options] <administratorLogin> <administratorPassword> <location>
help:      sql server show [options] <serverName>
help:      sql server list [options]
help:      sql server delete [options] <serverName>
help:    Commands to manage your SQL Server firewall rules
help:      sql firewallrule create [options] <serverName> <ruleName> <startIPAddress> <endIPAddress>
help:      sql firewallrule show [options] <serverName> <ruleName>
help:      sql firewallrule list [options] <serverName>
help:      sql firewallrule delete [options] <serverName> <ruleName>
help:    Commands to manage your SQL Server databases
help:      sql db create [options] <serverName> <databaseName> <administratorLogin> <administratorPassword> [collationName] [edition] [maxSizeInGB]
help:      sql db list [options] <serverName> <administratorLogin> <administratorPassword>
help:      sql db show [options] <serverName> <databaseName> <administratorLogin> <administratorPassword>
help:      sql db delete [options] <serverName> <databaseName> <administratorPassword>
help:    Options:
help:      -h, --help  output usage information
PS C:\Users\Magnus>
```

<http://bit.ly/azurexplatcli>

Selecting the right SQL Database edition

Microsoft Azure

Service Tier	Performance Level	Common App Pattern	Performance			Business Continuity		
			Max DB Size	Transaction Perf. Objective	DTU	PITR	DR / GEO-Rep	
Basic	Basic	Small DB, SQL opp	2 GB	Reliability / Hr.	5	7 Days	DB Copy + Manual Export	
Standard	S0	Wrkgp/cloud app, multiple concurrent operations	250 GB	Reliability / Min.	10	14 Days	DB Copy + Manual Export	
	S1				20			
	S2				50			
Premium	P1	Mission Critical, High volume, Many concurrent Users	500 GB	Reliability / sec.	100	35 Days	Active Geo-replication	
	P2				200			
	P3				800			

This information is subject to change over time.



- Configurable to track & log database activity
- Dashboard views in the portal for at-a-glance insights
- Pre-defined Power View reports for deep visual analysis on Audit log data
- Audit logs reside in your Azure Storage account
- Available in Basic, Standard, and Premium

- Fast and flexible indexing of textual data
- Data types: char, varchar, nchar, nvarchar, text, ntext, image, xml, varbinary(max), or FILESTREAM
- Handles high query volume
- Common use cases:
 - Searching websites, product catalogs, news items and more
 - Document management systems
 - Any applications that need to provide search capabilities over data stored in a SQL Database

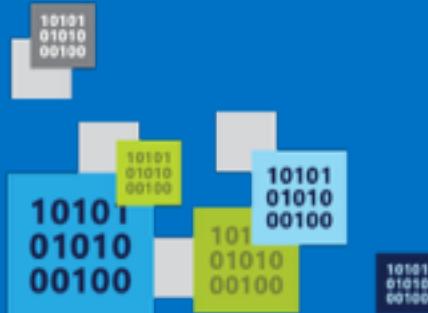
- XML Indexes - improves XQuery-based query performance
- Primary XML Index - speed up access to elements and attributes
 - CREATE PRIMARY XML INDEX XML_Order_Items
 - ON Sales.Order (Items);
- Secondary XML Index – help resolve specific XQuery expressions rapidly

- Monitor common database, execution and transaction related events in near-real time
- Diagnose blocked or long-running queries, resource bottlenecks, poor query plans, and more
- Help improve capacity planning
- Use familiar T-SQL language

Use Familiar Technologies

Transact-SQL

(obviously)



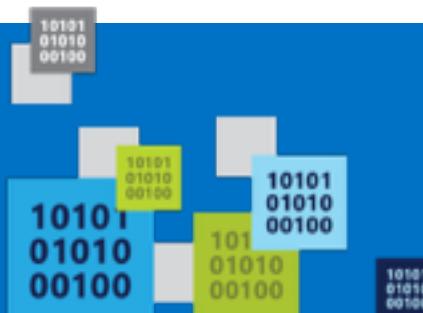
Use Familiar Technologies - Languages

.NET Framework (C#, Visual Basic, F#):
ADO.NET

C / C++: ODBC

Java: Microsoft JDBC provider

PHP: Microsoft PHP provider



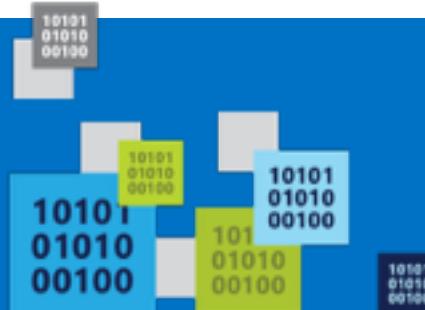
Use Familiar Technologies - Frameworks

OData

Entity Framework

WCF Data Services

NHibernate (etc.)

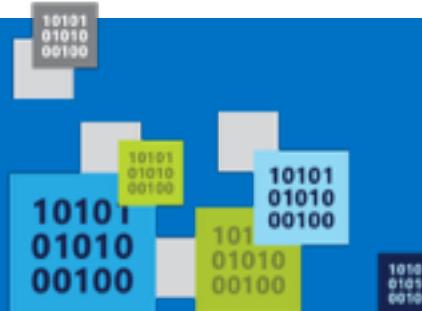


Use Familiar Technologies - Tools

SQL Server Management Studio (>=2008 R2)

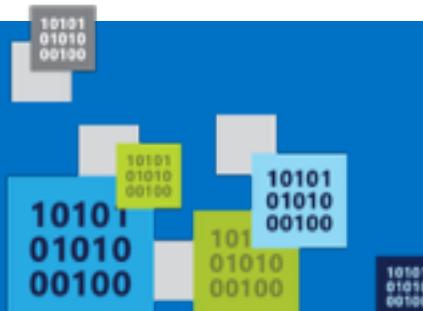
SQL Server command-line utilities (SQLCMD,
BCP)

Visual Studio IDE for database development



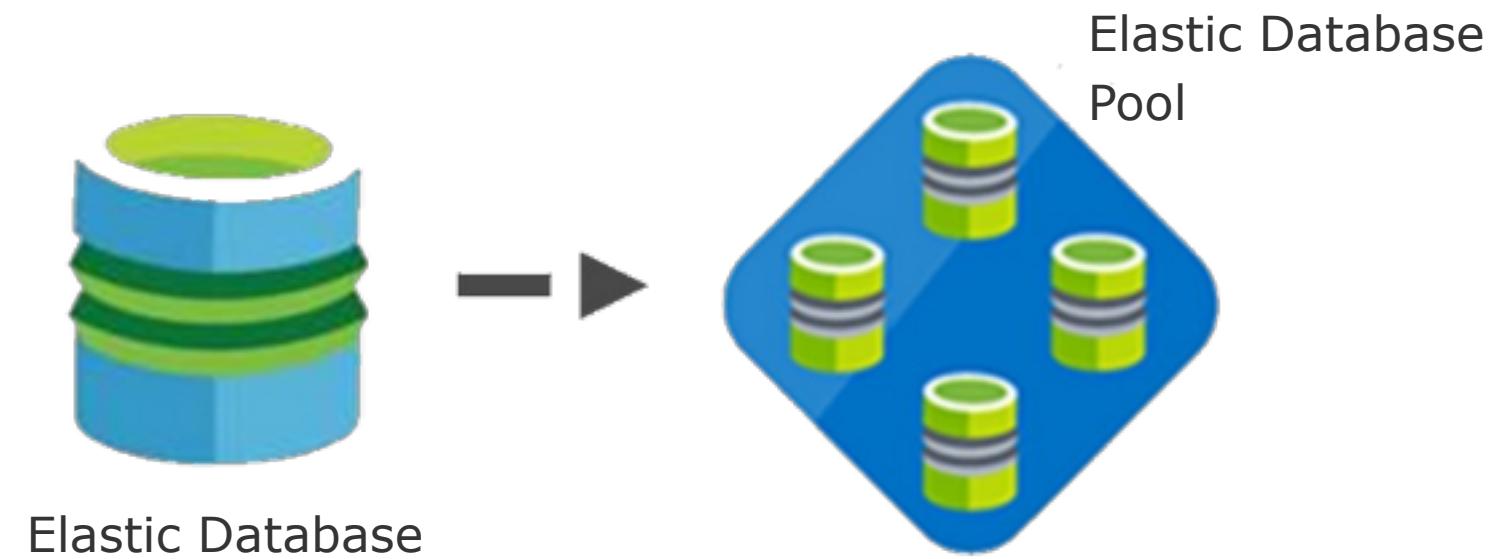
Unsupported SQL Server Features

- Use command, distributed transactions, distributed views
- Service Broker
- SQL Agent
- SQL Profiler
- Native Encryption



Elastic Database

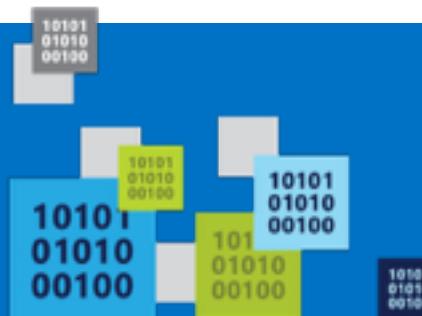




Elastic Database

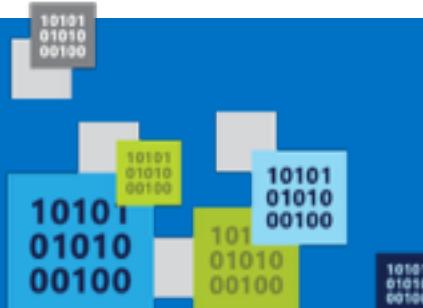
Elastic Database
Pool

Predictable model for deploying large numbers of databases



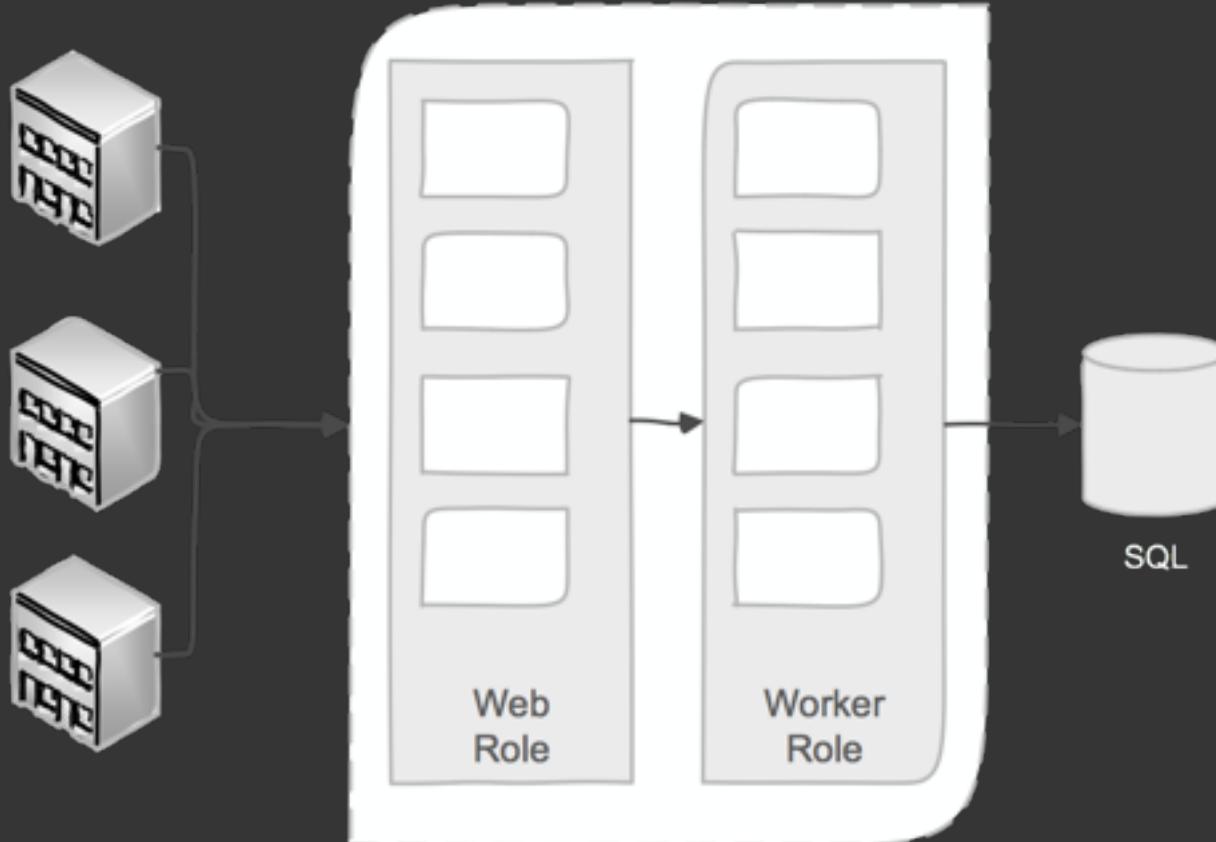
Elastic Database Jobs

- Apply changes or administrative operations to many databases
- Use familiar T-SQL scripts to define jobs
- Built-in automatic retries in case of transient failures
- Tightly integrated with elastic pools in the new Azure Portal
- Designed for batch processing



Elastic Scale

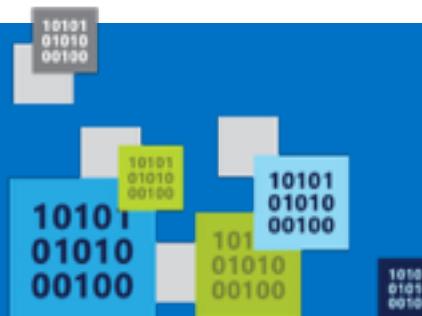
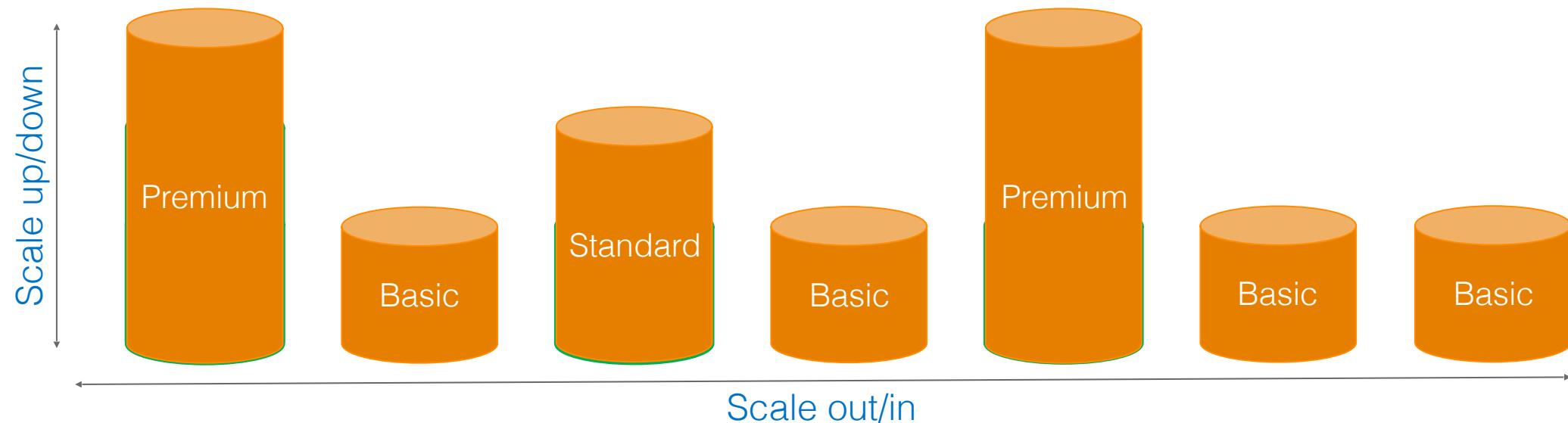




- Classic 3-tier enterprise architecture:
- Scale out the front ends to multiple instances is easy
- Scale the data-tier is more challenging

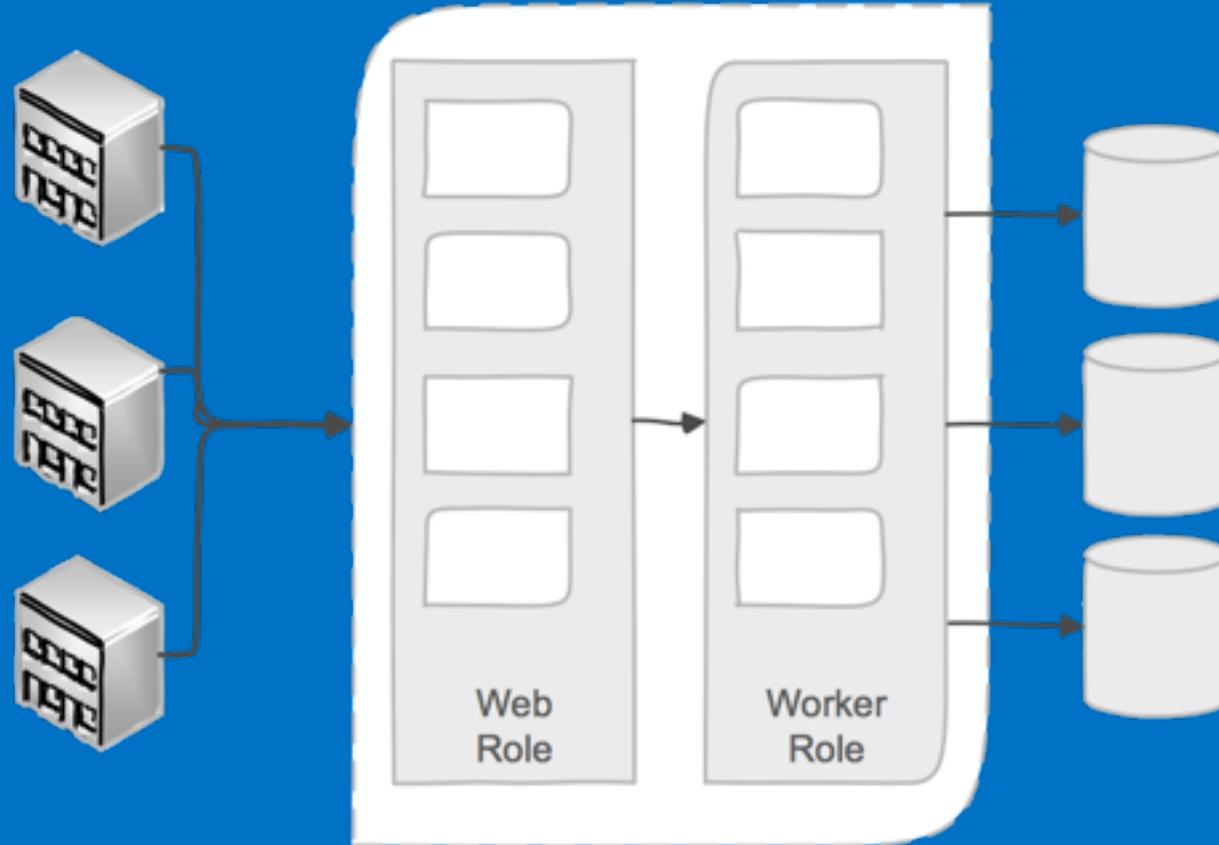
- Elastic Scale across thousands of databases via custom sharding
- Scale out via .NET Client libraries consumed by customer applications to support sharded database pattern
- Enables developer and manageability functions
- Supports split, merge, and move operations on data

Vertical: Scale-up or scale-down
Horizontal: Scale-out or scale-in



Elastic Scale architecture

Microsoft Azure



SQL Server VM

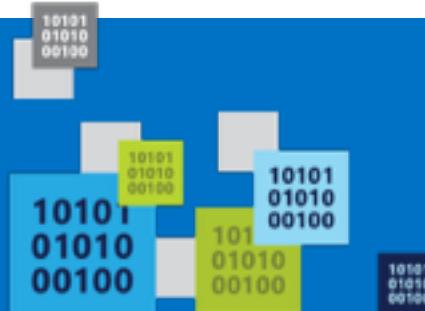


Run SQL on VM

- Run any SQL product on cloud VM
- Support for SQL Server, Oracle, MySql
- Ready to go VM images available in Gallery
- Persistent storage using attached disk in blob storage
- Has all the benefits and powers of VMs combined with the full features of a SQL Engine

SQL IaaS

SQL Database



SQL Database

When you want reduced overhead and possibly need elastic scale.

Customer does not want to add additional IT resources for support and maintenance.

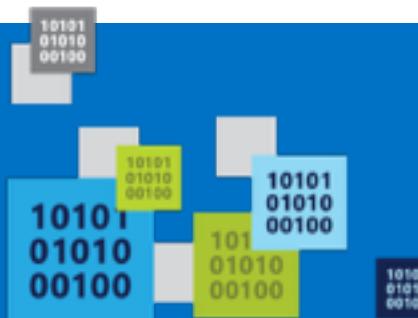
Avoiding CAPEX and OPEX.

SQL IaaS

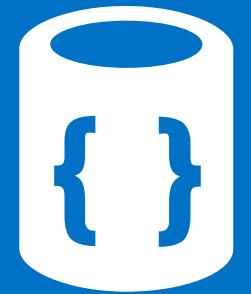
- | Existing applications which requires full box product functionality.
- | Customer has ecosystem of IT resources for support and maintenance.
- | Removing CAPEX.

Other features SQL IaaS supports that SQL Database doesn't (yet)

- Full SQL Server functionality (e.g. Reporting Services)
- Windows authentication available (requires VM to be joined to on-premises domain)
- Larger database sizes possible (16TB)

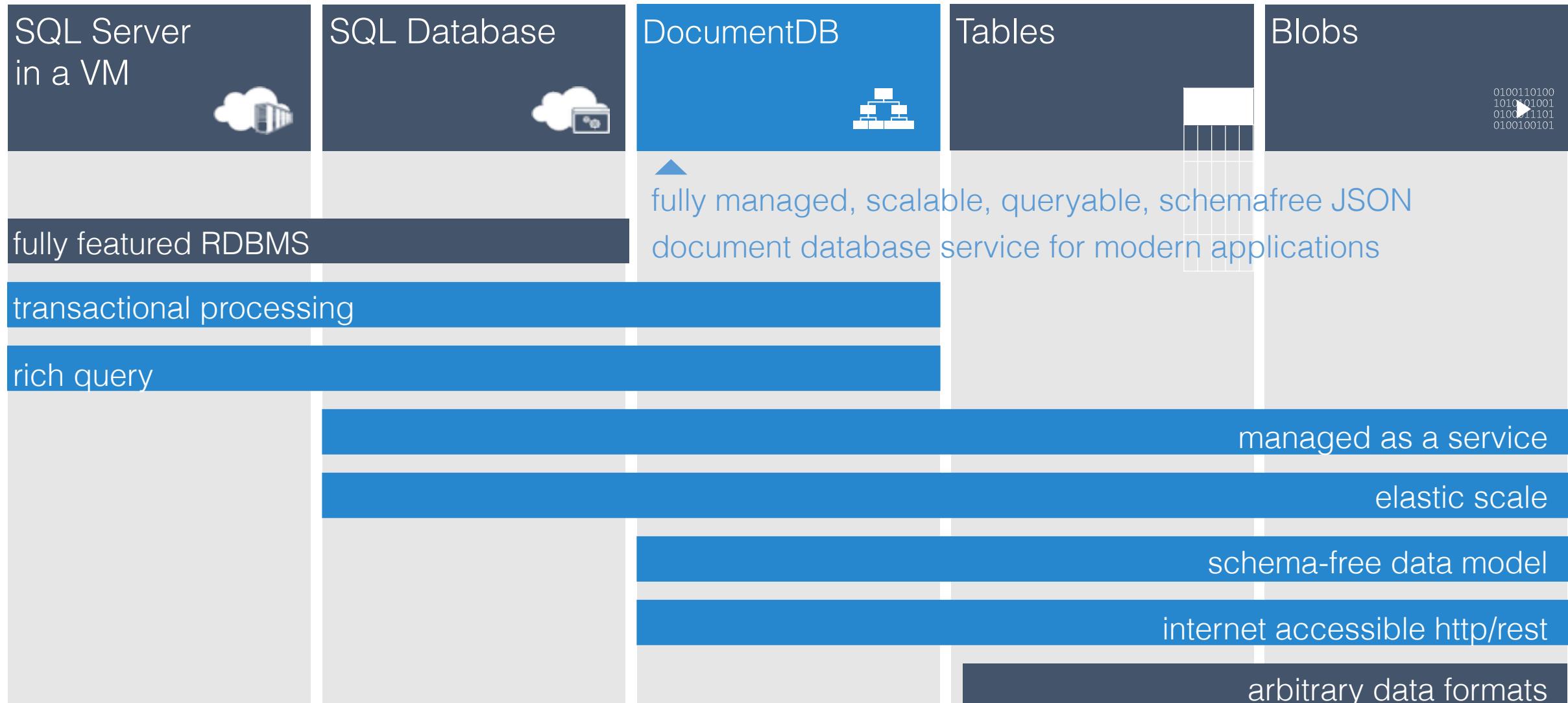


DocumentDB



Fully managed, scalable JSON document database service

Microsoft Azure Data Services



MongoDB

Existing applications which require extra capacity for scale out and can not be migrated

Customer has ecosystem of IT resources for support and maintenance

Removing CAPEX

Mongo MMS compatibility

DocumentDB

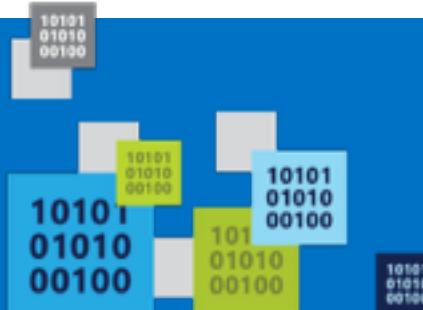
- | Applications that need managed elastic scale, query over schema free data, native JSON/JavaScript support
- | Customer does not want to add additional IT resources for support and maintenance
- | Avoiding CAPEX and OPEX
- | Built-for-the-cloud database technology

Tunable Consistency – four distinct levels

Strong
Bounded Stateless
Session
Eventual

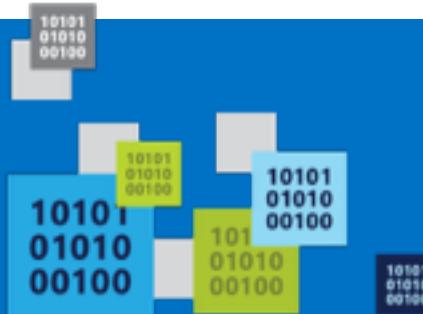
Tunable Consistency
Strong

All writes are visible to all readers.
Writes synchronously committed by a
majority quorum of replicas and
reads are acknowledged by the
majority read quorum.



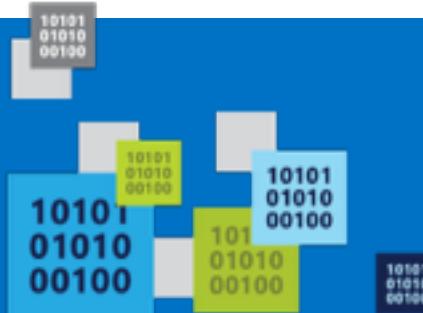
Tunable Consistency
Bounded Stateless

Guaranteed ordering of writes, reads adhere to minimum freshness. Writes are propagated asynchronously, reads are acknowledged by majority quorum lagging by at most K prefixes.



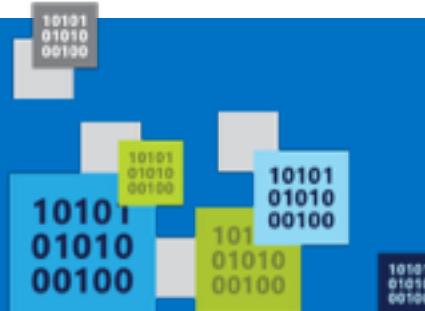
Tunable Consistency
Session

Read your own writes. Writes are propagated asynchronously while reads for a session are issued against the replica that can serve the requested version.



Tunable Consistency
Eventual

Reads eventually converge with writes. Writes are propagated asynchronously while reads can be acknowledged by any replica. Readers may view older data than previously observed.



	Writes	Reads
Strong	sync quorum writes	quorum reads
Bounded	async replication	quorum reads
Session	async replication	session bound replica
*		
Eventual	async replication	any replica

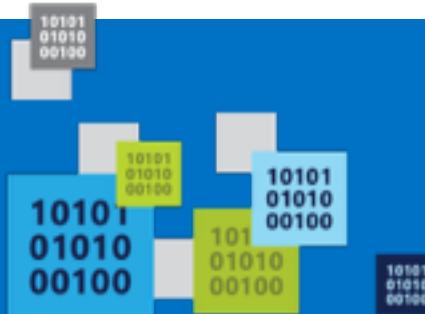
- * Ideal consistency and performance tradeoff for many application scenarios. High performance writes and reads with predictable consistency.

Partitioning Data

Hash Range Lookup

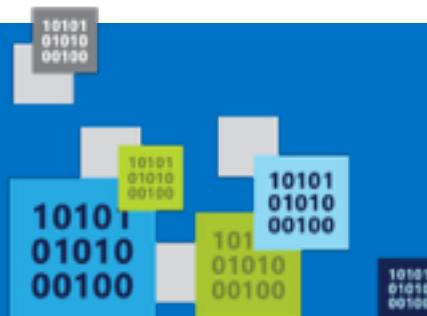
Partitioning **Hash**

Partitions are assigned based on the value of a hash function, allowing you to evenly distribute requests and data across a number of partitions



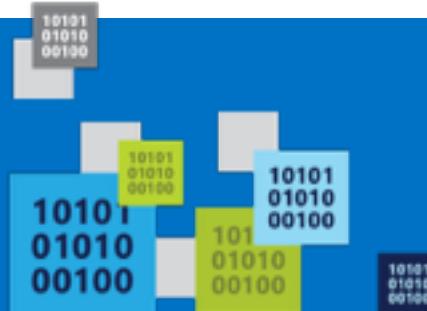
Partitioning **Range**

Partitions are assigned based on whether the partition key is within a certain range.



Partitioning **Lookup**

Partitions are assigned based on a lookup map that assigns discrete partition values to specific partitions a.k.a. a partition or shard map.

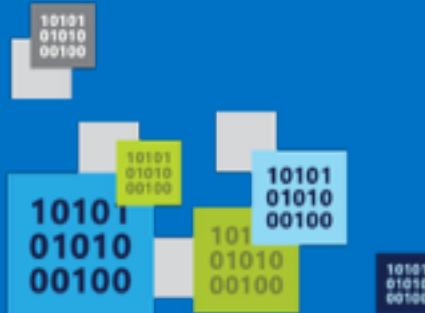


Search



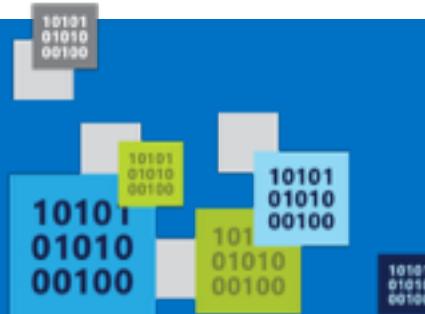
Azure Search

Embed a sophisticated search experience into web and mobile applications without having to worry about the complexities of full-text search and without having to deploy, maintain or manage any infrastructure.



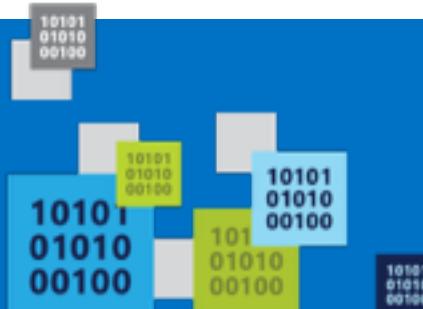
Azure Search

Perfect for enterprise cloud developers, cloud software vendors, cloud architects who need a fully-managed search solution.



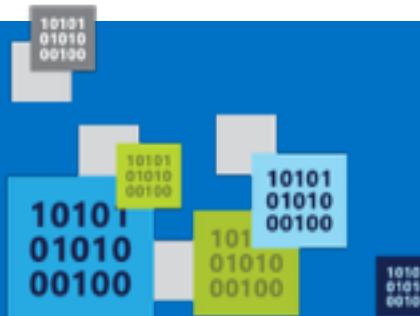
Search Functionality

- Simple HTTP/JSON API for creating indexes, pushing documents, searching
- Keyword search with user-friendly operators (+, -, *, "", etc.)
- Hit highlighting
- Faceting (histograms over ranges, typically used in catalog browsing)

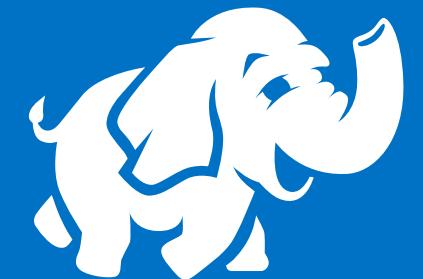


Search Functionality

- Suggestions (auto-complete)
- Rich structured queries (filter, select, sort) that combines with search
- Scoring profiles to model search result relevance
- Geo-spatial support integrated in filtering, sorting and ranking



HDInsight



Relational DB vs. Hadoop

Microsoft Azure



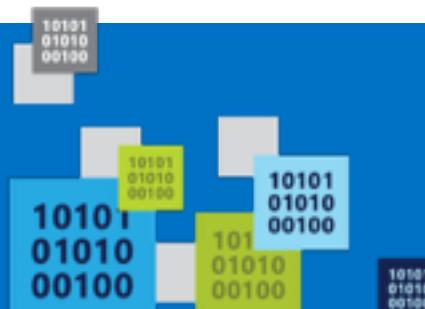
Data size	Gigabytes (Terabytes)	Petabytes (Hexabytes)
Access	Interactive and Batch	Batch
Updates	Read / Write many times	Write once, Read many times
Structure	Static Schema	Dynamic Schema
Integrity	High (ACID)	Low
Scaling	Nonlinear	Linear

Reference: Tom White's Hadoop: The Definitive Guide

Programming HDInsight
– Existing ecosystem

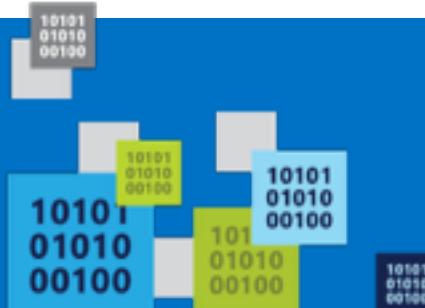
Hive
Pig
Mahout
Cascading
Scalding
Scoobi
Pegasus

...



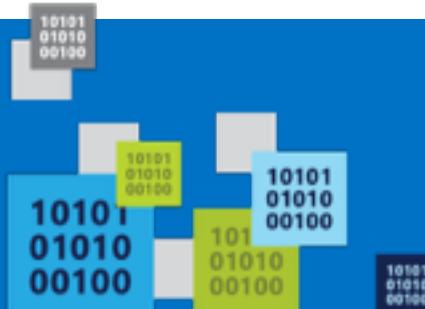
Programming HDInsight
– Microsoft .NET

C#
F#
Map/Reduce
Microsoft .NET management clients

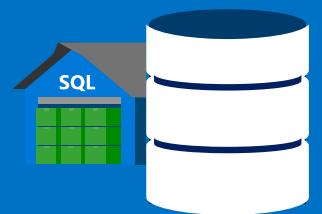


Programming HDInsight
– DevOps / IT Pros

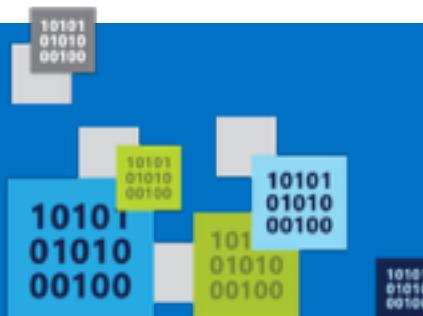
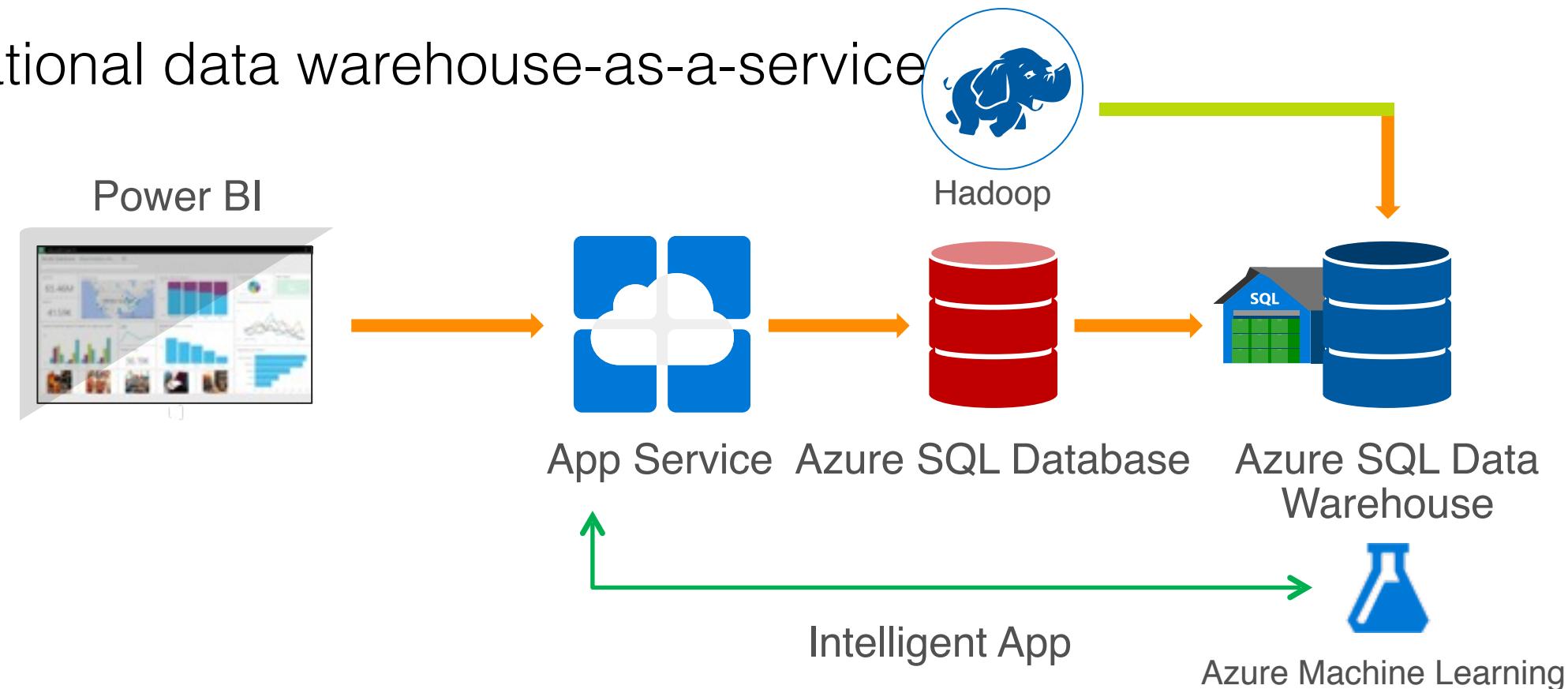
PowerShell Cross-Platform CLI tools (xplat-cli)



Data Warehousing



A relational data warehouse-as-a-service



Elastic scale & performance

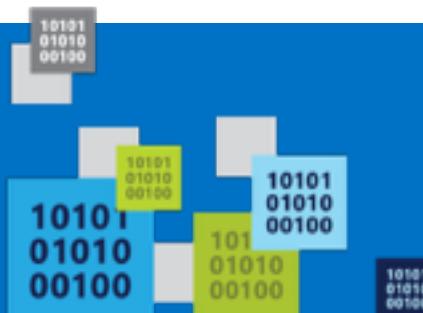
Scales to petabytes of data
Massively Parallel Processing
Instant-on compute scales in seconds
Query Relational / Non-Relational

Powered by the Cloud

Get started in minutes
Integrated with Azure ML, PowerBI & ADF
Enterprise Ready

Market Leading Price & Performance

Simple billing compute & storage
Pay for what you need, when you need it with dynamic pause
Bring DW to the Cloud without rewriting



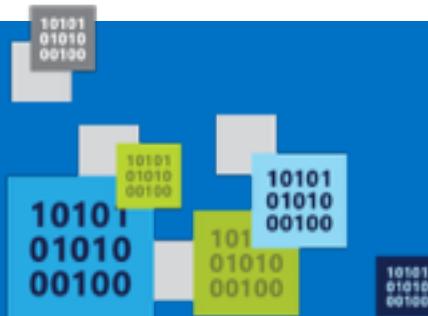
Data Lake



Azure Data Lake service

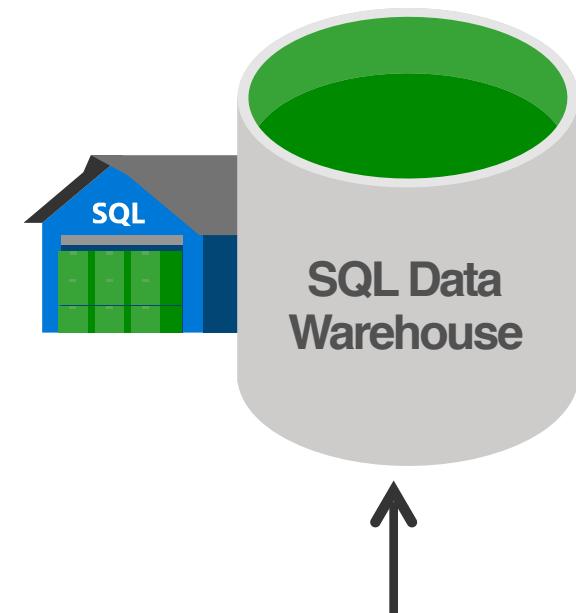


- Store and manage infinite data
- Keep data in its original form
- High through put, low latency analytic jobs
- Enterprise-grade security + access control



Data Lake service

Transformative way to store and process infinite data



HDFS API
Data Lake

Additional Database options in Azure

- Azure Table Service is a “Big Table” entity store.
- MongoDB is a document (JSON) store.
- Cassandra is a columnar store with excellent replication.
- HBase is a Big Data (Hadoop) store available in HDInsight.
- Oracle VMs are supported in Azure.
- MySQL is offered from the partner ClearDB.

Microsoft Azure Data Platform

SQL Database

SQL on IaaS

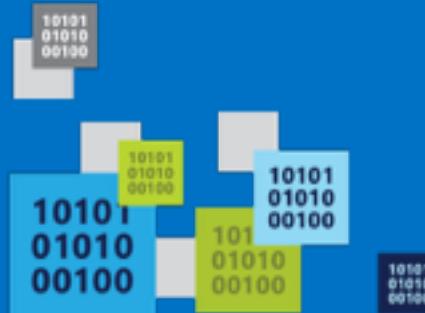
DocumentDB

MongoDB,
MySQL, Oracle,
Cassandra,
Neo4j and more

HDIInsight

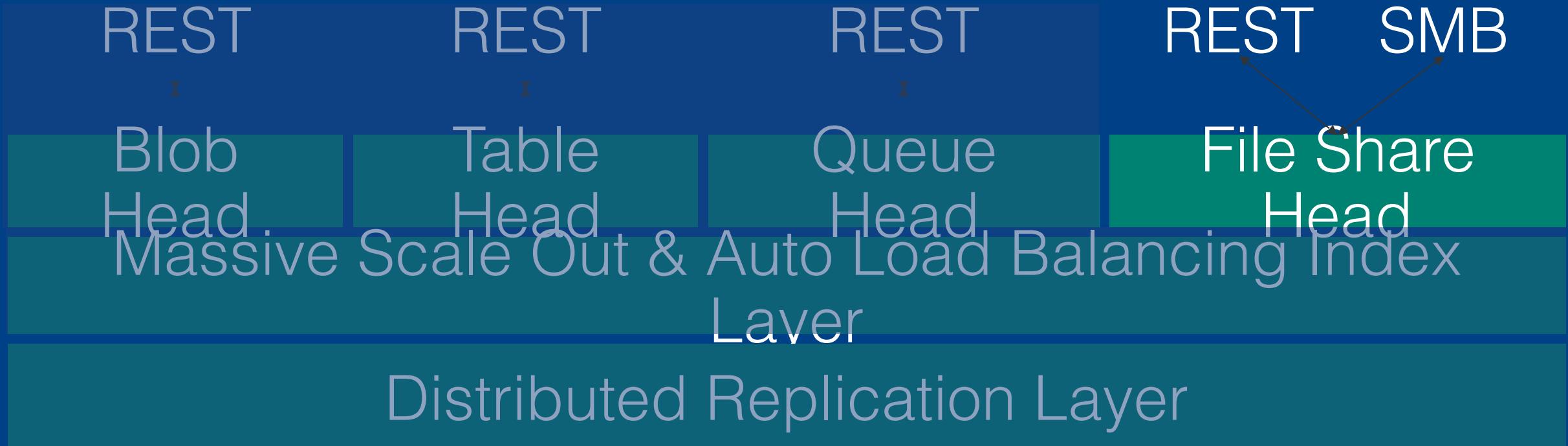
Search

Azure Data Storage

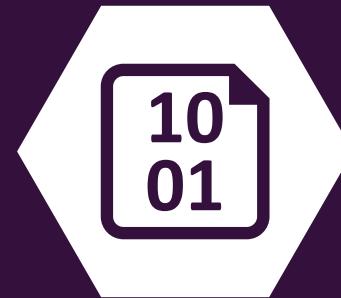


Azure Storage Architecture

Microsoft Azure



Blobs



Microsoft Azure Storage Blob

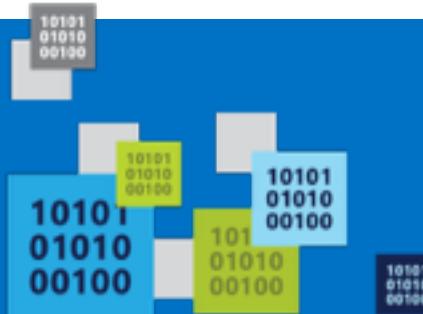
Two Types of Blobs Under the Hood

Block Blob

Page Blob

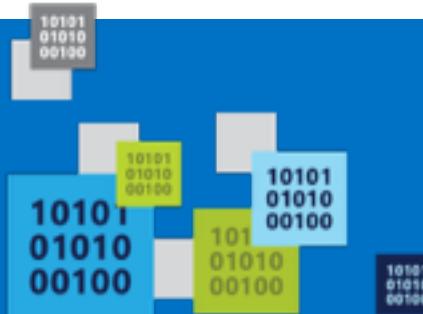
Block Blob

Targeted at streaming workloads
Each blob consists of a sequence of blocks
Each block is identified by a Block ID
Size limit 200GB per blob
Optimistic Concurrency via Etags



Page Blob

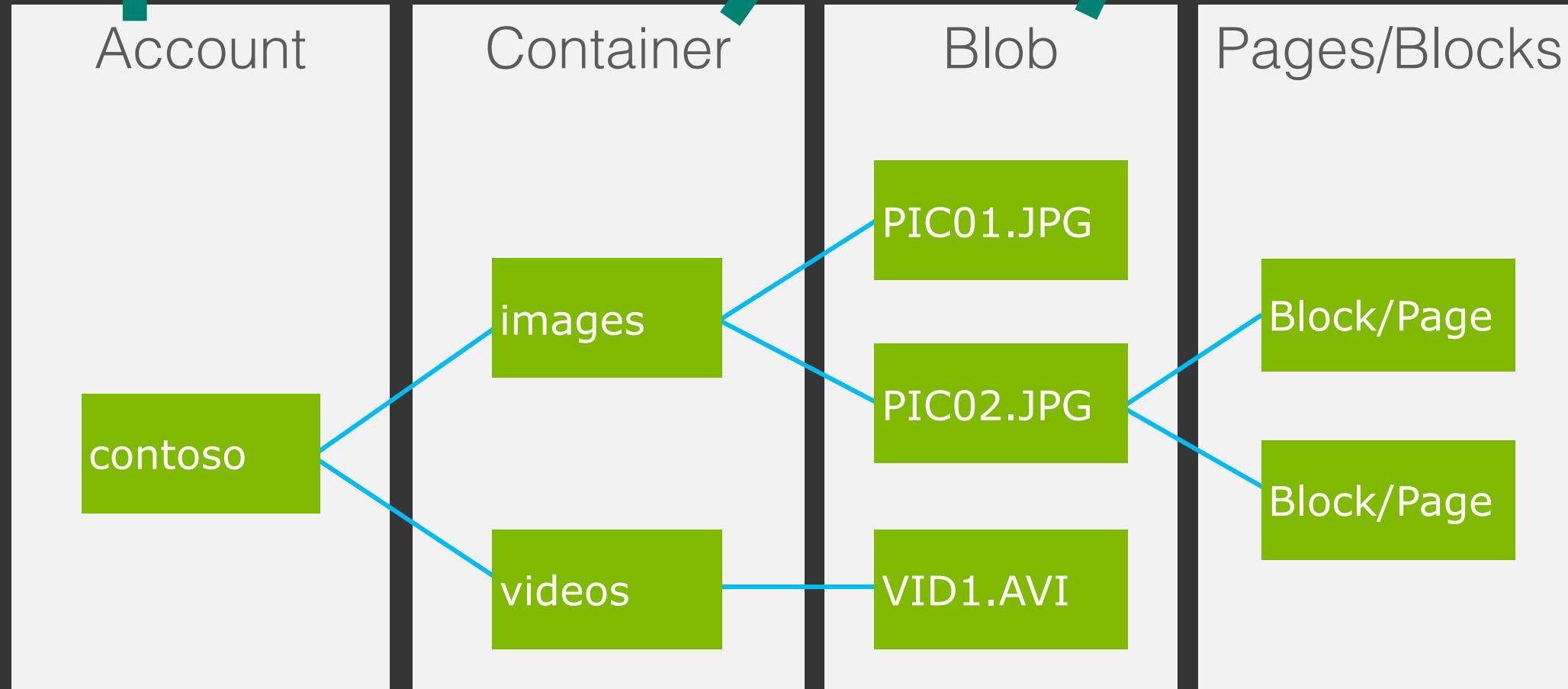
Targeted at random read/write workloads
Each blob consists of an array of pages
Each page is identified by its offset from the start of the blob
Size limit 1TB per blob
Optimistic or Pessimistic (locking) concurrency via leases



Blob Storage Concepts

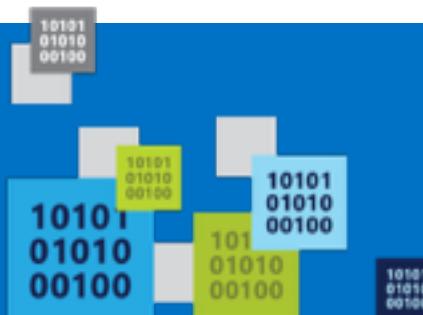
Microsoft Azure

`http://{account}.blob.core.windows.net/{container}/{blobname}`



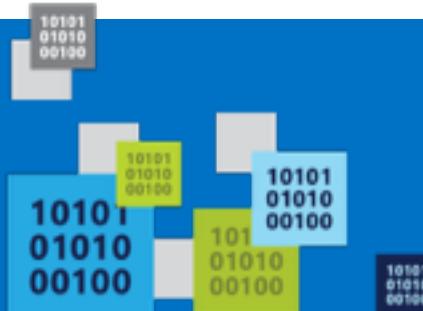
Blob Details – Containers

- Multiple Containers per Account
- Special \$root container

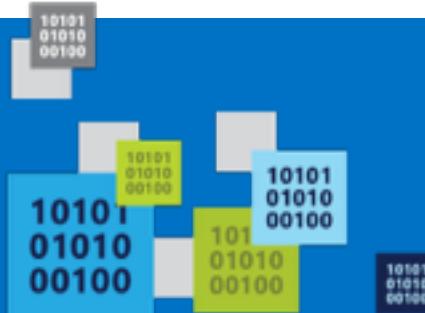


Blob Details – Containers

- A container holds a set of blobs
- Set access policies at the container level
- Associate Metadata with Container
- List the blobs in a container
- Including Blob Metadata and MD5
 - no search on metadata WHERE MetadataValue = ?



PutBlob
GetBlob
DeleteBlob
CopyBlob
SnapshotBlob
LeaseBlob



Blob Details

Associate metadata with blob

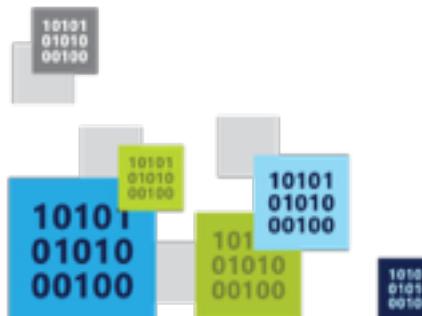
- Standard HTTP metadata/headers
(Cache-Control, Content-Encoding, Content-Type, etc)
- Metadata is <name, value> pairs, up to 8KB per blob
- Either as part of PutBlob or independently

Blob Details – Blob always accessed by name

Can include ‘/’ or other delimiter in name

e.g. /<container>/myblobs/smurf.png

blob name



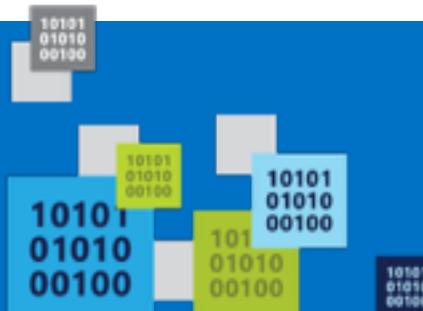
GET Blob operation takes parameters

Prefix

Delimiter

Include = (snapshots,
metadata etc...)

Blob Details



Blob sample listing

http://
adventureworks.blob.core.windows.net/
Products/Bikes/
SuperDuperCycle.jpg
Products/Bikes/FastBike.jpg
Products/Canoes/Hybrid.jpg
Products/Canoes/Flatwater.jpg
Products/Canoes/Whitewater.jpg
Products/Tents/PalaceTent.jpg
Products/Tents/ShedTent.jpg

GET http://.../products?comp=list&prefix=Tents

```
<Blobs>
    <Blob><Name>Tents/PalaceTent.jpg</Name>[...]</
Blob>
    <Blob><Name>Tents/ShedTent.jpg</Name>[...]</
```

Blob sample listing full response

```
<Blobs>
  <Blob>
    <Name>Tents/PalaceTent.jpg</Name>
    <Url>https://readinesscloudcamp.blob.core.windows.net/products/Tents/PalaceTent.jpg</Url>
    <LastModified>Wed, 17 Dec 2014 09:00:26 GMT</LastModified>
    <Etag>0x8D1E7EF08F31520</Etag>
    <Size>150027</Size>
    <ContentType>image/jpeg</ContentType>
    <ContentEncoding />
    <ContentLanguage />
  </Blob>
  <Blob>
    <Name>Tents/ShedTent.jpg</Name>
    <Url>https://readinesscloudcamp.blob.core.windows.net/products/Tents/ShedTent.jpg</Url>
    <LastModified>Wed, 17 Dec 2014 09:00:26 GMT</LastModified>
    <Etag>0x8D1E7EF08EA6257</Etag>
    <Size>150027</Size>
    <ContentType>image/jpeg</ContentType>
    <ContentEncoding />
    <ContentLanguage />
  </Blob>
</Blobs>
```

Blob sample listing with maxresults

http://
adventureworks.blob.core.windows.net/
Products/Bikes/
SuperDuperCycle.jpg
Products/Bikes/FastBike.jpg
Products/Canoes/Hybrid.jpg
Products/Canoes/Flatwater.jpg
Products/Canoes/Whitewater.jpg
Products/Tents/PalaceTent.jpg
Products/Tents/ShedTent.jpg
http://.../products?

comp=list&prefix=Canoes&maxresults=2

<Blob>Canoes/Hybrid.jpg</Blob>
<Blob>Canoes/Flatwater.jpg</Blob>
<NextMarker>1!28!Q2Fub2VzL1doaXRId2F0ZXluanBn</
NextMarker>

Blob sample listing with maxresults

```
http://  
adventureworks.blob.core.windows.net/  
    Products/Bikes/  
    SuperDuperCycle.jpg  
    Products/Bikes/FastBike.jpg  
    Products/Canoes/Hybrid.jpg  
    Products/Canoes/Flatwater.jpg  
    Products/Canoes/Whitewater.jpg  
    Products/Tents/PalaceTent.jpg  
    Products/Tents/ShedTent.jpg  
http://.../products?
```

```
comp=list&prefix=Canoes&maxresults=2  
&marker=1!28!Q2Fub2VzL1doaXRId2F0ZXluanBn  
    <Blob>Canoes/Whitewater.jpg</  
    Blob>  
    </NextMarker>
```

Uploading a Block Blob

Uploading



THE BLOB

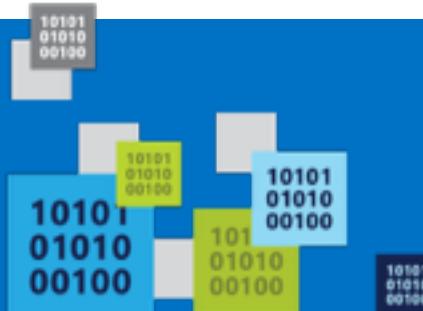
```
blobName = "TheBlob.wmv";
PutBlock(blobName, blockId1,
block1Bits);
PutBlock(blobName, blockId2,
block2Bits);
.....
PutBlock(blobName, blockIdN,
blockNBits);
PutBlockList(blobName,
blockId1,...,blockIdN);
```

TheBlob.wm
v

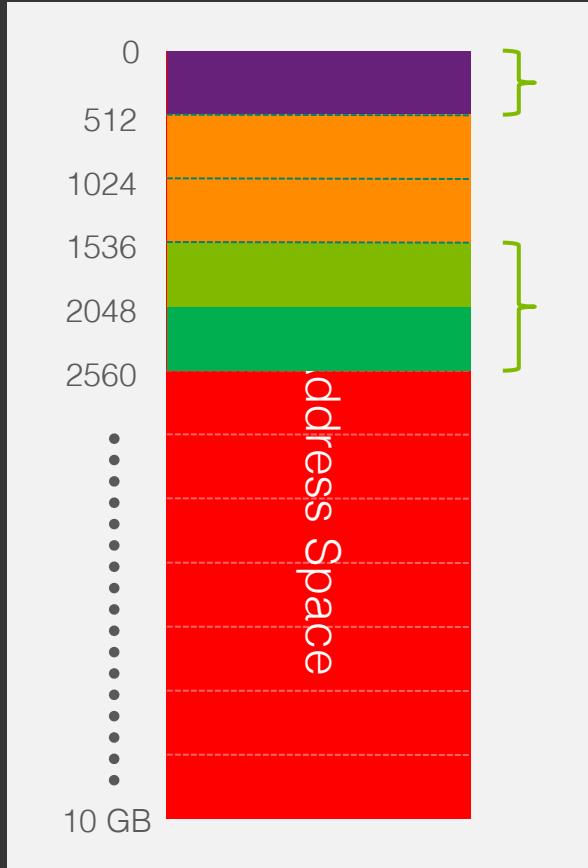
Blob block uploading benefits

Efficient continuation and retry

Parallel and out of order upload of blocks



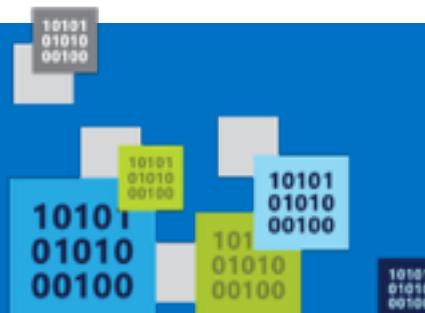
Page Blob – Random Read/Write



Sparse storage:
Only charged for pages with data stored in them

Shared Access Signatures

Fine grain access rights to blobs and containers
Sign URL with storage key – permit elevated rights



Shared Access Signatures – Two broad approaches

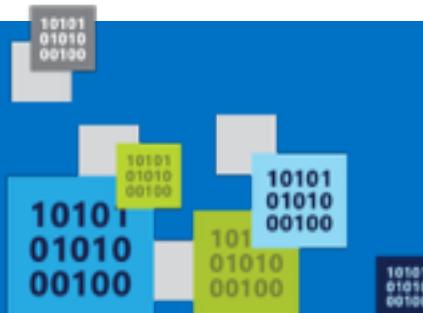
Ad-hoc:
Stored Access Policy

Policy based:
Shared Access Signature

Shared Access Signatures – Revocation

Use short time periods and re-issue

Use container level policy that can be deleted



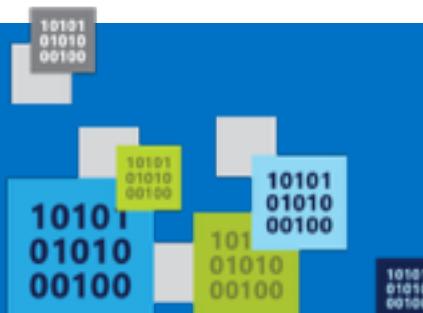
Shared Access Signatures – Ad Hoc Signatures

Create Short Dated Shared Access Signature

Signed resource Blob or Container

AccessPolicy Start, Expiry and Permissions

Signature HMAC-SHA256 of above fields

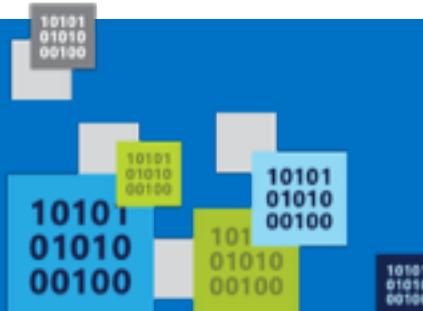


Shared Access Signatures – Ad Hoc Signatures

Use case

Single use URLs

E.g. Provide URL to mobile client to upload to container



Shared Access Signatures

Ad Hoc Signatures

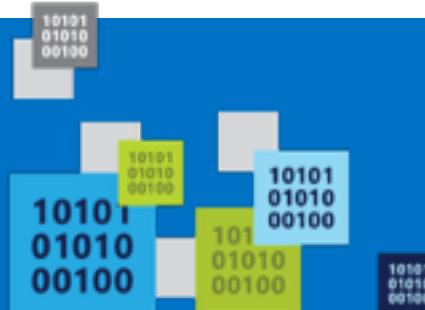
Microsoft Azure

http://...blob.../pics/image.jpg?
sr=c&st=2009-02-09T08:20Z&se=2009-02-10T08:30Z&sp=w
&sig= dD80ihBh5jfNpymO5Hg1IdiJIEvHcJpCMiCMnN%2fRnbI%3d

Store Access Policy – Policy Based Signatures

Create Container Level Policy

Specify StartTime, ExpiryTime, Permissions



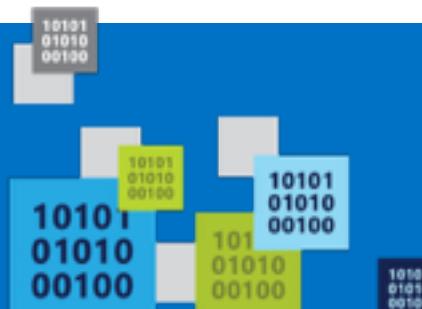
Store Access Policy – Policy Based Signatures

Create Shared Access Signature URL

Signed resource Blob or Container

Signed identifier Optional pointer to container policy

Signature HMAC-SHA256 of above fields

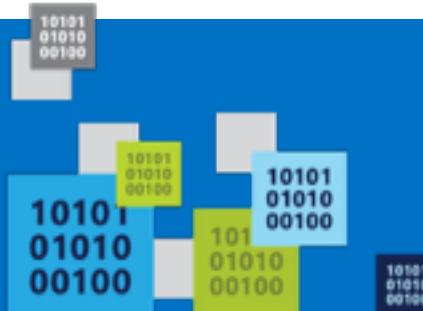


Store Access Policy – Policy Based Signatures

Use case

Providing revocable permissions to certain users/groups

To revoke: Delete or update container policy



```
http://...blob.../pics/image.jpg?  
sr=c&si=MyUploadPolicyForUserID12345  
&sig=dD80ihBh5jfNpym05Hg1IdiJIEvHcJpCMiCMnN%2fRnbI%3d
```

Files

“I wish I could go to storage and provision a cloud drive, giving it a namespace, and that drive would then be UNC-addressable by the OSes.”

“I need two VM's running with a shared drive. One will write to the drive, the other will read [it].”

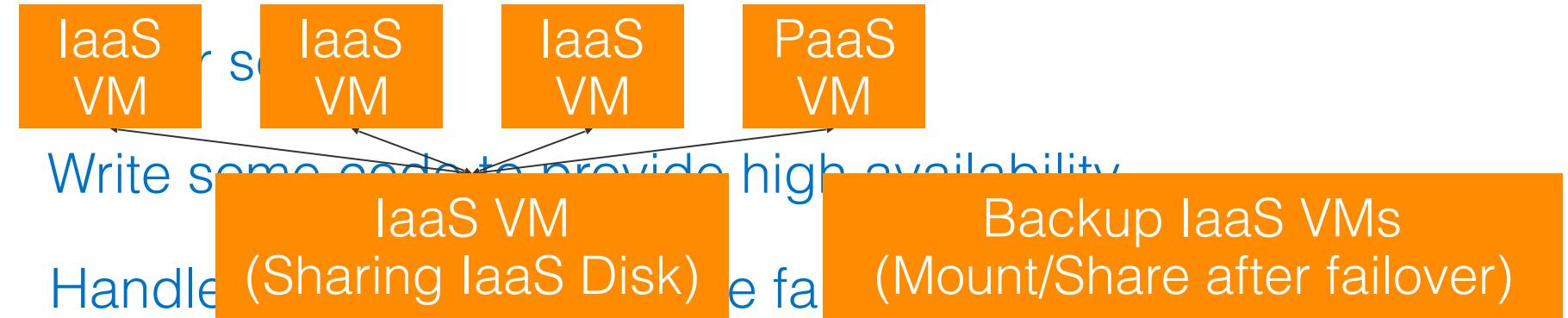
“Hi, I have two VM's in Microsoft Azure. All I want to do is set up a file share between them. Is this possible?”

“Is it possible to share a secondary disk between different VM instances?”

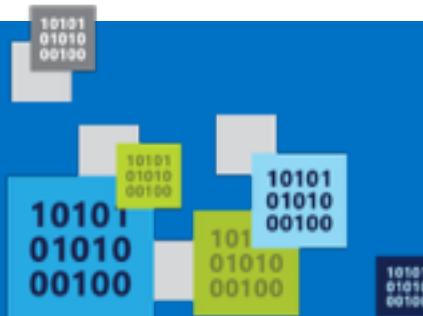
Sharing Files – The old way

Setup an IaaS VM to host a File Share backed by an IaaS Disk

Write code to find the IaaS File Share from the rest of the VMs

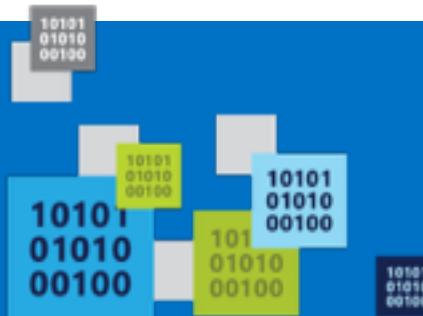
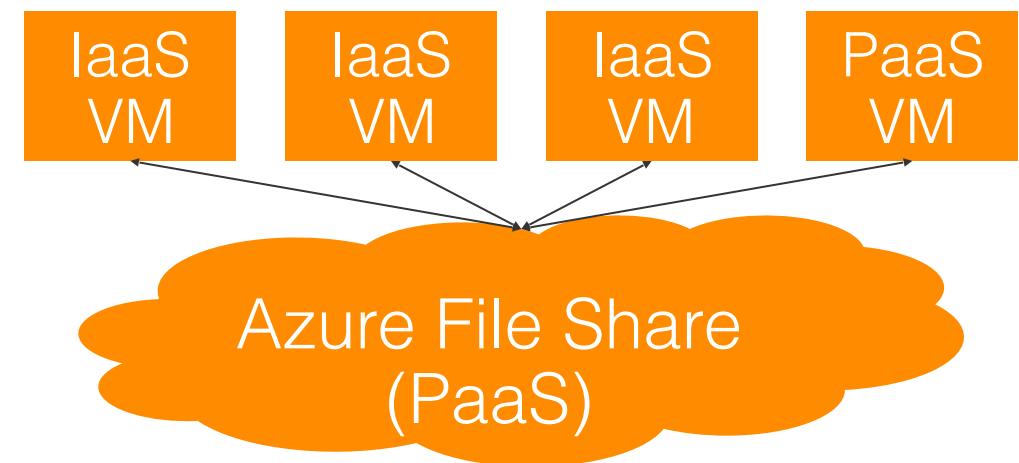


You can only access the File Share from other VMs



Azure Files

- Shared Network File Storage for Azure
- Availability, durability, scalability are managed automatically
- Supports two interfaces: SMB and REST



Azure Files – Usage

- Share data across VMs and applications
- Share settings throughout services
- Dev/Test/Debug

Queues

Why use a Queue?

Queue length reflects how well the backend processing nodes are doing.

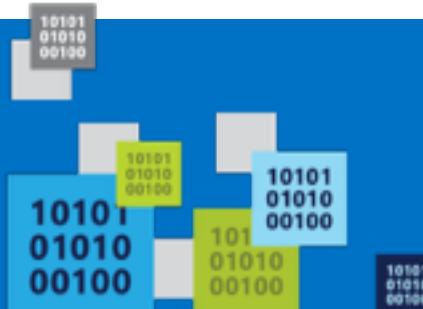
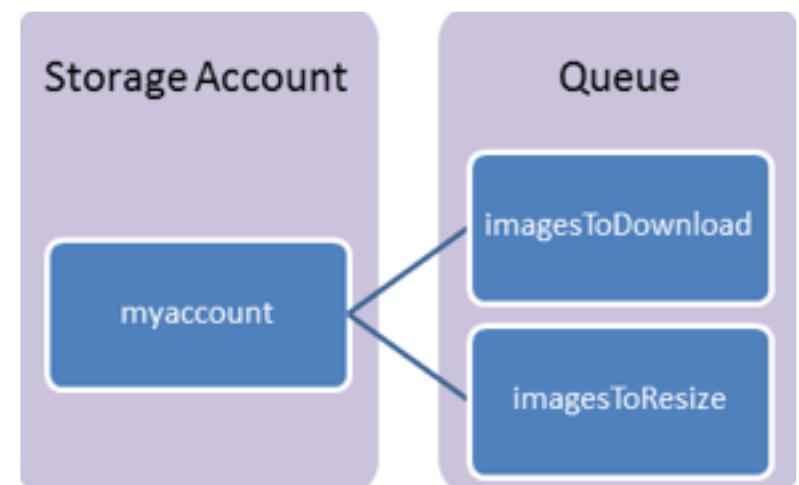
Decouples the application.

Flexibility of efficient resource usage within an application.

Absorb traffic bursts and reduce the impact of individual component failures.

Queue Components

- Storage Account: All access to Azure Storage is done through a storage account.
- Queue: A queue contains a set of messages.
- Message: A message, in any format, of up to 64KB.



Queue URL format

Queues are addressable using the following URL format:

`http://{storage-account}.queue.core.windows.net/{queue}`

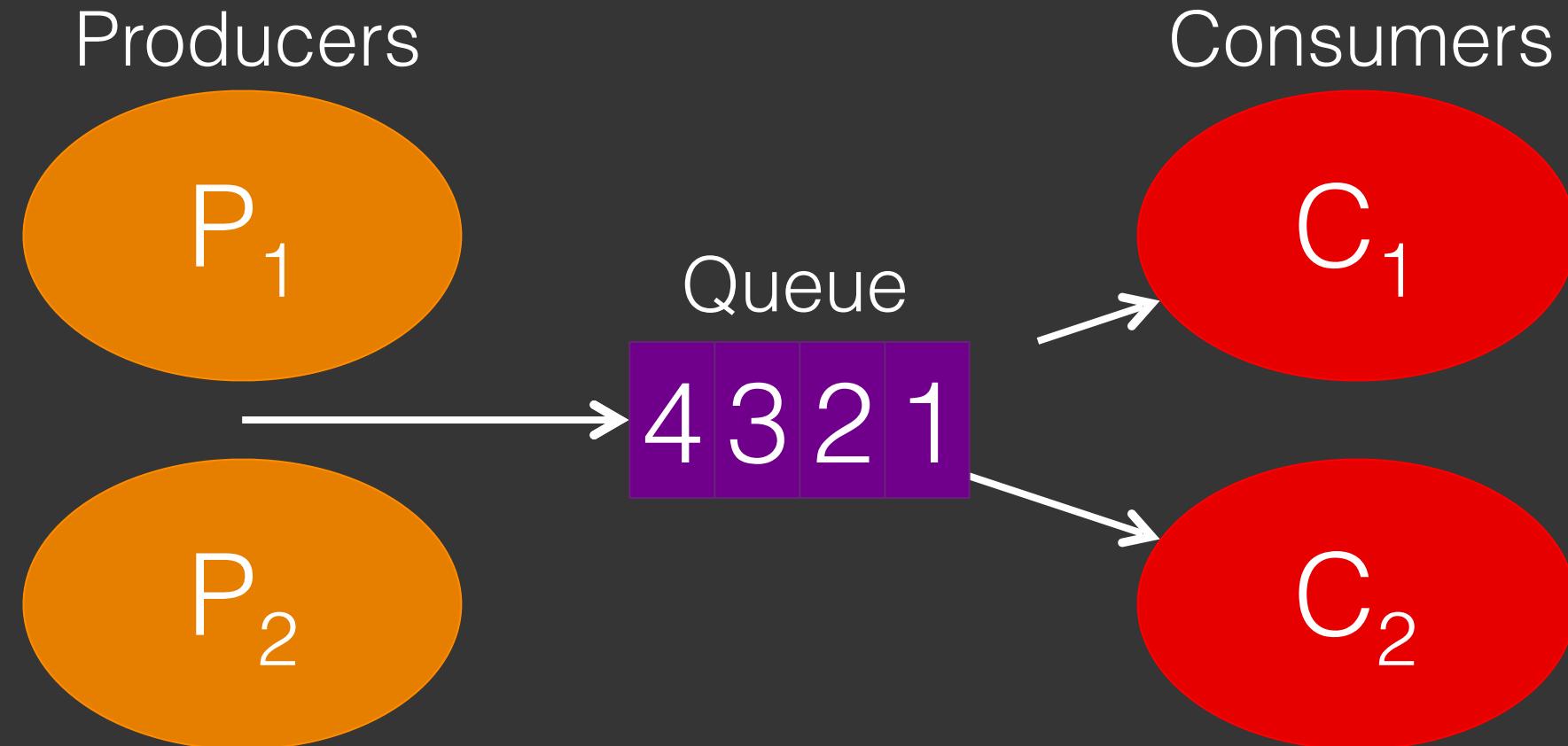
Queue URL format

Example:

`http://myaccount.queue.core.windows.net/imagesToDownload`

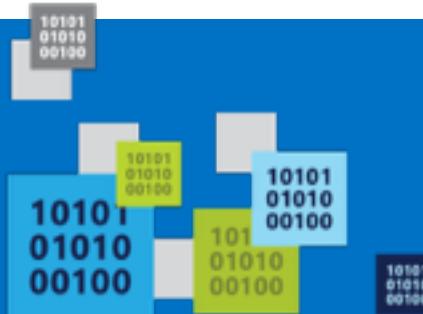
Queue-based Load Levelling Pattern

Microsoft Azure



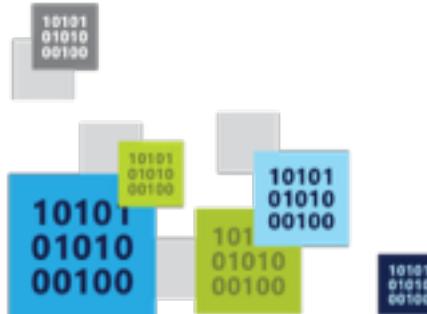
Queue Considerations

- Messages are ordered but not guaranteed FIFO.
- Message will be processed at least once.
- Message may be processed more than once.
- .DequeueCount increases every time.
 - > Processing must be idempotent.



Queue Considerations

Messages are stored up to 7 days



Tables

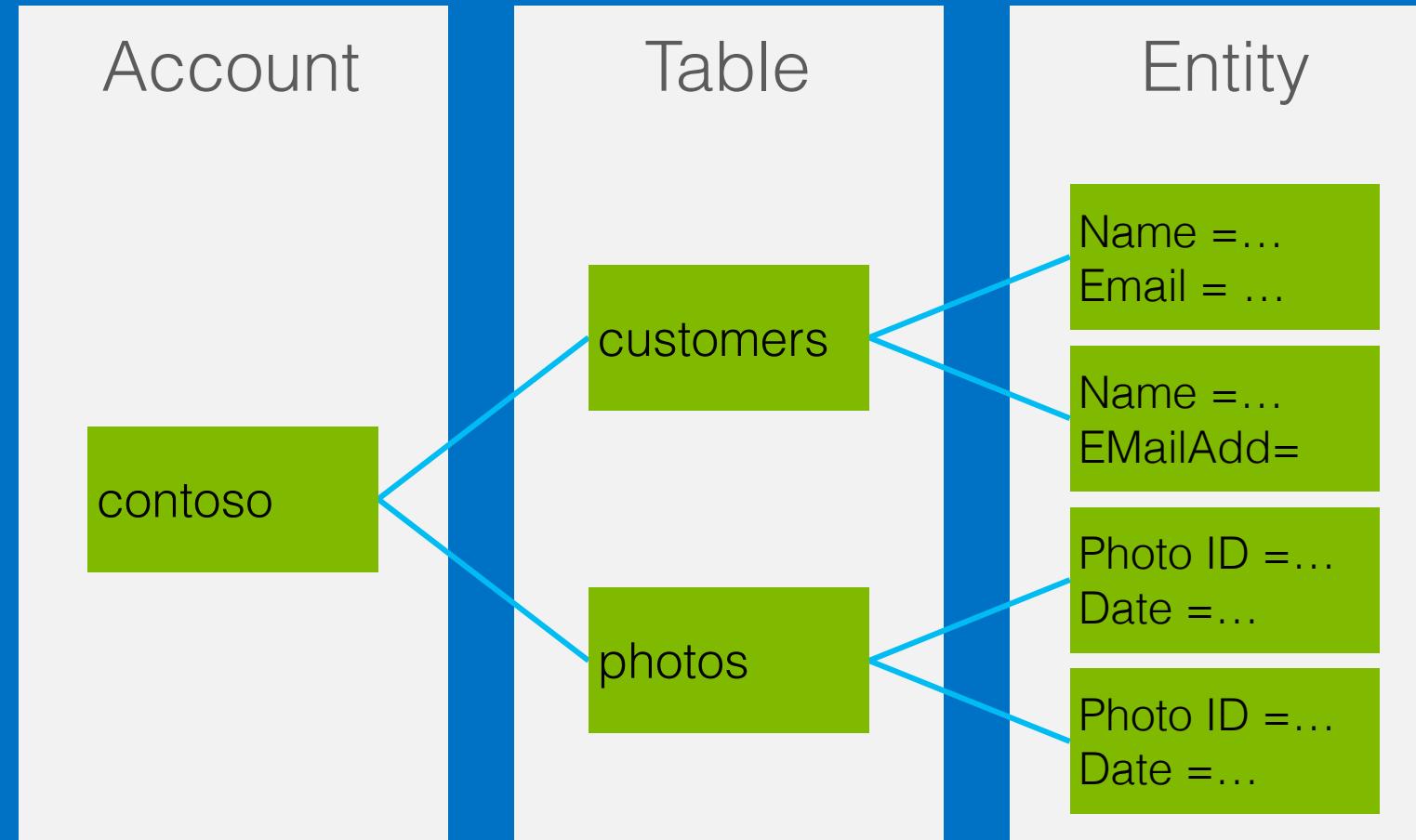


Table Storage Details

Not an RDBMS Table!
The mental picture is ‘Entities’

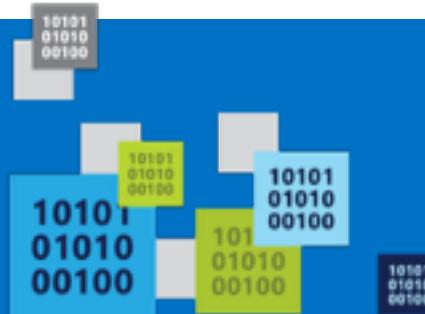


Table Storage Details

Entity can have up to 255 properties

Up to 1MB per entity

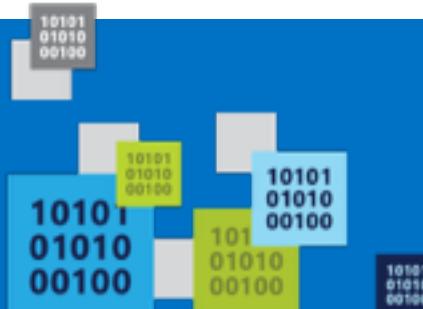


Table Storage Details

Entity Properties

PartitionKey & RowKey are mandatory properties

Composite key which uniquely identifies an entity

They are the only indexed properties

Defines the sort order

Table Storage Details

Purpose of the PartitionKey

Entity Locality

Entity Group Transactions

Table Scalability

Table Storage Details

Purpose of the PartitionKey

Entity Locality

Entities in the same partition will be stored together

Efficient querying and cache locality

Endeavour to include partition key in all queries

Table Storage Details

Purpose of the PartitionKey

Entity Group Transactions

Atomic multiple CRUD in same partition in a single transaction

Table Storage Details

Purpose of the PartitionKey

Table Scalability

Target throughput – 500 tps/partition, several thousand tps/account

Microsoft Azure monitors the usage patterns of partitions

Table Storage Details

Purpose of the PartitionKey

Table Scalability

Automatically load balance partitions

Each partition can be served by a different storage node

Scale to meet the traffic needs of your table

Table Storage Details
Entity Properties

Timestamp property

Optimistic Concurrency

Exposed as an HTTP Etag

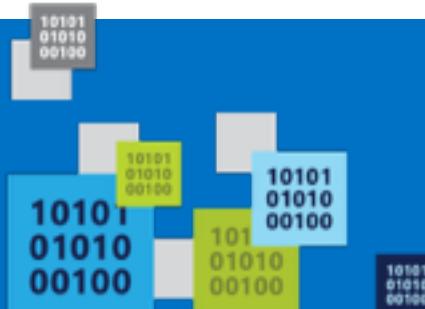


Table Storage Details

Entity Properties

No fixed schema for other properties

Each property is stored as: <name, typed value>

Properties can be the standard .NET types:

string, binary, bool, DateTime, GUID, int, int64, double

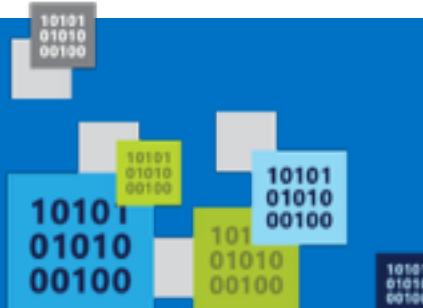
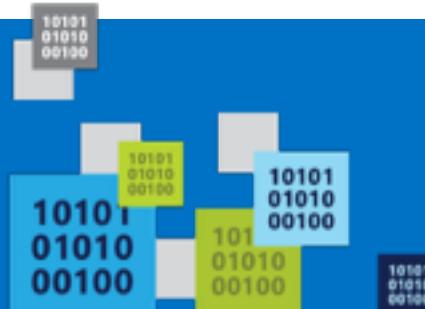


Table Storage Details

Supports full manipulation (CRUD)

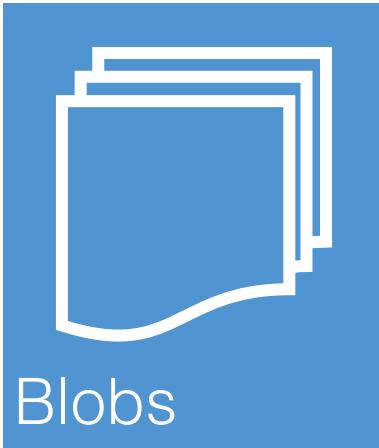
Including Upsert and Entity Group Transactions

Tables can have metadata



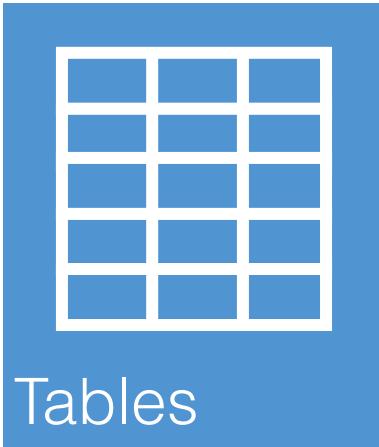
Azure Storage and Cognitive Services

Azure Storage



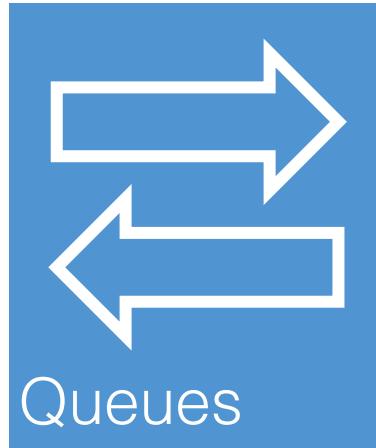
Blobs

Storage for any type of data, analogous to files in a file system, with individual blobs storing up to 1 TB of data



Tables

NoSQL data storage rapid development and fast access to large quantities of data



Queues

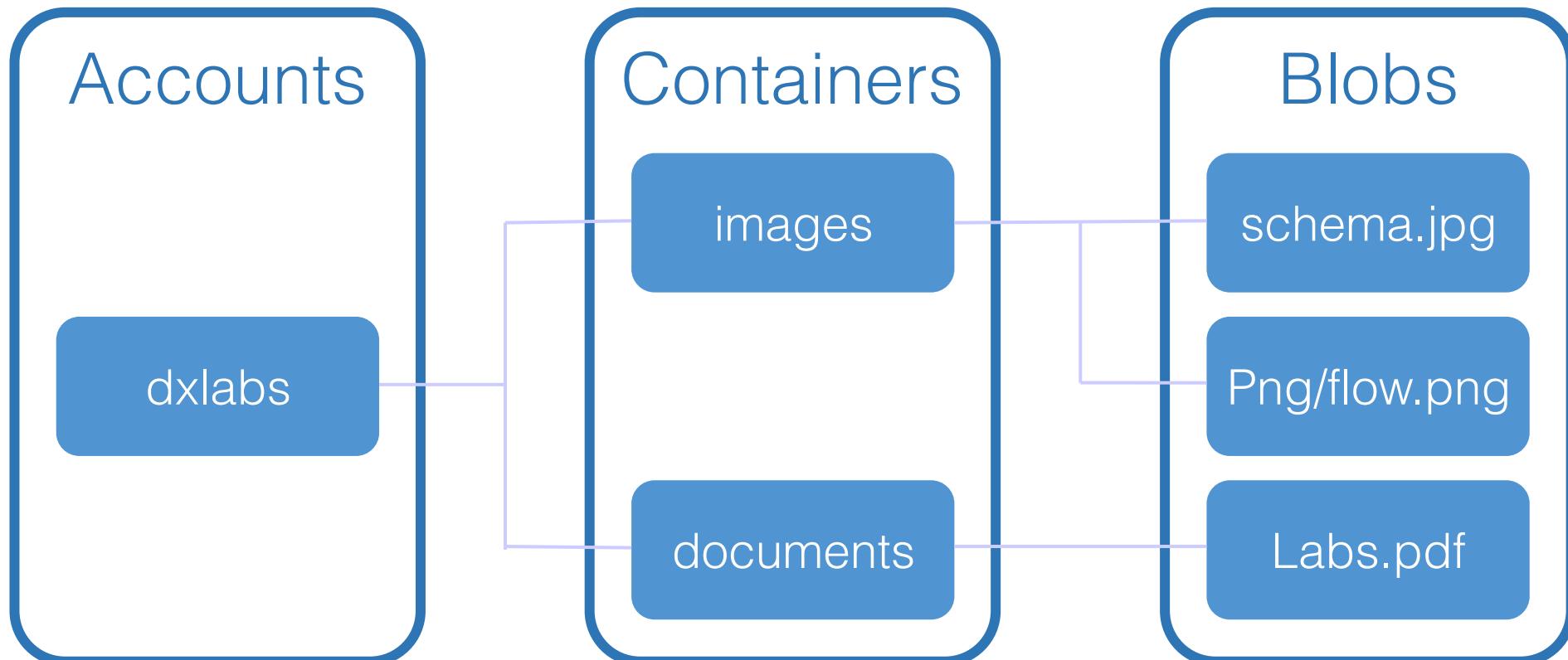
Reliable messaging for workflow processing and for communication between applications or application components



Files

File sharing using Server Message Block (SMB) protocol

Blob Storage

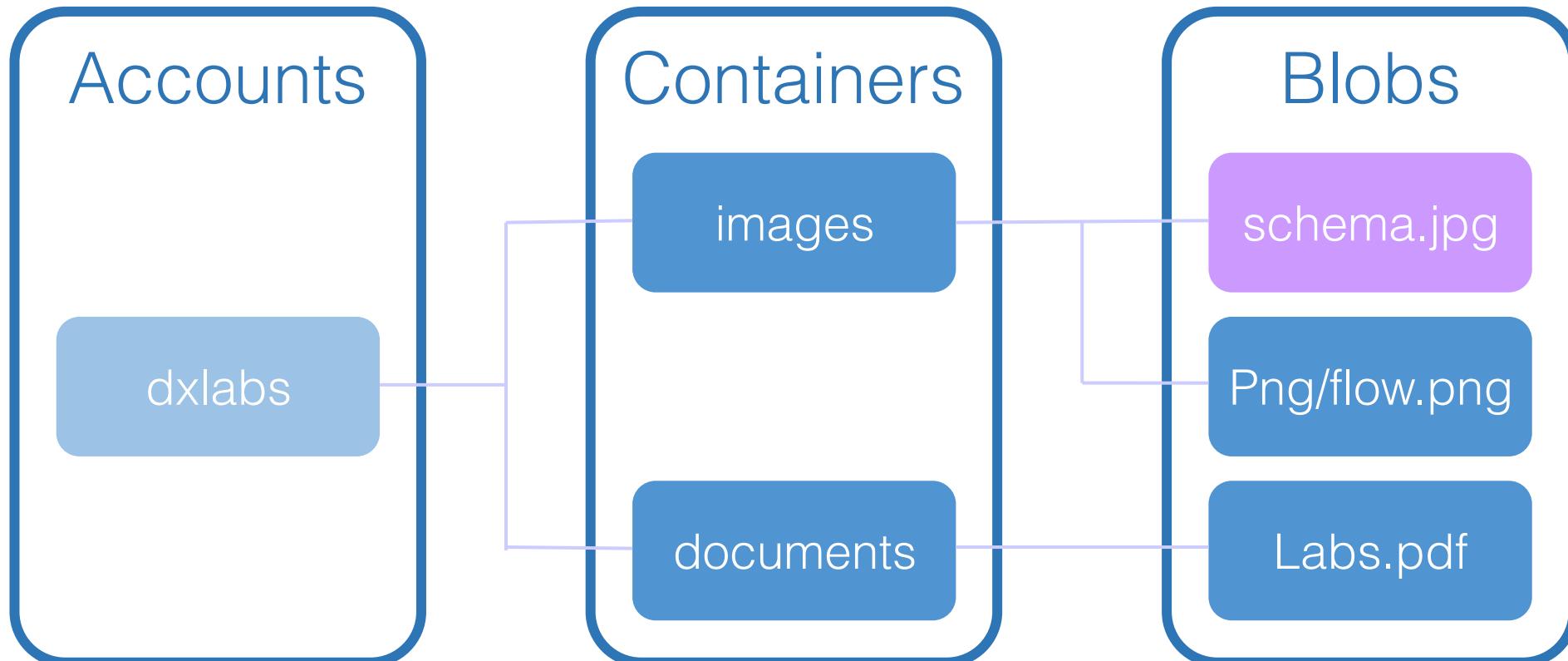


3 to 24 characters
0-9 and a-z
Unique within Azure

3 to 63 characters
0-9, a-z, and dashes

1 to 1,024 characters
Any characters (including slashes)
URL characters must be escaped
Max. 254 path segments

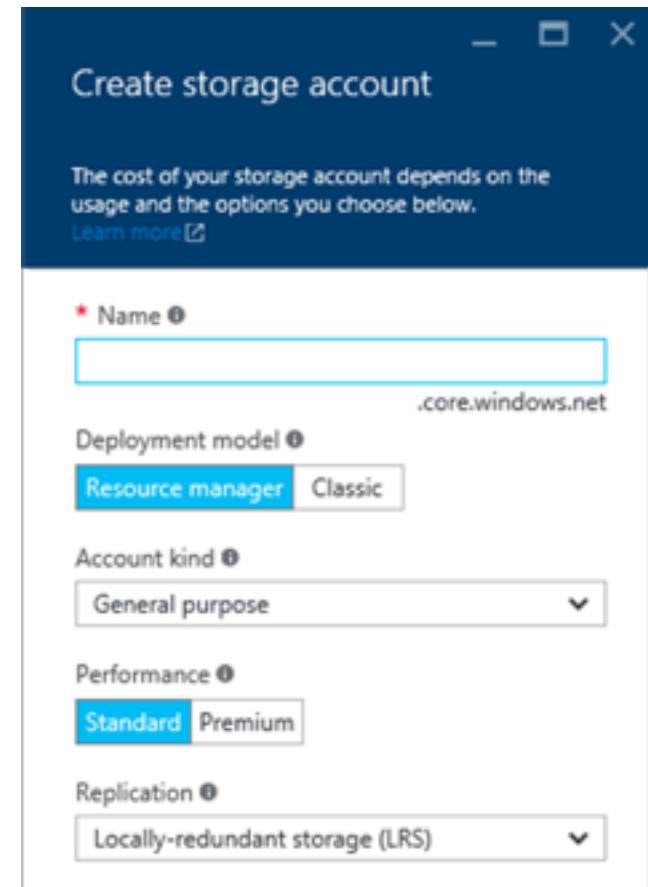
Blob URLs



`https://dxlabs.blob.core.windows.net/images/
schema.jpg`

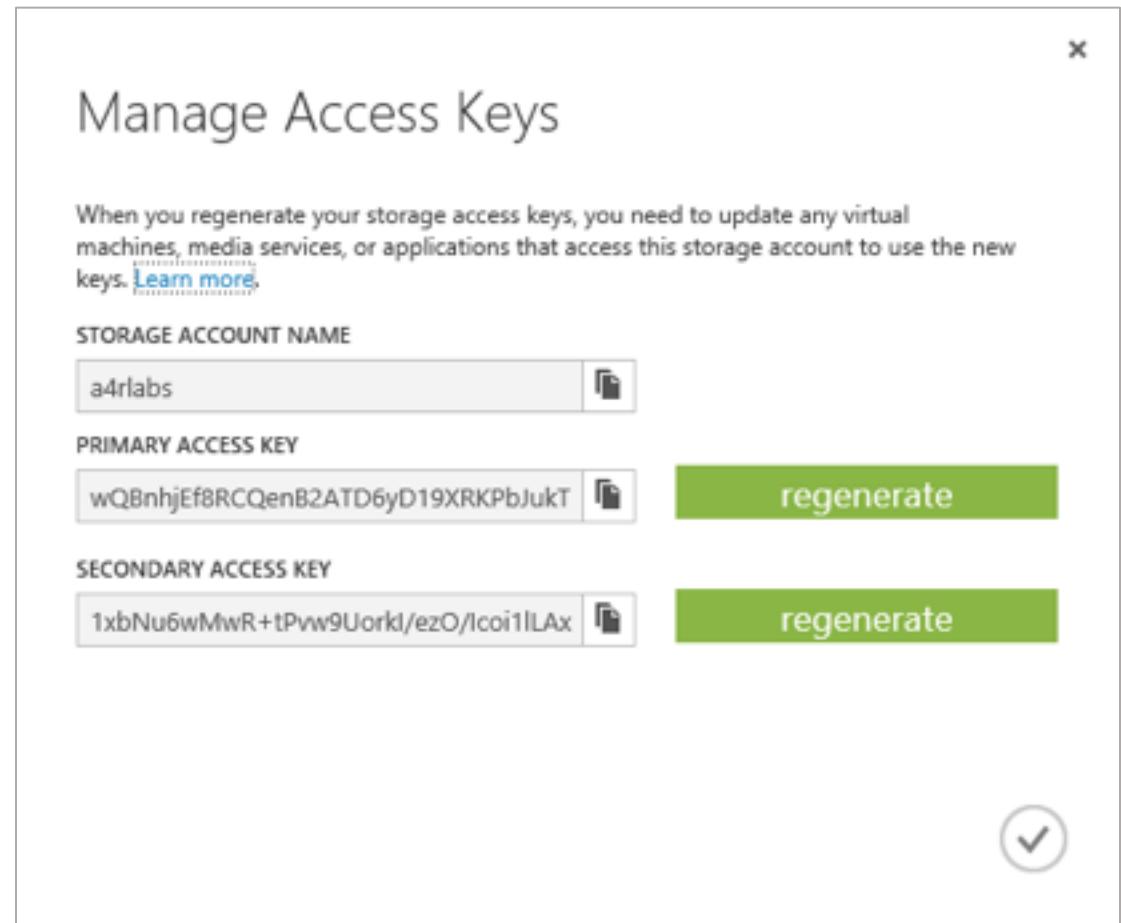
Storage Accounts

- Up to 500 TB of data per account
- Maximum of 100 storage accounts per subscription
- Two types of accounts
 - "General purpose" and "Blob storage"
- Four types of replication
 - LRS, ZRS, GRS, and RA-GRS
- Support optional 256-bit AES encryption (currently in preview)



Storage Keys

- Access to storage by non-account-owners relies on keys for authentication
 - Two 512-bit keys per account
- Keys should be "rolled" periodically for security
- Keys can be used to generate shared-access signatures (SAS) for secure and restricted access



Shared-Access Signatures

Blob URL

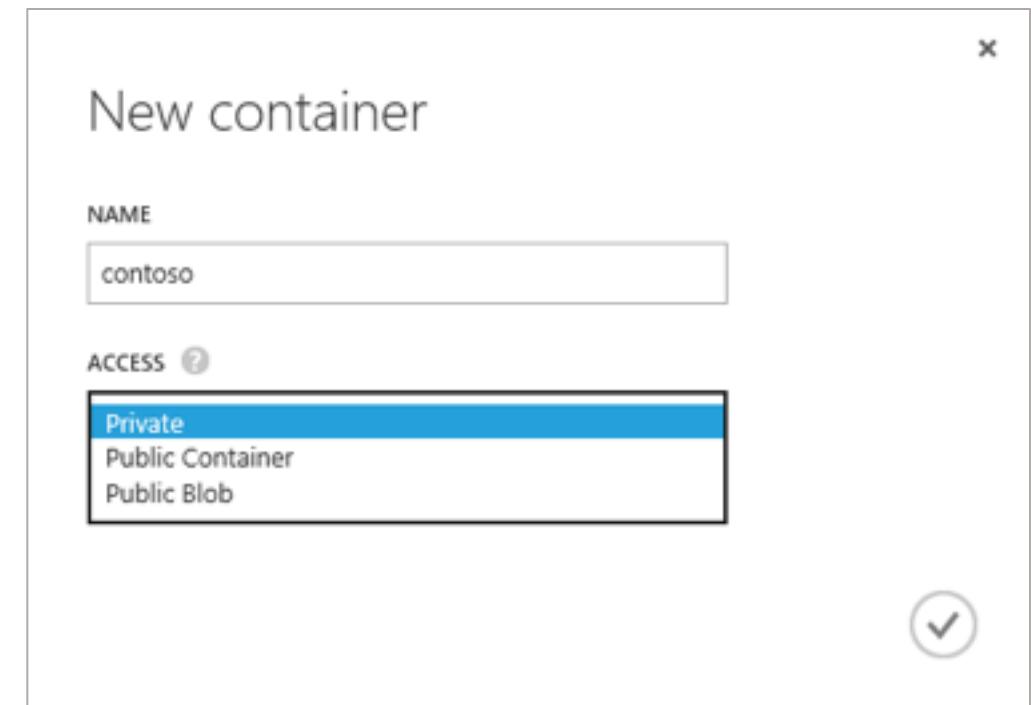
[https://a4rlabs.blob.core.windows.net/images/
schema.jpg?](https://a4rlabs.blob.core.windows.net/images/schema.jpg?st=2016-02-07T19%3A58%3A00Z&se=2016-02-08T19%3A58%3A00Z&sp=r&sv=2015-02-21&sr=b&sig=BGebg1eduvPTwQnZWZIBphM8YGP9sRYt2WiPIL70vcw%3D)

st=2016-02-07T19%3A58%3A00Z&se=2016-02-08T
19%3A58%3A00Z&sp=r&sv=2015-02-21&sr=b&sig=
BGebg1eduvPTwQnZWZIBphM8YGP9sRYt2WiPIL70vcw
%3D

Query string containing
shared-access signature

Storage Containers

- Unlimited number of blob containers per storage account
- Three access policies
 - Private – Blobs can't be read or enumerated anonymously
 - Public Container – Blobs can be read and enumerated anonymously
 - Public Blob – Blobs can be read anonymously, but cannot be enumerated



Storage Blobs

- Unlimited number of blobs per container
- Three types of blobs

Block

Up to 195 GB

General-purpose
streaming and storage

Append

Up to 195 GB

Optimized for append
operations

Page

Up to 1 TB

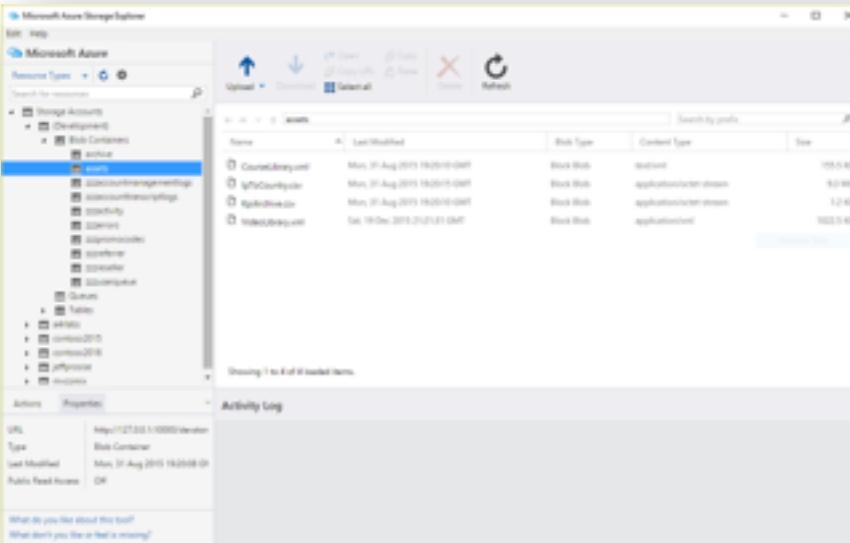
VHDs only; optimized for
random access

- Blobs also support user-defined metadata (key-value pairs)

Azure Storage Tools

- Portal doesn't provide functionality for uploading blobs
- Use free, third-party, cross-platform tools instead

Microsoft Azure Storage Explorer



Azure Command-Line Interface (CLI)

A screenshot of the Windows Azure SDK Environment window, specifically the 'Windows Azure SDK Shell'. It shows a command-line interface with several lines of text output. The output includes the Azure logo, information about the tool version (0.9.6), and help text for the 'login' and 'logout' commands. The text is color-coded in green and blue.

Accessing Blob Storage Programmatically

- Blob service can be accessed using REST APIs
 - Accessible to any programming language that supports HTTP(S)
- Blob service can also be accessed using Azure Storage SDKs available for popular languages and platforms



- Also available from NuGet, NPM, and other package managers

Uploading a Blob (C#)

- Create a blob in the specified storage account and specified container using the Azure Storage SDK for .NET
- Upload the contents of a local file to the blob
- Get the connection string for the storage account from the Azure portal

```
CloudStorageAccount account =  
    CloudStorageAccount.Parse("connection_string");  
CloudBlobClient client = account.CreateCloudBlobClient();  
CloudBlobContainer container =  
    client.GetContainerReference("container_name");  
CloudBlockBlob blob =  
    container.GetBlockBlobReference("blob_name"));  
await blob.UploadFromFileAsync("file_name");  
  
// Or use UploadFromStreamAsync or  
// UploadFromByteArrayAsync
```

Downloading a Blob (Node.js)

- Get a reference to a specified blob in a specified container in a specified storage account
- Download the blob and store its contents in a local file

```
var storage = require("azure-storage");
var service =
    storage.createBlobService("connection_string");
service.getBlobToLocalFile(
    "container_name", "blob_name", "file_name",
    function(error, result, response) {
        if (!error) {
            // File downloaded
        }
    });
// Or use getBlobToStream, getBlobToText, or
// createReadStream
```

Enumerating Blobs in a Container (C#)

- Enumerate all the block blobs in a specified container in a specified storage account
- Retrieve the name of each blob
- `IListBlobItem` could CloudBlockBlob, CloudPageBlob, or CloudAppendBlob

```
CloudStorageAccount account =  
    CloudStorageAccount.Parse("connection_string");  
CloudBlobClient client = account.CreateCloudBlobClient();  
CloudBlobContainer container =  
    client.GetContainerReference("container_name");  
  
foreach (IListBlobItem item in container.ListBlobs())  
{  
    var blob = item as CloudBlockBlob;  
    if (blob != null)  
    {  
        string name = blob.Name;  
    }  
}
```

Writing Blob Metadata (Node.js)

- Add metadata properties named "Property1," "Property2," and "Property3" to a blob

```
var storage = require("azure-storage");
var service =
    storage.createBlobService("connection_string");

var metadata = {
    "Property1", "Value1",
    "Property1", "Value2",
    "Property1", "Value3"
};

service.setBlobMetaData("container_name", "blob_name",
    metadata, function(error, result, response) {
    if (!error) {
        // Succeeded
    }
});
```

Reading Blob Metadata (C#)

- Read metadata properties named "Property1," "Property2," and "Property3" from a blob

```
blob.FetchAttributes();
string p1 = blob.Metadata.ContainsKey("Property1") ?
    blob.Metadata["Property1"] : null;
string p2 = blob.Metadata.ContainsKey("Property2") ?
    blob.Metadata["Property2"] : null;
string p3 = blob.Metadata.ContainsKey("Property3") ?
    blob.Metadata["Property3"] : null;
```

Deleting a Blob (Node.js)

- Get a reference to a specified blob in a specified container in a specified storage account
- Delete the blob

```
var storage = require("azure-storage");
var service =
    storage.createBlobService("connection_string");
service.deleteBlob("container_name", "blob_name",
    function(error, response) {
        if (!error) {
            // Blob deleted
        }
});
```

Microsoft Cognitive Services

- Intelligence APIs for building intelligent apps

Give your apps a human side

Knock down barriers between you and your ideas. Enable natural and contextual interaction with tools that augment users' experiences via the power of machine-based AI. Plug them in and bring your ideas to life.

[Get started for free](#)

A photograph of a young man with dark hair and a beard, smiling broadly. He is wearing a blue zip-up jacket over a grey t-shirt with a large green letter 'A' on it. A pair of teal headphones hangs around his neck. He is standing in front of a computer setup, which includes a monitor mounted on an adjustable stand and a keyboard. The background shows a plain, light-colored wall.

Cognitive Services APIs

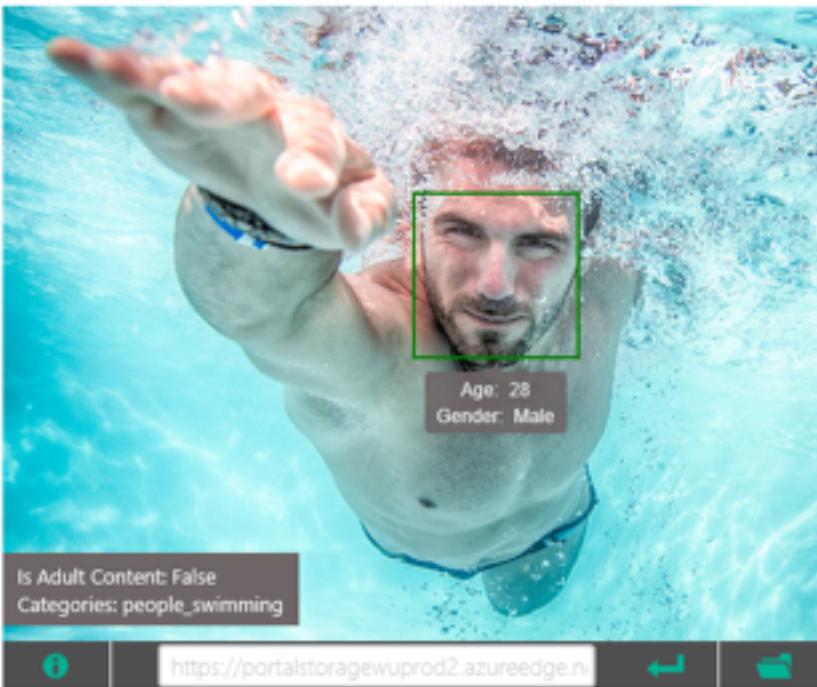
Vision	Computer Vision	Emotion	Face	Video
Speech	Bing Speech	Custom Recognition	Speaker Recognition	
Language	Bing Spell Check	Language Understanding	Linguistic Analysis	Text Analytics
Knowledge	Academic Knowledge	Entity Linking	Knowledge Exploration	Recommendations
Search	Bing Auto-suggest	Bing Image Search	Bing News Search	Bing Video Search
				Bing Web Search

Computer Vision API

Analyze an image

This feature returns information about visual content found in an image. Use tagging, descriptions and domain-specific models to identify content and label it with confidence.

Apply the adult/racy settings to enable automated restriction of adult content. Identify image types and color schemes in pictures.



Features:	
Feature Name	Value
Description	[{"type": 0, "captions": [{"text": "a man swimming in a pool of water", "confidence": 0.7850108693093019}]]
Tags	[{"name": "water", "confidence": 0.9996442794799805}, {"name": "sport", "confidence": 0.9504992365837097}, {"name": "swimming", "confidence": 0.9062818288803101, "hint": "sport"}, {"name": "pool", "confidence": 0.8787588477134705}, {"name": "water sport", "confidence": 0.631849467754364, "hint": "sport"}]
Image Format	jpeg
Image Dimensions	1500 x 1155
Clip Art Type	0 Non-clipart
Line Drawing Type	0 Non-LineDrawing
Black & White Image	False

Using the Computer Vision API (C#)

- Submit an image via URI to the Computer Vision API and ask for captions and descriptive tags
 - Optionally pass a stream instead of a URI
- Uses Microsoft.Project-Oxford.Vision NuGet package
- Other VisualFeatures include Adult, Category, Color, Faces, ImageType, and Tags

```
VisionServiceClient vision =  
    new VisionServiceClient("subscription_key");  
  
VisualFeature[] features =  
    new VisualFeature[] { VisualFeature.Description };  
  
AnalysisResult result =  
    await vision.AnalyzeImageAsync(uri, features);  
  
  
string caption = result.Description.Captions[0].Text;  
  
  
foreach (string tag in result.Description.Tags)  
{  
    // tag holds descriptive tag for image (e.g., "river")  
}
```

Using the Computer Vision API (Node.js)

- Submit an image via URI to the Computer Vision API and ask for captions and descriptive tags
 - Optionally pass a stream instead of a URI
- Other VisualFeatures include Adult, Category, Color, Faces, ImageType, and Tags

```
var options = {
  url: "https://api.projectoxford.ai/vision/v1.0/analyze",
  qs: { visualFeatures: "Description" },
  method: 'POST',
  headers: {
    'Content-Type': 'application/json',
    'Ocp-Apim-Subscription-Key': 'subscription_key'
  },
  ...
};

request(options, function(err, response, result) {
  if(!err) {
    var caption = result.description.captions[0].text;
  }
});
```

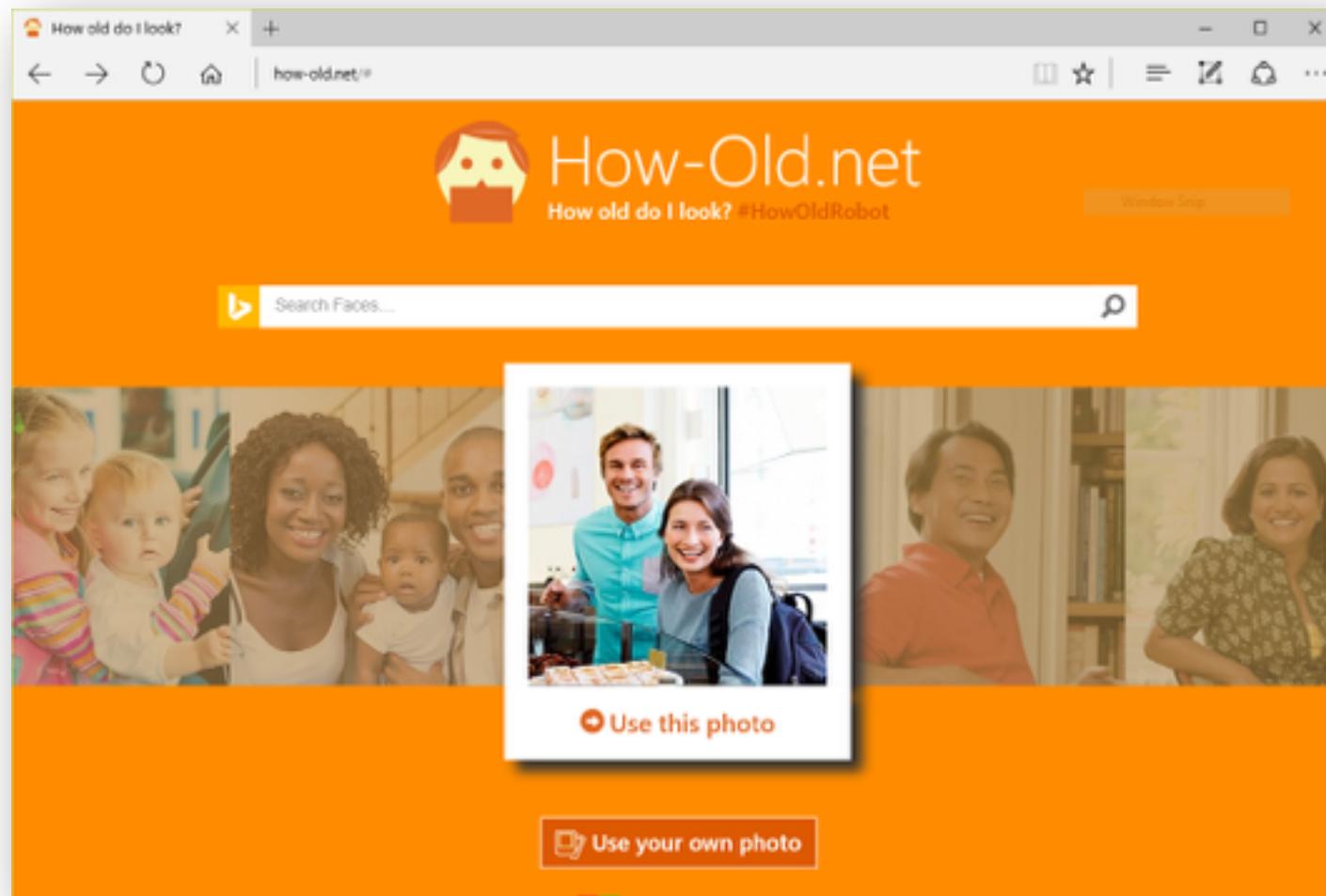
Azure Machine Learning

What is Machine Learning?

- Branch of computer science in which a computer "learns" from data in order to perform predictive analytics
 - Credit-card fraud detection
 - Online shopping recommendations
 - Self-driving cars and more
- Supervised learning
 - Regression and classification
- Unsupervised learning
 - Clustering

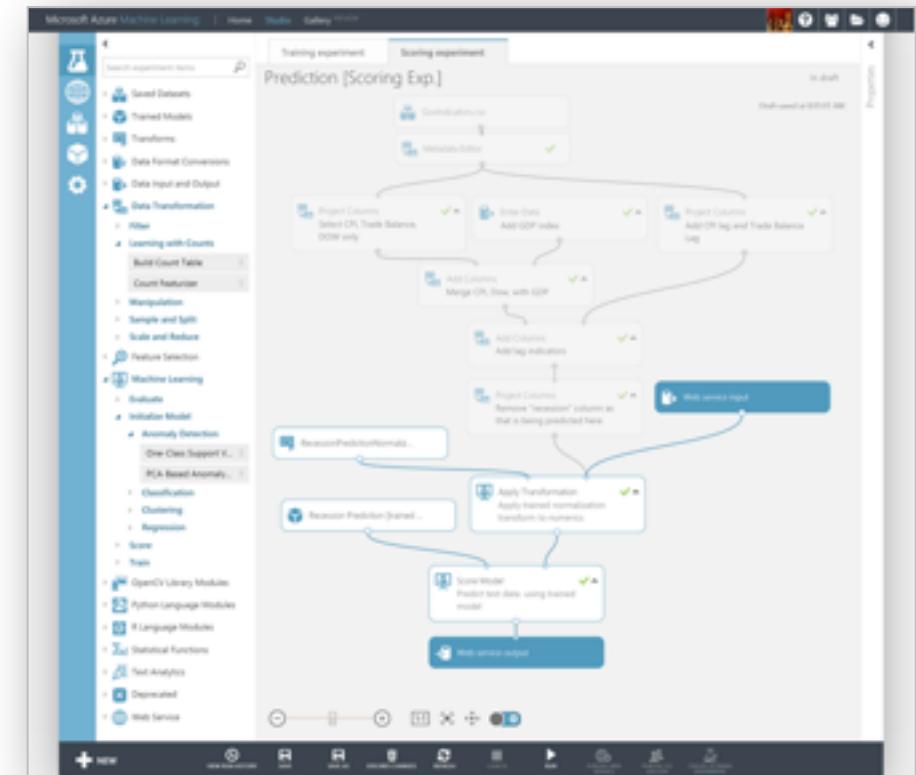


Machine Learning in Action



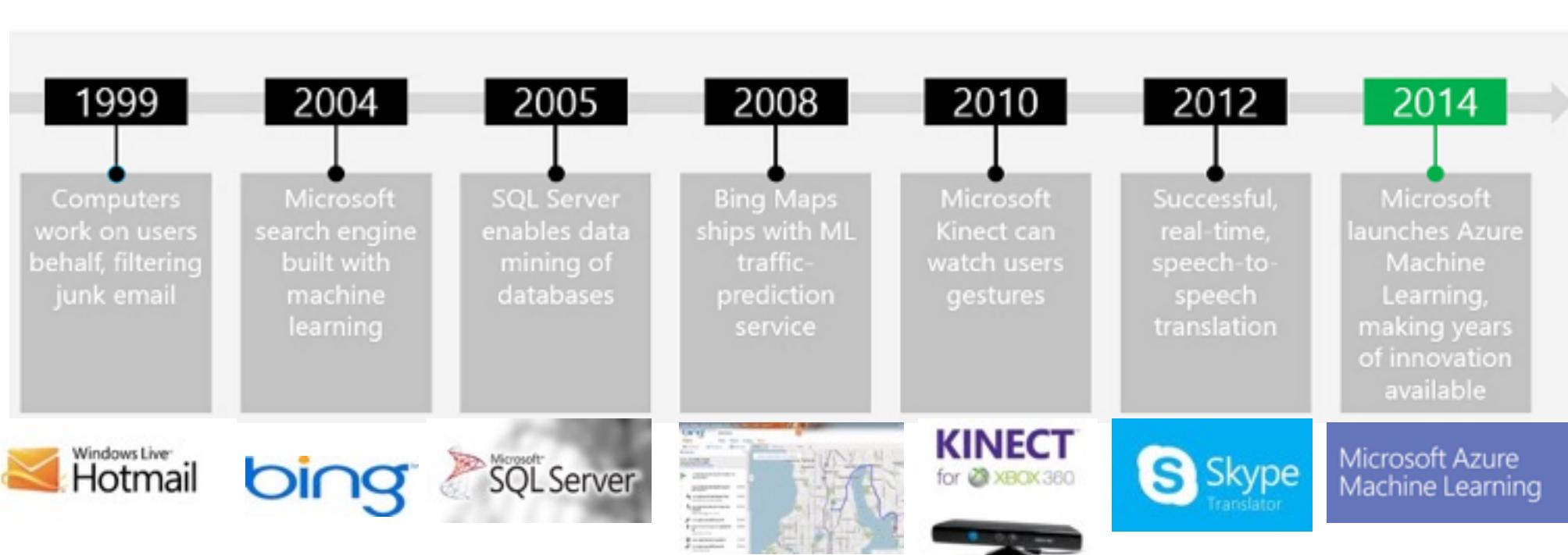
Azure Machine Learning

- Cloud service for building rich Machine Learning models
- ML Studio for composing models
 - Includes hundreds of modules
 - Includes common algorithms for classification, regression, and more
 - Supports numerous input formats
 - Supports R and Python
- Machine Learning for the masses



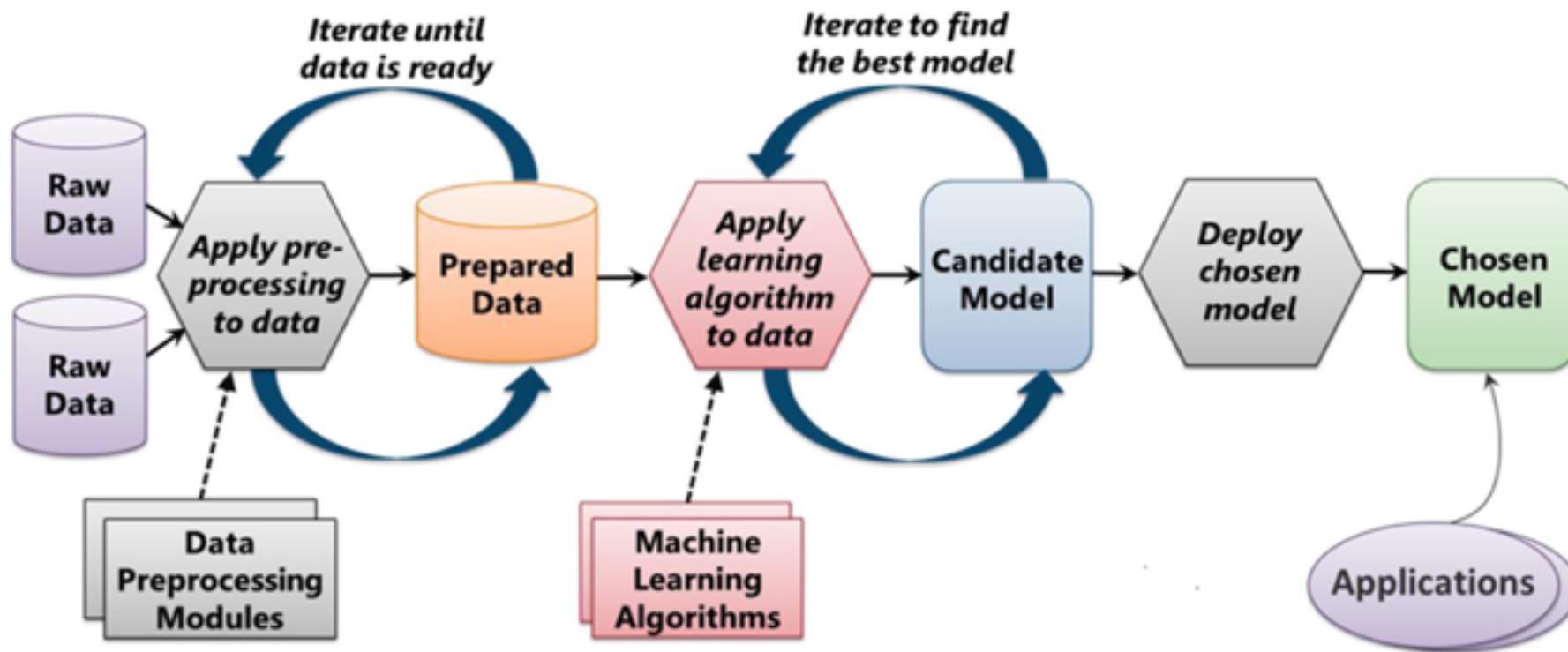
“ I spent last semester building a regression model in Python, and I just did the same thing in 10 minutes with Azure ML, ”

Microsoft and Machine Learning



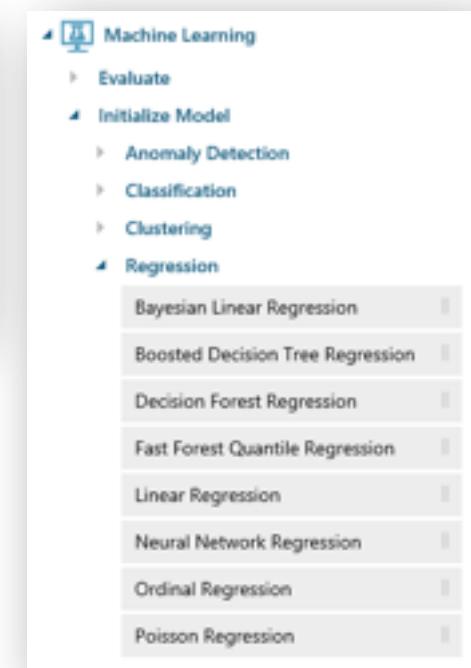
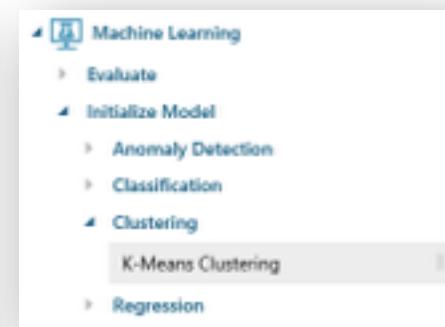
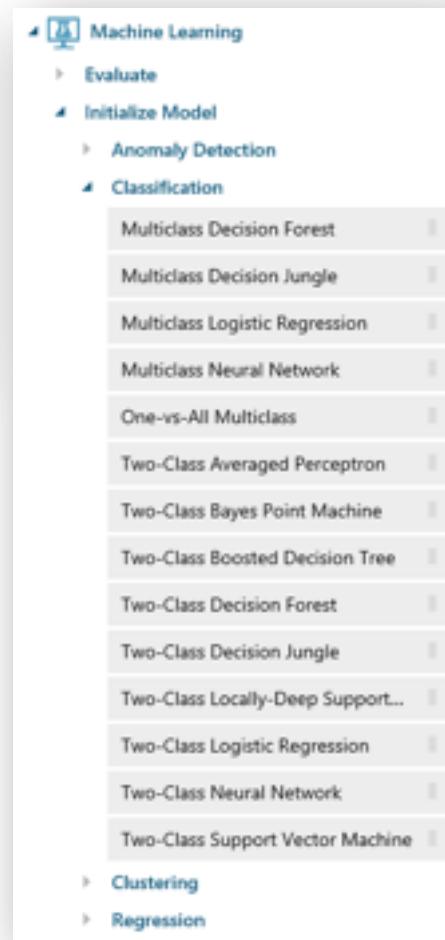
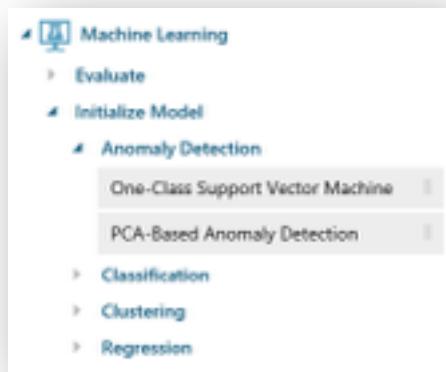
Modified from <http://pulsweb.fr/predict-wine-quality-azureml>

The Machine Learning Process



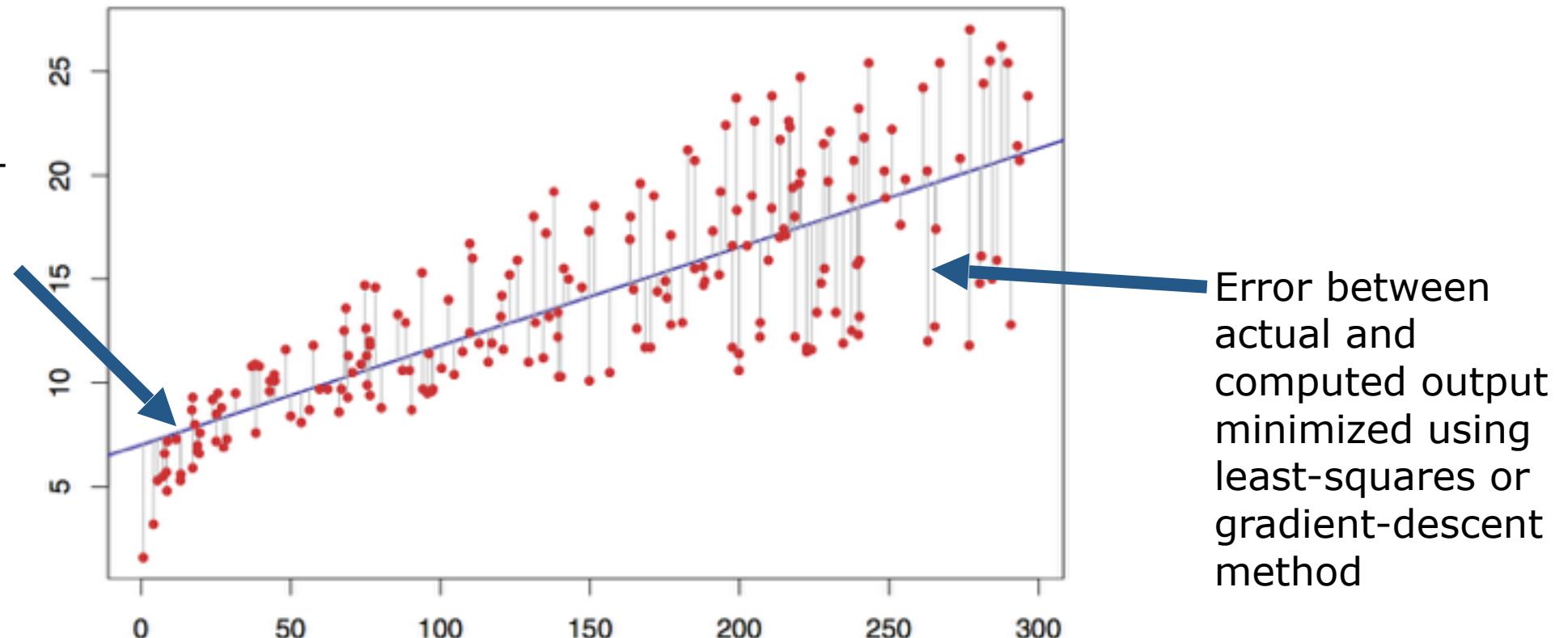
From "Introduction to Microsoft Azure" by David Chappell

Azure Machine Learning Algorithms



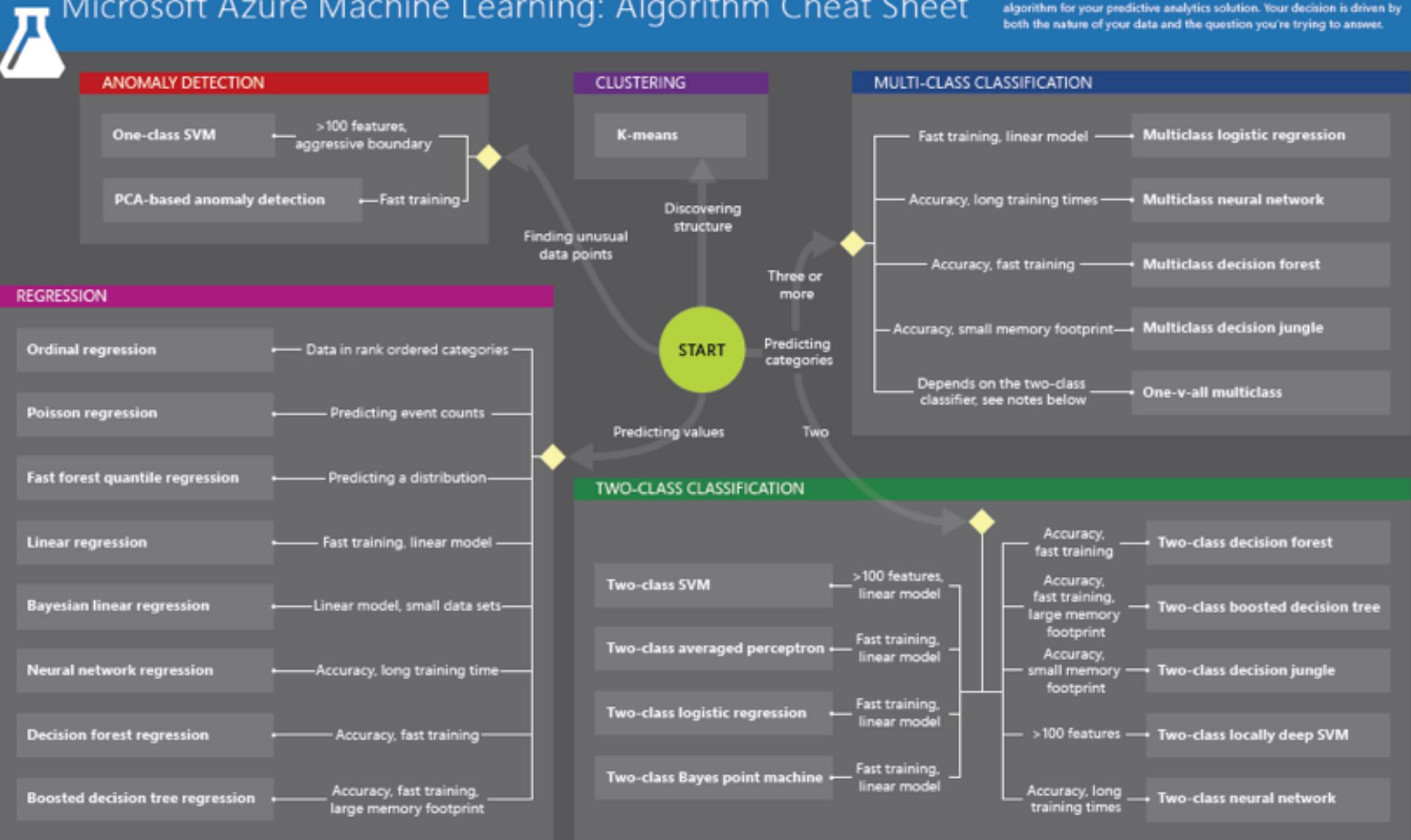
Simple (Univariate) Linear Regression

Regression line represented by an equation of the form $Y = b_0 + b_1X$ where Y is the dependent variable



Microsoft Azure Machine Learning: Algorithm Cheat Sheet

This cheat sheet helps you choose the best Azure Machine Learning Studio algorithm for your predictive analytics solution. Your decision is driven by both the nature of your data and the question you're trying to answer.



<http://aka.ms/MLCheatSheet>

Deploying as a Web Service

- A button click in ML Studio deploys a model as a Web service and provides sample code for calling it in three languages



The screenshot shows a code editor window with tabs for C#, Python, and R. The C# tab is selected, displaying the following code:

```
// This code requires the NuGet package Microsoft.AspNet.WebApi.Client to be installed.  
// Instructions for doing this in Visual Studio:  
// Tools -> NuGet Package Manager -> Package Manager Console  
// Install-Package Microsoft.AspNet.WebApi.Client  
  
using System;  
using System.Collections.Generic;  
using System.IO;  
using System.Net.Http;  
using System.Net.Http.Formatting;  
using System.Net.Http.Headers;  
using System.Text;  
using System.Threading.Tasks;  
  
namespace CallRequestResponseService  
{  
  
    public class StringTable  
    {  
        public string[] ColumnNames { get; set; }  
        public string[,] Values { get; set; }  
    }  
  
    class Program  
    {  
        static void Main(string[] args)  
        {  
            // Generated code for calling the web service goes here.  
        }  
    }  
}
```

A dropdown menu labeled "Select sample code..." is visible on the right side of the window.

Azure Stream Analytics

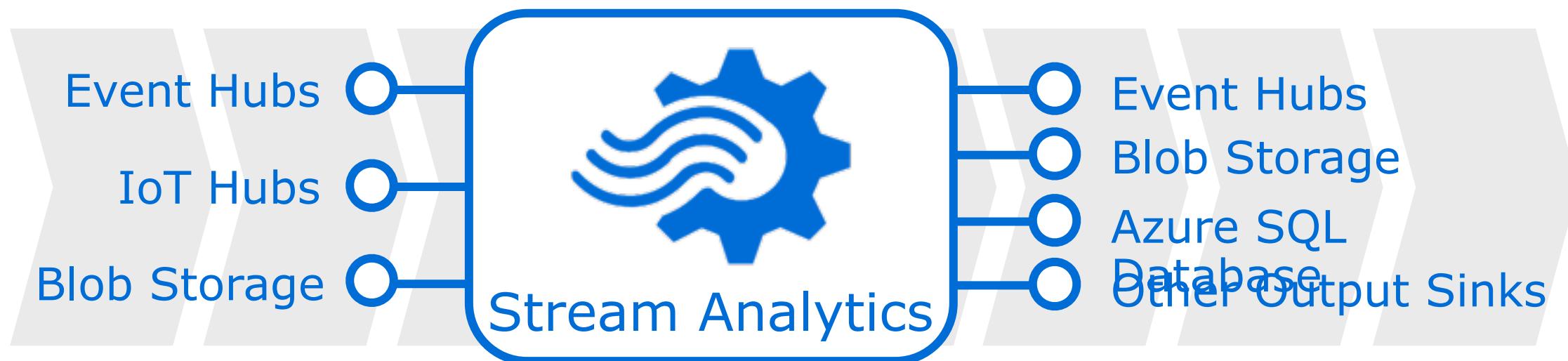
The Internet of Things (IoT)

- Currently 20 billion devices connected to the Internet
- By 2020, expect 50 billion or more
 - Health-monitoring devices
 - Thermostats, wind turbines, and solar farms
 - Cars, trucks, traffic lights, and drones
 - EVERYTHING will be connected
- How do you process all that data?
- How do you process it in real time?

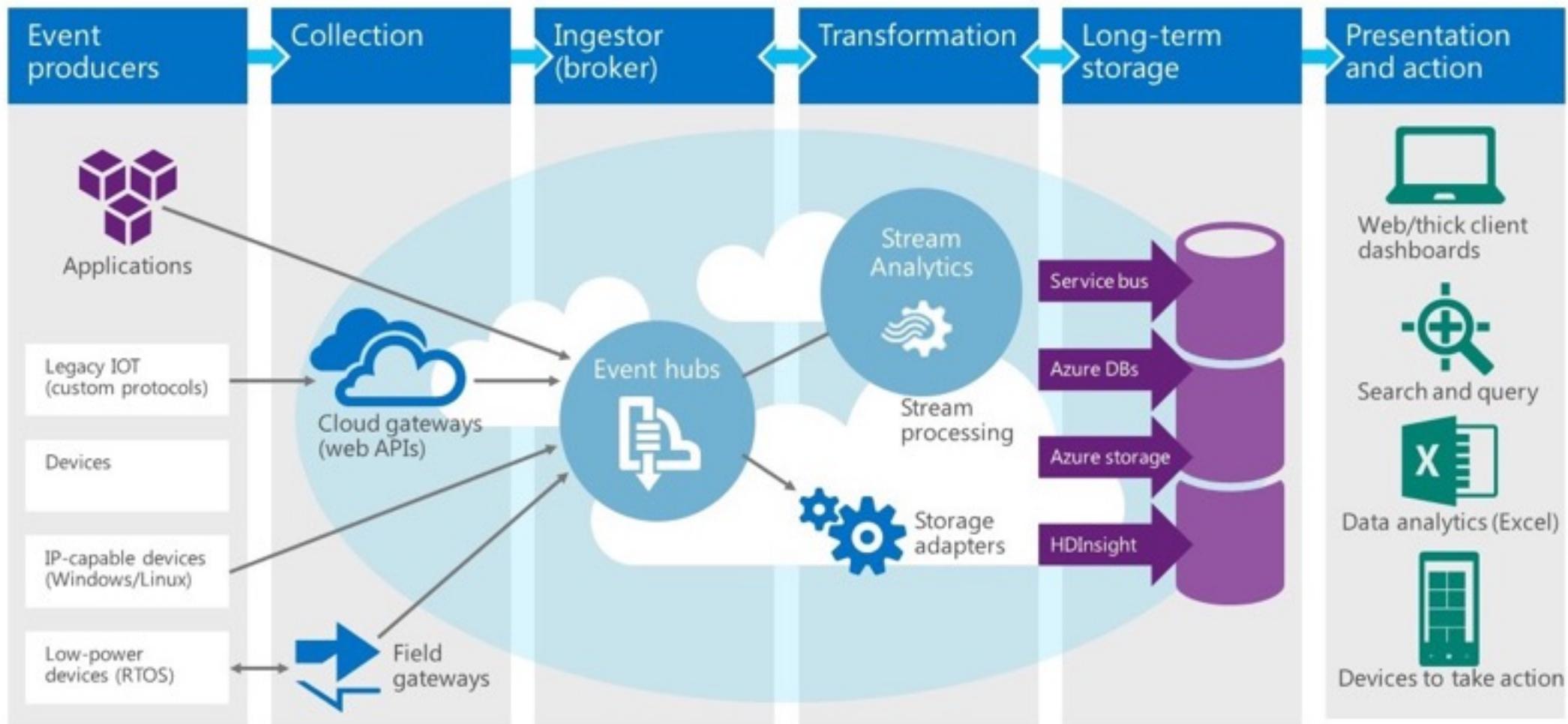


Azure Stream Analytics

- Highly scalable service for analyzing data in motion
- Supports SQL-like query language for data analysis
- Scales using Streaming Units (1 SU ~ = 1 MB/sec)



Stream Analytics at Work



Stream Analytics Query Language

- SQL-like language for querying live data streams
 - Subset of T-SQL
 - Supports bigint, float, nvarchar(max), datetime, record, and array
 - Supports SELECT, FROM, WHERE, GROUP BY, and other common Data Manipulation Language (DML) statements
 - Supports COUNT, AVG, DATEDIFF, and other common functions
- Adds extensions such as TIMESTAMP BY and System.Timestamp
- Supports temporal grouping of events via "windowing"

Querying a Data Stream

- List all Connecticut cars that enter a toll booth, and include the entry time, toll booth ID, and license-plate number

```
SELECT EntryTime, TollId, LicensePlate  
FROM EntryData  
WHERE State = 'CT'
```

ENTRYTIME	TOLLID	LICENSEPLATE
2014-09-10T12:02:00+00:00	3	ABC 1004
2014-09-10T12:03:00+00:00	2	XYZ 1003
2014-09-10T12:11:00+00:00	1	NJB 1006

Designating a Field as the Event Time

- Designate the EntryTime field as the event time for calculations that involve event time

```
SELECT System.Timestamp AS [Entry Time],  
    TollId, LicensePlate  
FROM EntryData TIMESTAMP BY EntryTime  
WHERE State = 'CT'
```

ENTRYTIME	TOLLID	LICENSEPLATE
2014-09-10T12:02:00+00:00	3	ABC 1004
2014-09-10T12:03:00+00:00	2	XYZ 1003
2014-09-10T12:11:00+00:00	1	NJB 1006

JOINing Two Data Streams

- How long does it take each car that enters a toll booth to pay the toll and exit the booth?

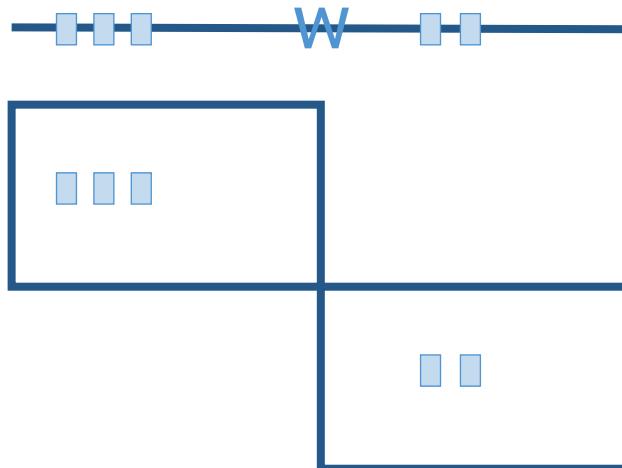
```
SELECT EN.TollId, EN.EntryTime, EN.LicensePlate,  
      DATEDIFF(minute, EN.EntryTime, EX.ExitTime) AS Minutes  
FROM EntryData EN TIMESTAMP BY EntryTime  
JOIN ExitData EX TIMESTAMP BY ExitTime  
ON EN.TollId = EX.TollId  
AND EN.LicensePlate = EX.LicensePlate  
AND DATEDIFF(minute, EN, EX) BETWEEN 0 AND 60
```

TOLLID	ENTRYTIME	LICENSEPLATE	MINUTES
1	2014-09-10T12:01:00.000Z	JNB 7001	2
1	2014-09-10T12:02:00.000Z	YXZ 1001	1
3	2014-09-10T12:02:00.000Z	ABC 1004	2

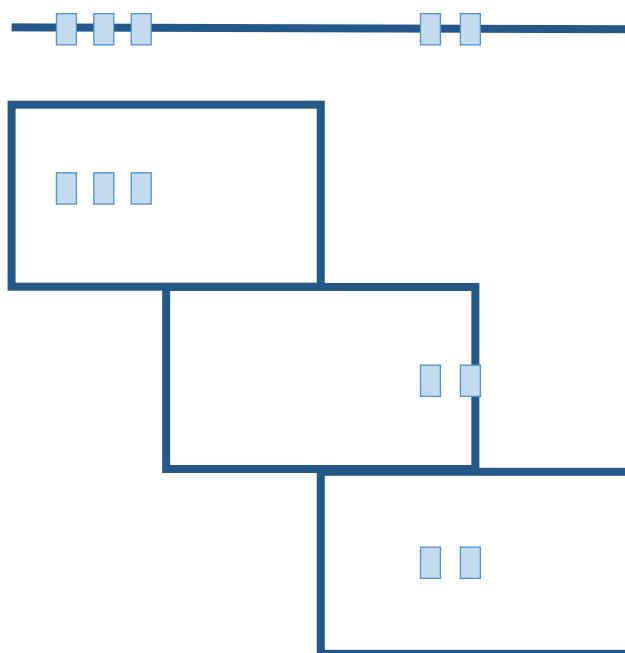
Windowing

- Count or aggregate events over a specified time period

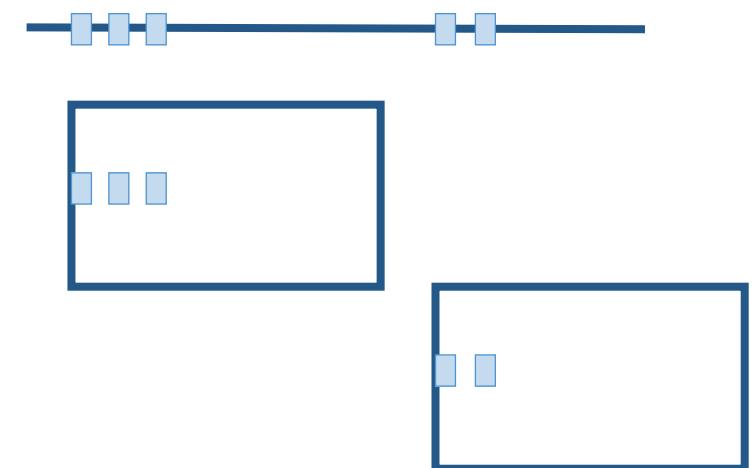
Tumbling Windo



Hopping Window



Sliding Window



Using TumblingWindow

- How many New York cars enter a toll booth every 5 minutes?

```
SELECT DateAdd(minute, -5, System.TimeStamp)
      AS [Start Time], System.TimeStamp AS [End Time],
      COUNT(*)
  FROM EntryData TIMESTAMP BY EntryTime
 WHERE State = 'NY'
 GROUP BY TumblingWindow(minute, 5)
```

START TIME	END TIME	COUNT
2014-09-10T12:00:00.000Z	2014-09-10T12:05:00.000Z	3
2014-09-10T12:05:00.000Z	2014-09-10T12:10:00.000Z	6
2014-09-10T12:15:00.000Z	2014-09-10T12:20:00.000Z	2

Using HoppingWindow

- What is the average wait time at all toll booths for the last 5 minutes, updated every 1 minute?

```
SELECT DateAdd(minute, -5, System.TimeStamp)
AS [Start Time], System.TimeStamp AS [End Time],
AVG(DATEDIFF(minute, EN.EntryTime, EX.ExitTime))
AS [Average Wait Time]
FROM EntryData EN TIMESTAMP BY EntryTime
JOIN ExitData EX TIMESTAMP BY ExitTime
ON EN.TollId = EX.TollId
AND EN.LicensePlate = EX.LicensePlate
AND DATEDIFF(minute, EN, EX) BETWEEN 0 AND 60
GROUP BY HoppingWindow(minute, 5, 1)
```

START TIME	END TIME	AVERAGE WAIT TIME
2014-09-10T11:58:00.000Z	2014-09-10T12:03:00.000Z	1.5
2014-09-10T11:59:00.000Z	2014-09-10T12:04:00.000Z	1.6666666666666667
2014-09-10T12:00:00.000Z	2014-09-10T12:05:00.000Z	1.6666666666666667

Using SlidingWindow

- In which 5-minute windows does at least one Connecticut car enter a toll booth?

```
SELECT DateAdd(minute, -5, System.TimeStamp)
      AS [Start Time], System.TimeStamp AS [End Time],
      TollId, COUNT(*)
FROM EntryData TIMESTAMP BY EntryTime
WHERE State = 'CT'
GROUP BY TollId, SlidingWindow(minute, 5)
HAVING COUNT(*) > 0
```

START TIME	END TIME	TOLLID	COUNT
2014-09-10T11:57:00.000Z	2014-09-10T12:02:00.000Z	3	1
2014-09-10T11:58:00.000Z	2014-09-10T12:03:00.000Z	2	1
2014-09-10T12:06:00.000Z	2014-09-10T12:11:00.000Z	1	1

Building Real-Time Dashboards

- Direct Stream Analytics output to an Azure event hub
- Write code that subscribes to events from the event hub

The screenshot shows a web application titled "ATM Dashboard". At the top, there is a navigation bar with links for "Application name", "Home", "About", "Contact", "Register", and "Log in". The main content area has a title "ATM Dashboard" and a subtitle: "The table below lists potentially fraudulent ATM transactions and is updated every 5 seconds." Below this, there is a table with three columns: "Card Number", "ATM 1", and "ATM 2". The data in the table is as follows:

Card Number	ATM 1	ATM 2
995172721	14957	65434
592830441	79817	23843
676470808	15223	74522
905825608	84048	62218
282119302	43681	47663
801485511	26945	66819

Azure HPC and Azure Container Service

Azure HPC

- Run massively parallel compute jobs in the cloud
 - Photorealistic 3D rendering
 - Brute force cryptographical analysis
 - Engineering design and simulation
 - Financial risk modeling, genomics research, and more
- Deploy an HPC cluster in minutes and scale as needed
- Automate deployments with deployment templates
- Combine with Azure Batch for batch scheduling and compute management (<http://bit.ly/a4r-batch>)

Virtual-Machine Sizes

A-Series

A8-A11 for HPC

Up to 112 GB RAM and 16 cores

Up to 16 data disks (1 TB each)

A0	A1	A2	A3
A4	A5	A6	A7
A8	A9	A10	A11

D/DS/Dv2-Series

Up to 100% faster than A-series

Up to 112 GB RAM and 16 cores

Up to 32 data disks (1 TB each)

Solid-state drives

D1	D2	D3	D4
D11	D12	D13	D14
D5v2			

G/GS-Series

35% faster than D-series

Up to 448 GB RAM and 32 cores

Up to 64 data disks (1 TB each)

Solid-state drives

G1	G2	G3	G4
G5			

See <http://bit.ly/a4r-vm-pricing> for pricing and availability

Power vs. Cost

A8

8 cores
56 GB RAM
382 GB SSD drives
32 Gbit/sec InfiniBand RDMA

 \$ 1.47/hr. or \$1,091/mo.

 \$0.98/hr. or \$725/mo.

D1

1 core
3.5 GB RAM
50 GB SSD drives

 \$0.14/hr. or \$104/mo.

 \$0.077/hr. or \$57/mo.

G5

32 cores
448 GB RAM
6,144 GB SSD drives
Latest Xeon E5 v3 processors

 \$ 9.65/hr. or \$7,180/mo.

 \$ 8.69/hr. or \$6,465/mo.

Azure Resource Manager

- Allows resources to be collated into resource groups
 - Deploy, manage, monitor, and delete all resources at once rather than one resource at a time
- Allows complex deployments to be performed declaratively via deployment templates
 - Deployment templates specify all the resources — VMs, switches, storage accounts, etc. — to be provisioned using JSON syntax
 - Templates can include parameters that are filled in at runtime
 - Learn more at <http://bit.ly/a4r-arm>

Azure Quickstart Templates

- Free, open-source deployment templates

[Create an HPC cluster with Linux compute nodes](#)

This template creates an HPC cluster with Linux compute nodes



by [Sunbin Zhu](#),
Last updated: 12/31/2015

[Create a SLURM cluster on SLES 12 HPC SKU](#)

SLURM HPC cluster



by [Christian](#),
Last updated: 11/11/2015

[Datastax Enterprise Edition on Ubuntu for Marketplace](#)

This template deploys a Datastax Enterprise Edition cluster on the Ubuntu

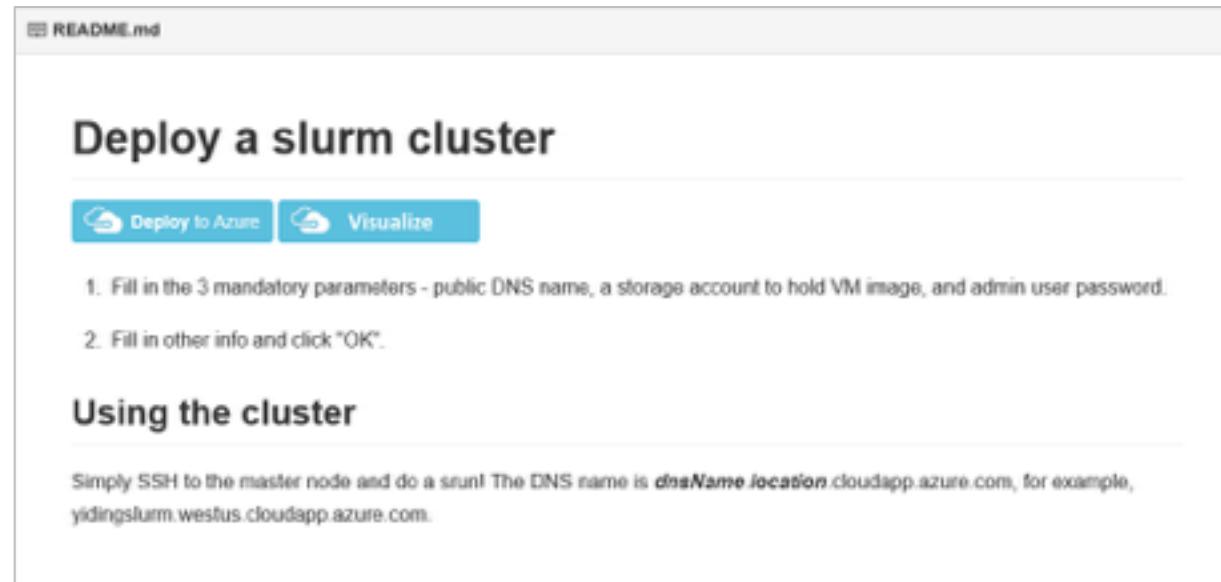


by [Mahesh Thiagarajan](#),
Last updated: 12/14/2015

- Find them on the Azure site (<http://bit.ly/a4r-quickstart>)
- Or browse them on GitHub (<http://bit.ly/a4r-github>)

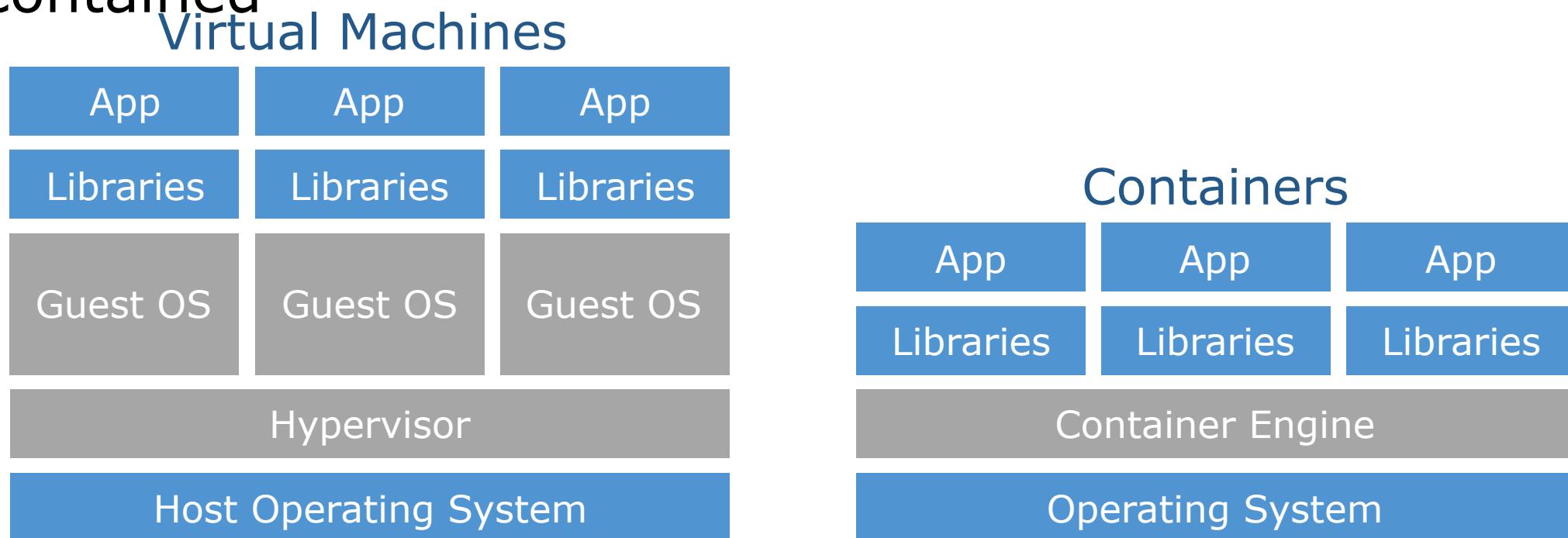
SLURM Clusters

- Simple Linux Utility for Resource Management (SLURM)
- Quickstart template at <http://bit.ly/a4r-slurm> enables easy deployment of SLURM clusters of user-specified sizes



Containers

- Lightweight alternative to virtual machines
- Smaller, less expensive, faster to start up, and self-contained

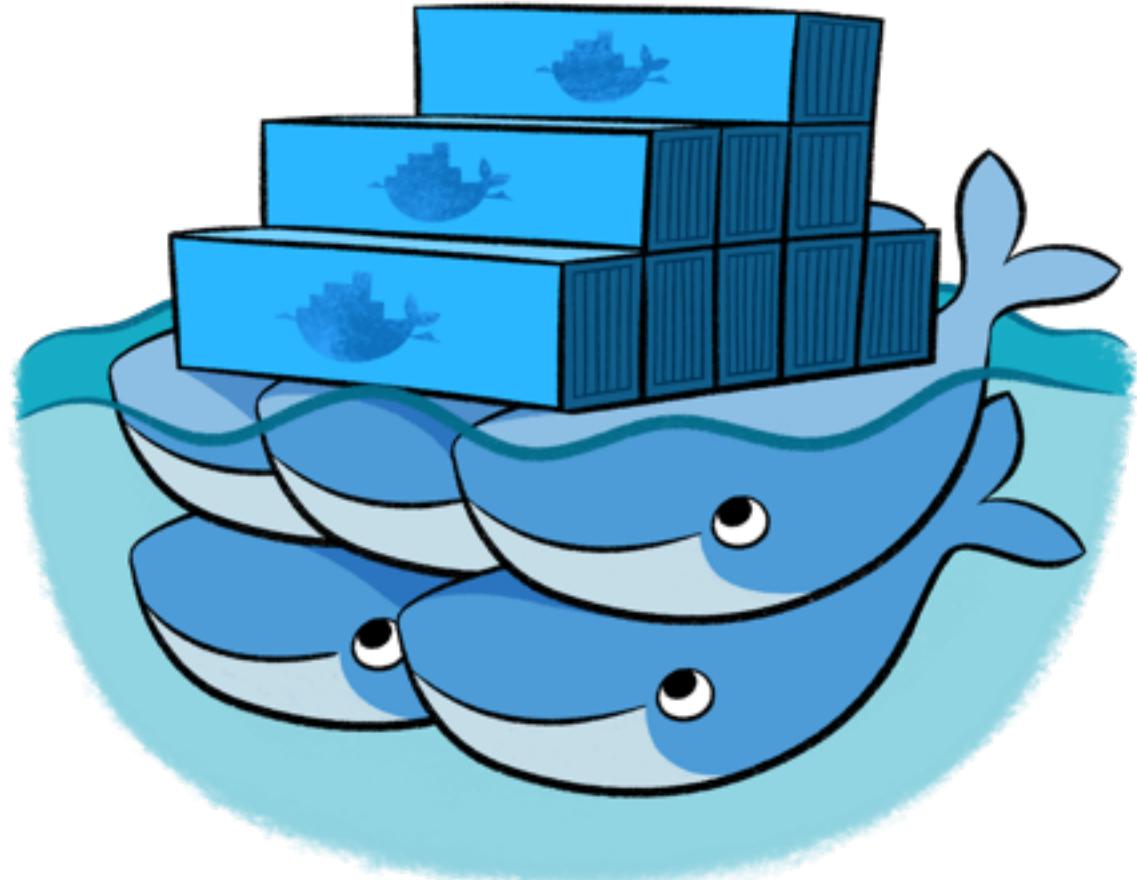


Docker

- Leading open-source containerization platform

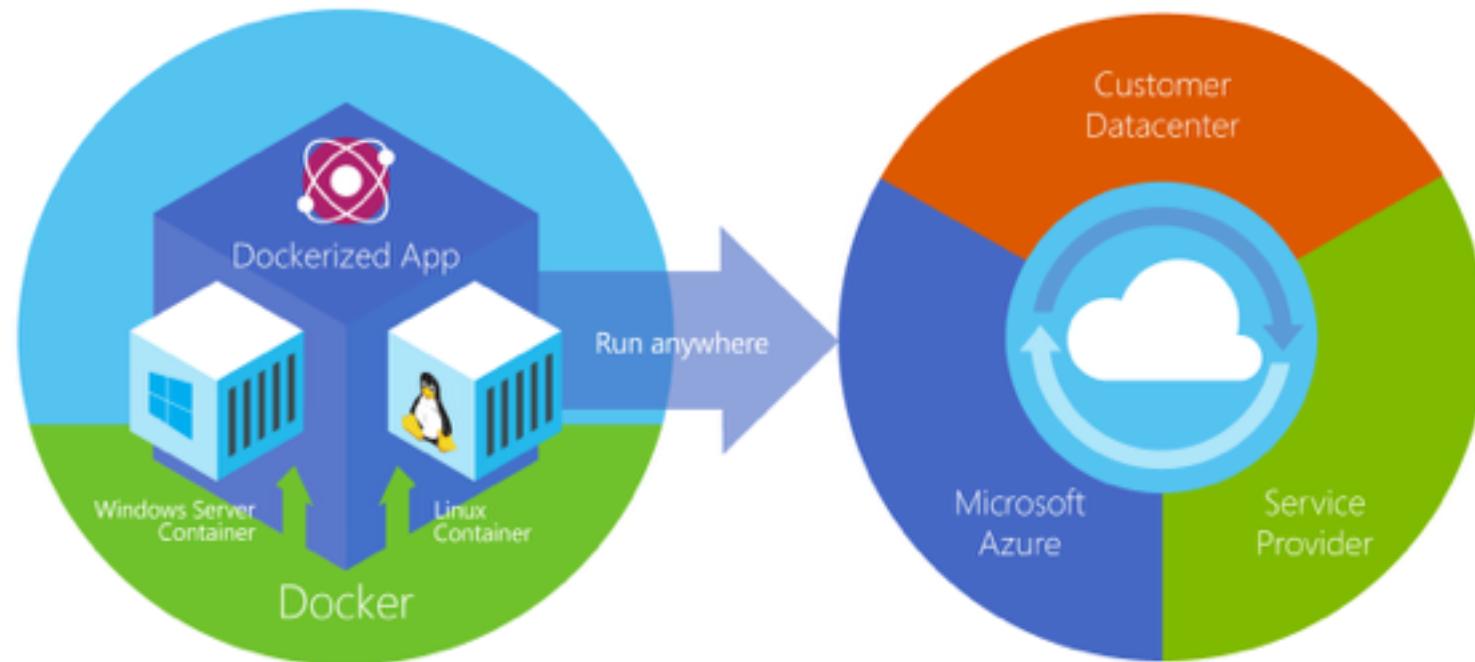
Docker containers wrap up a piece of software in a complete filesystem that contains everything it needs to run: code, runtime, system tools, system libraries – anything you can install on a server. This guarantees that it will always run the same, regardless of the environment it is running in

- Supported natively in Azure via Azure Container Service

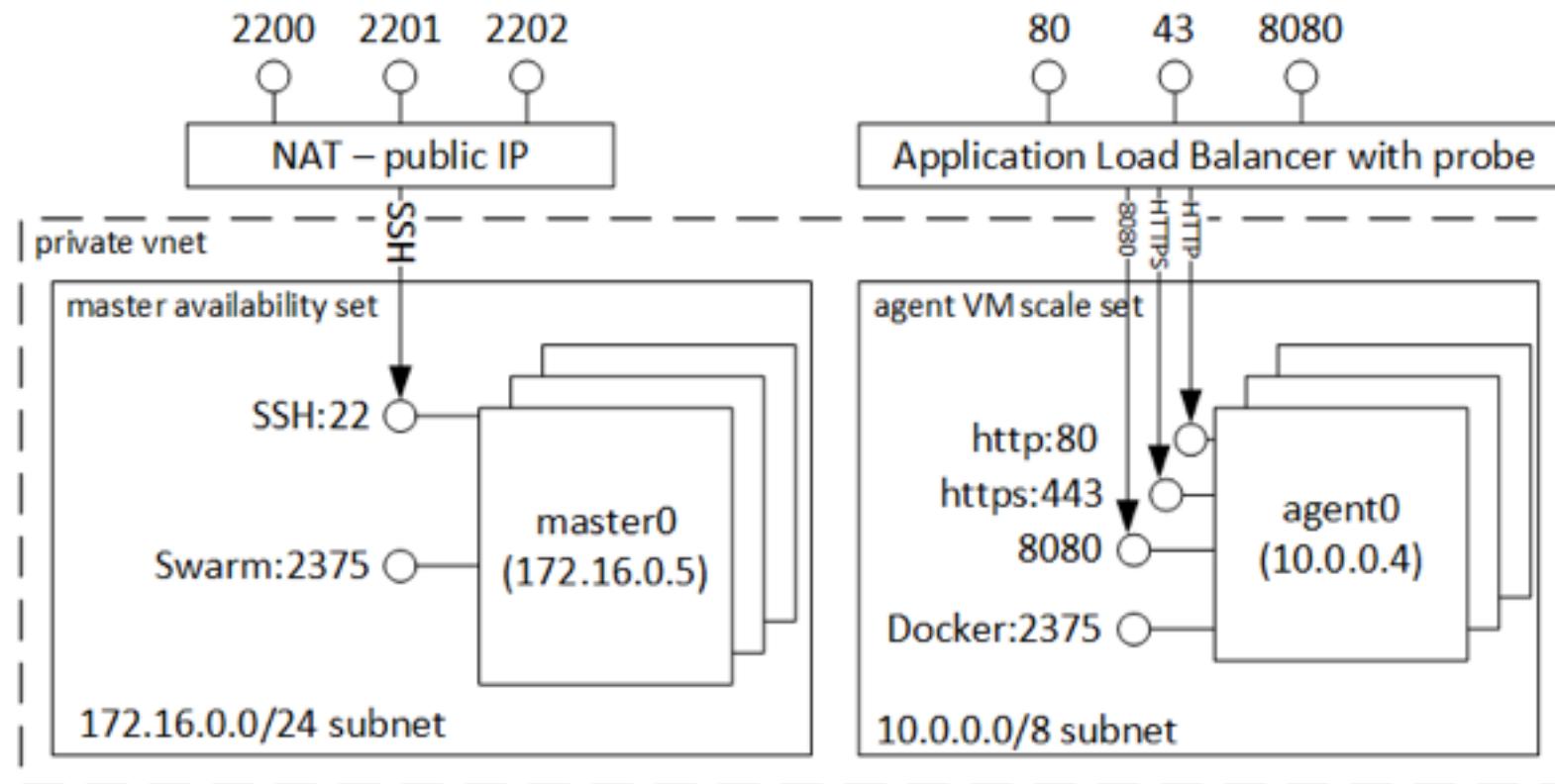


Azure Container Service

- Provides robust, ready-to-use Docker hosting environment
- Uses open-source orchestration tools (DC/OS and Swarm)

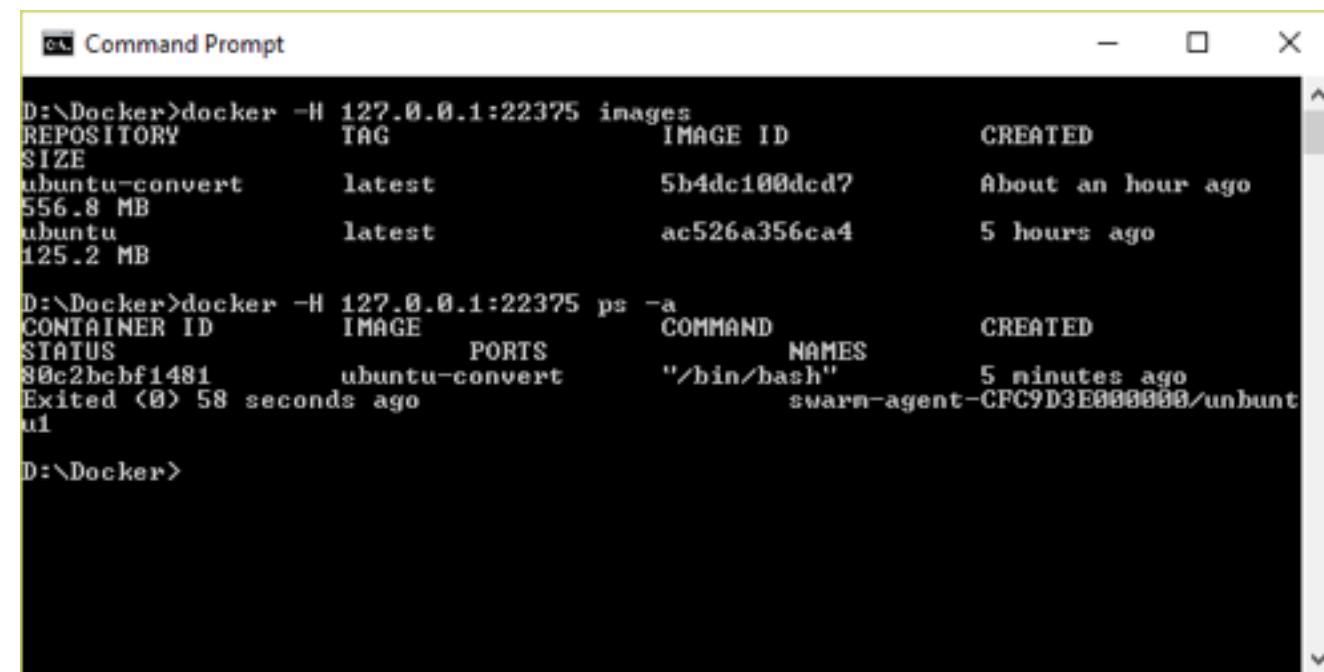


Clustering with Docker Swarm



Docker Client

- Command-line interface for Docker, available for Linux, OS X, and Windows (available separately or as part of Docker Toolbox)



The screenshot shows a Windows Command Prompt window titled "Command Prompt". It displays two command-line sessions using the Docker client:

```
D:\>Docker>docker -H 127.0.0.1:22375 images
REPOSITORY          TAG      IMAGE ID      CREATED
SIZE
ubuntu-convert      latest   5b4dc100dcd7  About an hour ago
556.8 MB
ubuntu              latest   ac526a356ca4  5 hours ago
125.2 MB

D:\>Docker>docker -H 127.0.0.1:22375 ps -a
CONTAINER ID        IMAGE      COMMAND      NAMES
STATUS             PORTS      NAMES
80c2bcbf1481       ubuntu-convert "/bin/bash"
Exited (0) 58 seconds ago      swarm-agent-CFC9D3E0000000/unbunt
u1

D:\>Docker>
```

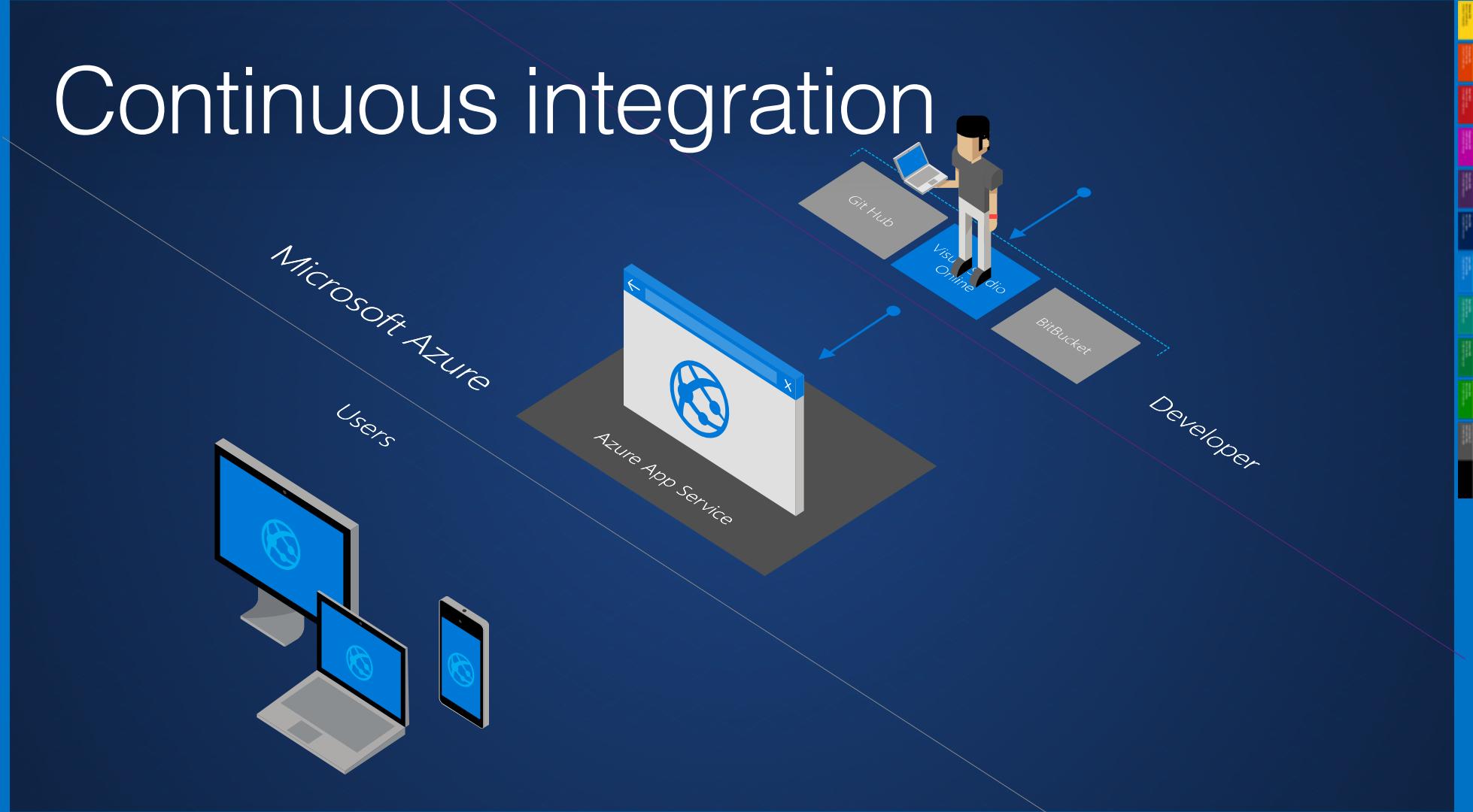
Microsoft Azure



Continuous Delivery with App Service



Continuous integration



Continuous Deployment for Web Apps

Microsoft Azure



Agility through Continuous Deployment

Web App
Production
Slot



Auto-Swap

Web App
Staging Slot



Hooks

Git pull



Source Control / Code
Repo

Commits
Changes



Developer

Microsoft

Source Control for Web/API/Mobile Apps

Microsoft Azure



Git



Visual Studio
CodePlex
Online



GitHub



BitBucket



DropBox



FTP

Choose your own adventure!

Microsoft



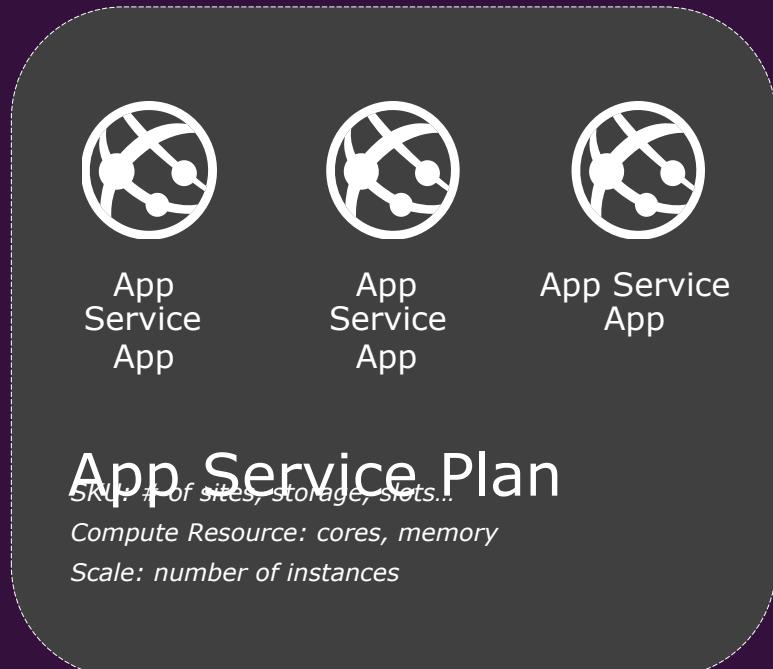
App Service Environment (ASE)

- New Premium Tier Feature
- Dedicated compute resources and network resources
- Increased Scaling Options
- Directly created in a Virtual Network
- Support all Web App features and capabilities
- Support Web, Mobile and API Apps
- Global Scale



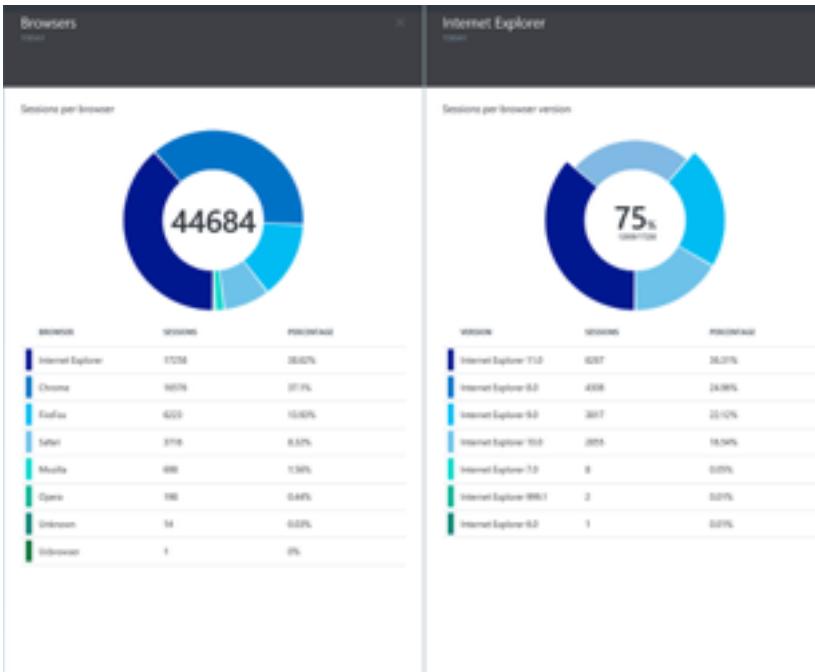


Conceptual Model



Note: For App Service Environment the SKU will always be Premium

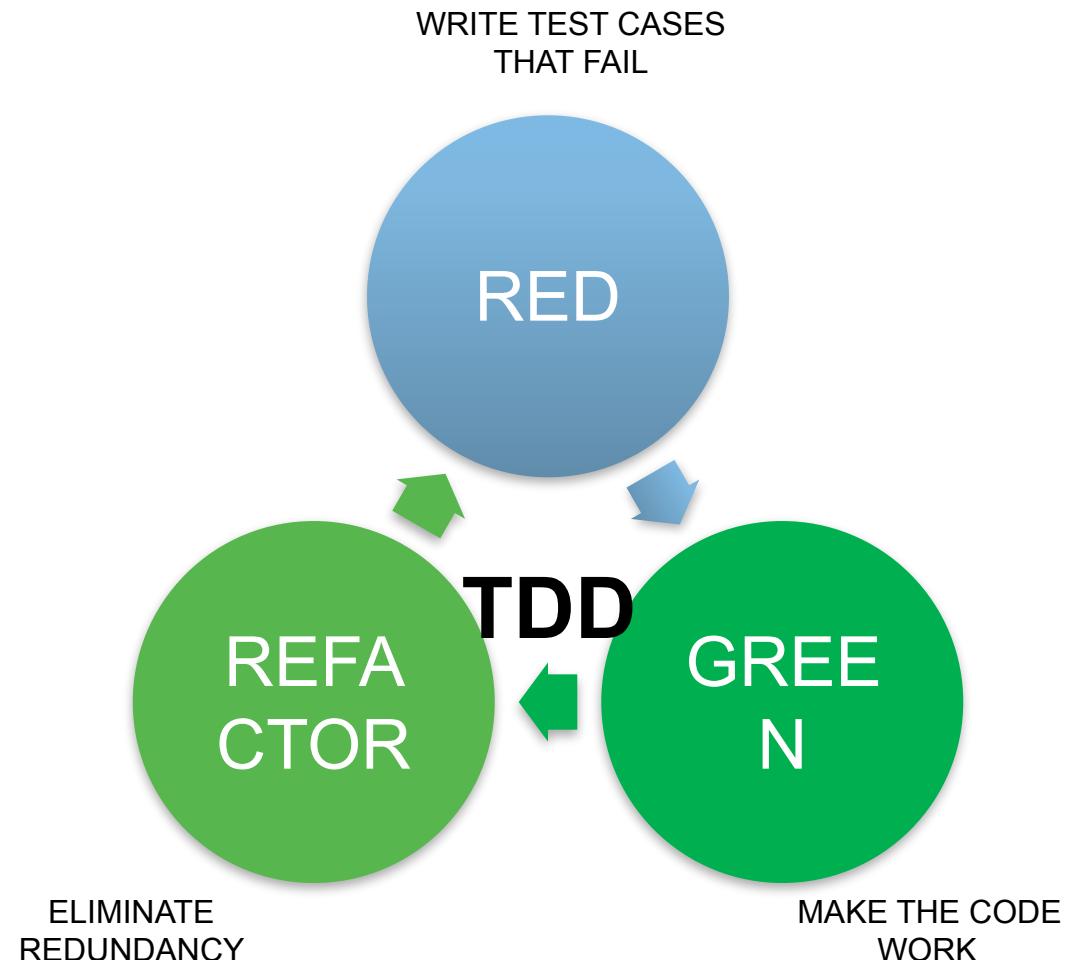
Application Insights



DevOps and Other Frameworks

Dev/Test Cycle

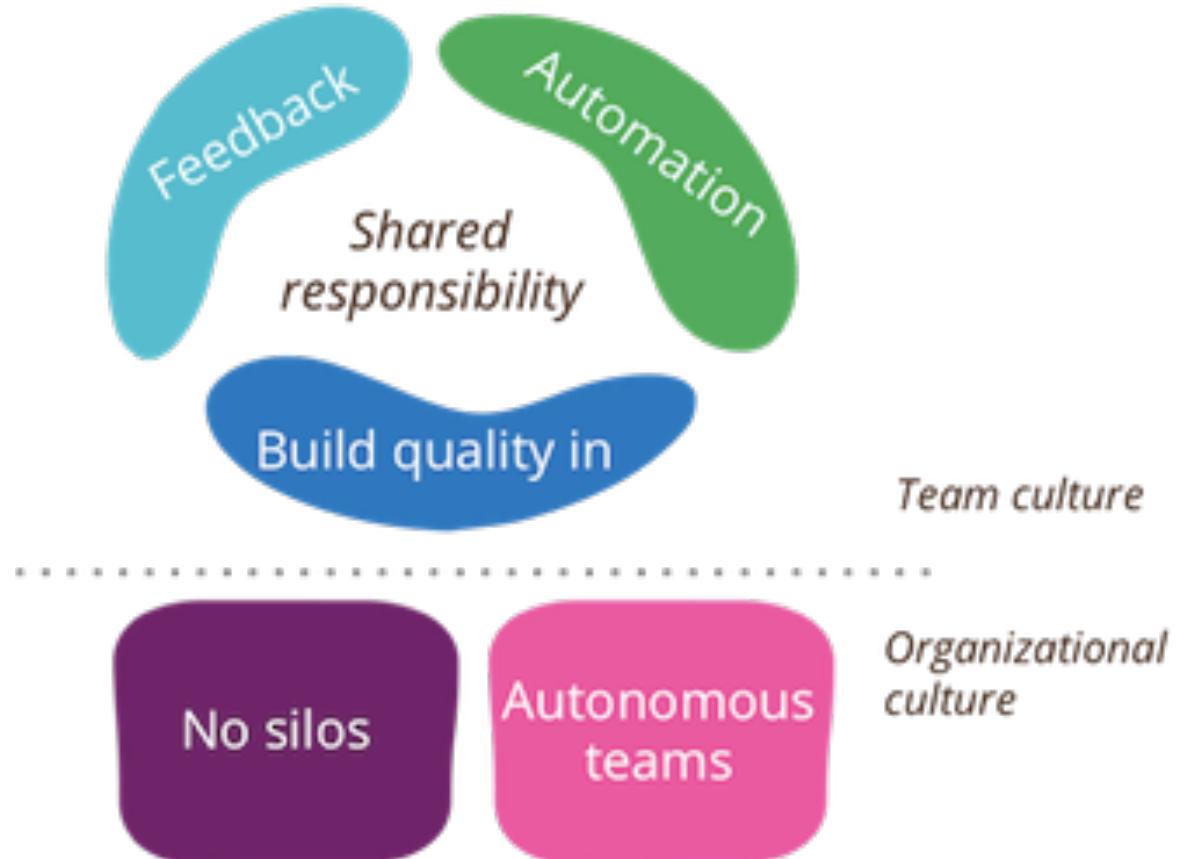
- Zealots of automation
- Time is short—getting to market needs a well-paved path
- Nothing manual
- Especially Q/A



DevOps Culture

Culture

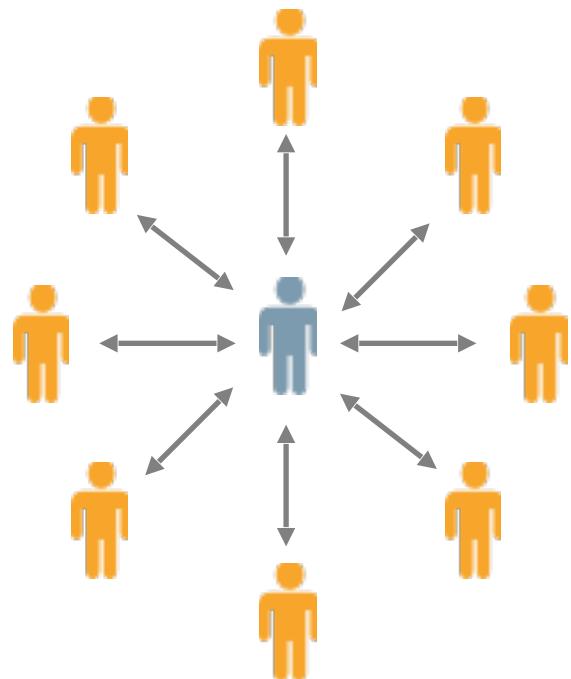
- Thinking in Systems
- Feedback Loops
- Continuous experimentation



Foundations

- Version control
- Automated like a zealot
- Visibility:
 - Everything in the open
 - Transparency
- Measure everything

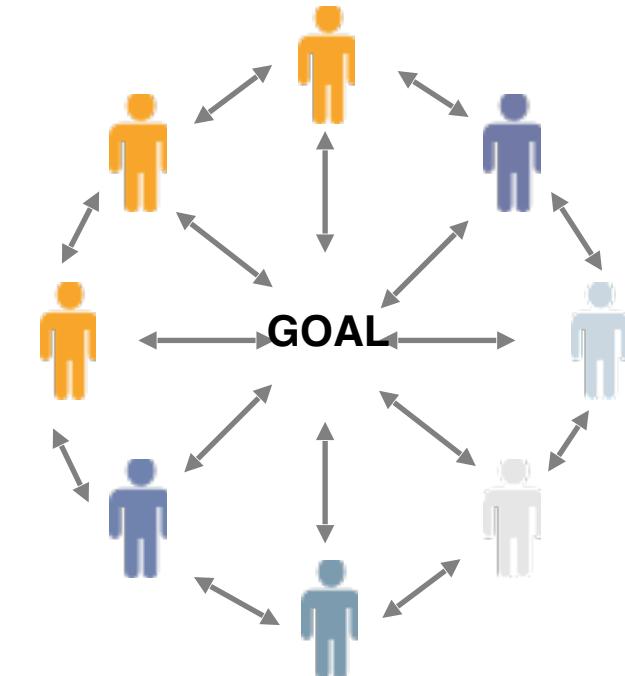
Organization Items



GROUPING DYNAMIC
Operational Silos
Centralized Management

From Silo to Open:

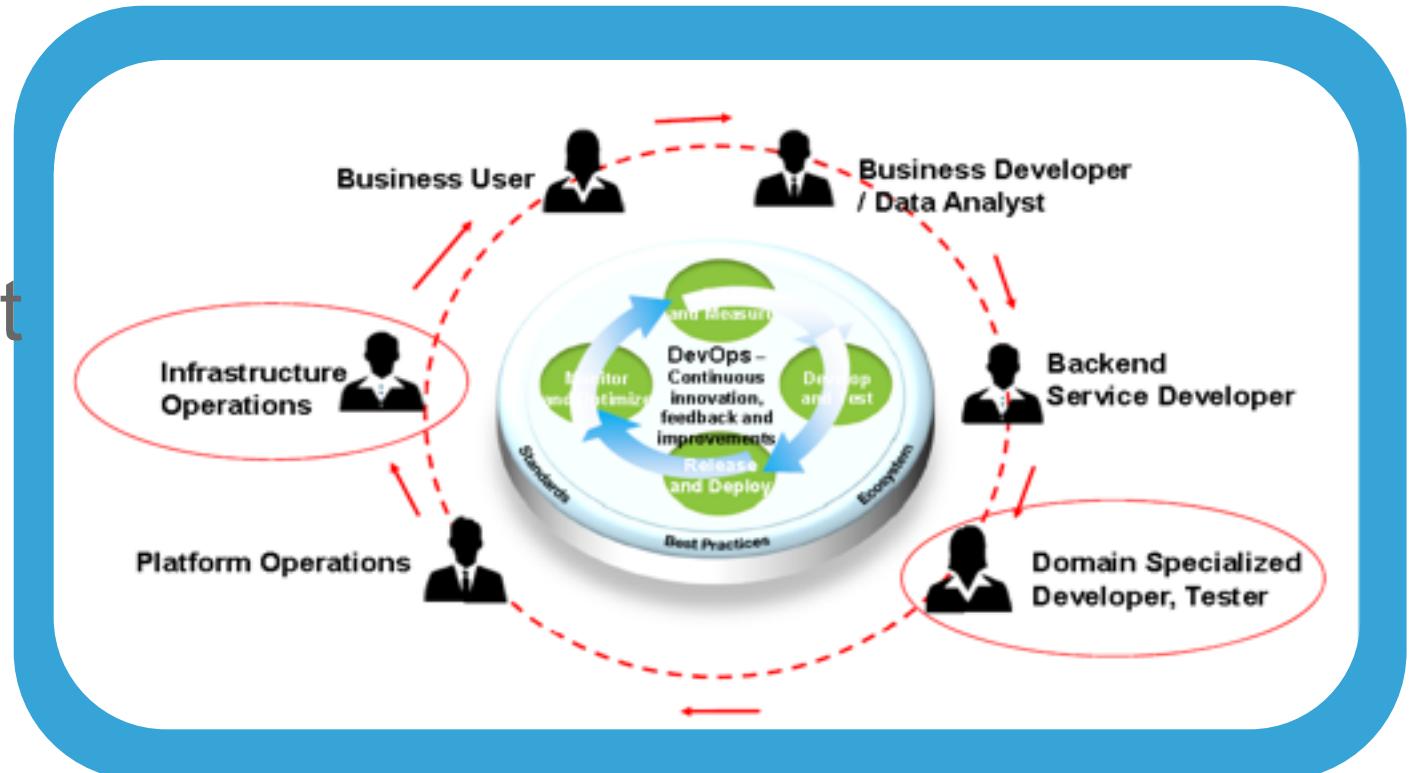
- Do not underestimate Transparency required



TEAMING MODEL
Cross-functional Team
Self-managed; Product-aligned

Stakeholders

- Who needs to buy in?
- Most DevOps movements will start at the grassroots level but will not succeed without management support



Roles

- Roles have to be re-adjusted
- Collapsed
- The Specialized Generalist



DevOps Practices

Roles

Make environments available early in the development process:

- Common Dev, QA and Prod environment creation process

The Bottlenecks in the Flow

- Environment creation
- Code deployment
- Test setup and run (menti)
- Overly tight architecture
- Development
- Product management



“In November 2011, running even the most minimal test for CloudFoundry required deploying to 45 virtual machines, which took a half hour. This was way too long, and also prevented developers from testing on their own workstations.

By using containers, within months, we got it down to 18 virtual machines so that any developer can deploy the entire system to single VM in six minutes.”

Elisabeth Hendrickson, Director of Quality Engineering, Pivotal Labs

Google Dev and Ops (2013)

- 15,000 engineers, working on 4,000+ projects
- All code is checked into one source tree (billions of files!)
- 5,500 code commits/day
- 75 million test cases are run daily

“Automated tests transform fear into boredom.”

Eran Messeri, Google

Inject Failures Often

The Netflix Tech Blog

We've sometimes referred to the Netflix software architecture in AWS as our Rambo Architecture. Each system has to be able to succeed, no matter what, even all on its own. We're designing each distributed system to expect and tolerate failure from other systems on which it depends.

One of the first systems our engineers built in AWS is called the Chaos Monkey. The Chaos Monkey's job is to randomly kill instances and services within our architecture. If we aren't constantly testing our ability to succeed despite failure, then it isn't likely to work when it matters most – in the event of an unexpected outage.



You Don't Choose Chaos Monkey—Chaos Monkey Chooses You



The 2014 AWS Reboot

“When we got the news about the emergency EC2 reboots, our jaws dropped. When we got the list of how many Cassandra nodes would be affected, I felt ill. Then I remembered all the Chaos Monkey exercises we’ve gone through. My reaction was, ‘Bring it on!’.”

Christos Kalantzis, Netflix Cloud DB Engineering

Add Ops into Dev

Enhance Service Design with Operational Knowledge:

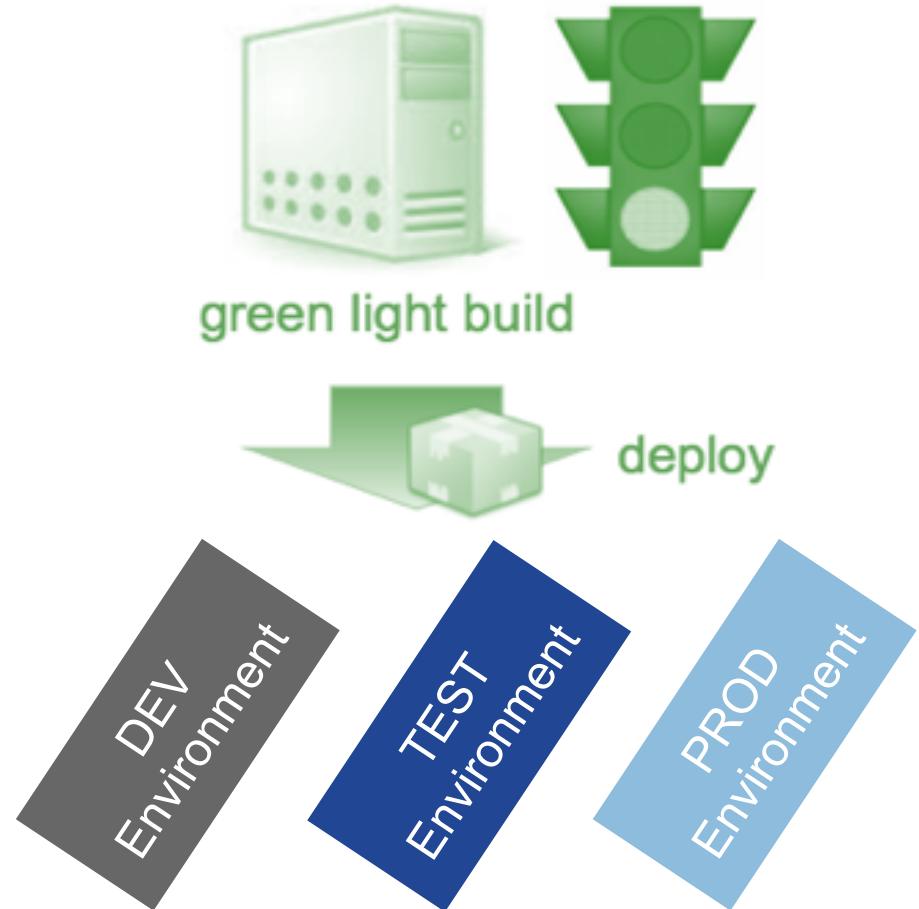
- Reliability
- Performance
- Security
- Test them

Build feedback paths back from Production:

- Foster a culture of responsibility
 - Whether your code passes test, gets deployed, and stays up for users is your responsibility – not someone else
- Make Development better with Ops:
 - Production-like environments
 - Power tooling

Continuous Deployment

- Extension of continuous integration
- First: automate deployment
- Application always known to be in a "deployable" state



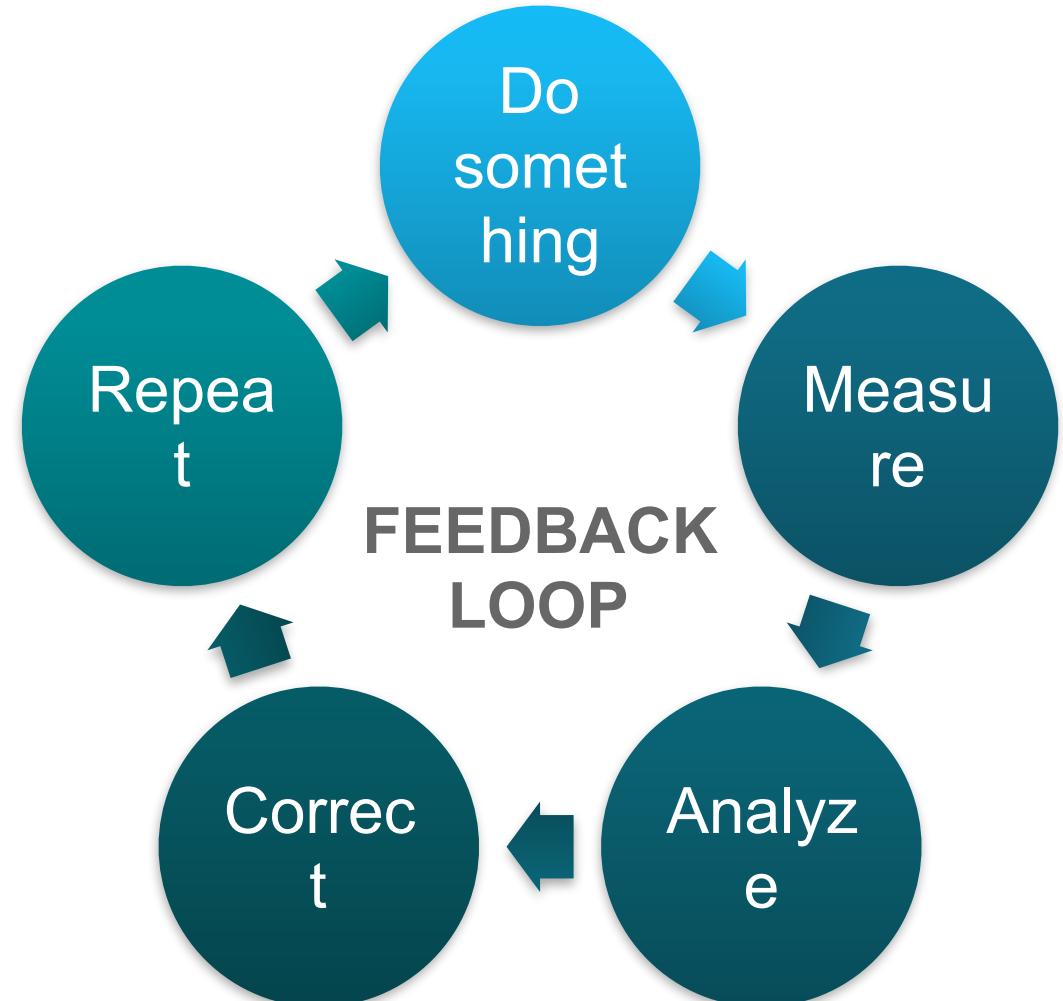
DevOps for IT Automation

One-step Environment Creation

- Need a common environment build process
- For development Q/A and production
- The environment will evolve as development proceeds
- The longer you wait to have a common environment build process, the harder it is to create one

Automating Feedback Loops

- Capture as much data as possible at the source
- The issue becomes the data



Break Things Early

- Consistency in code, environments and configuration
- ASSERTs to catch misconfigurations
- Static code analysis and testing becomes part of the continuous integration and deployment

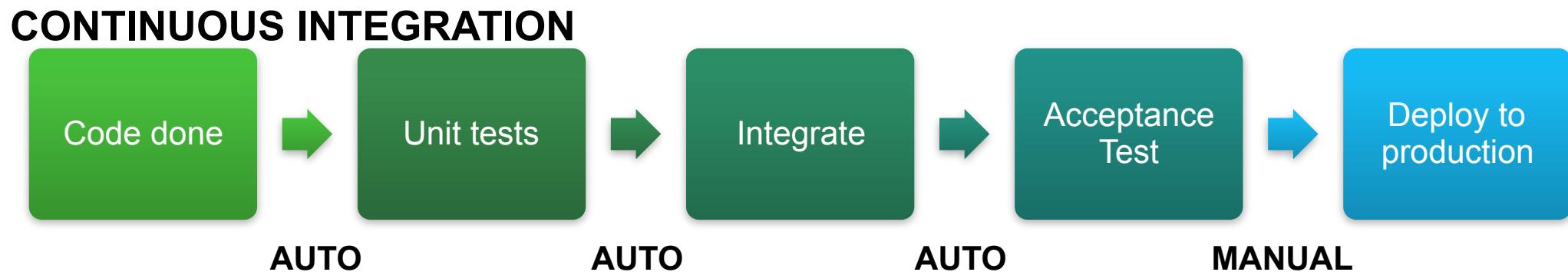
DevOps Lifecycles

Principles of Continuous Integration

- Code repository
- Automate the build
- Make the build self-testing
- Everyone commits to the main-line every day
- Every commit is built
- Build must be fast
- Test in a clone of the production environment
- Make it easy to get the latest deliverables
- Everyone can see the results of the latest build
- Automated deployments

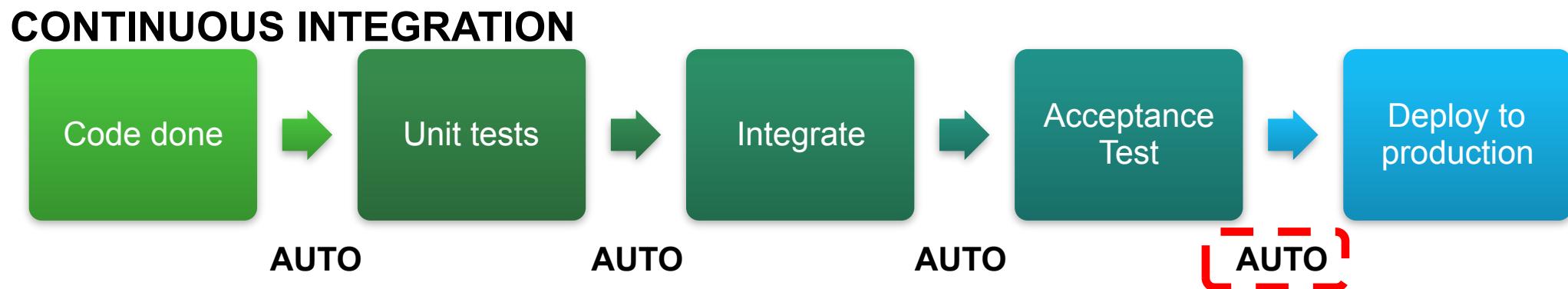
How CI Improves Efficiency

- Rapid feedback
- Reduce technical debt
- Visibility
- Builds automated
- Precursor to continuous delivery and deployment



Keys to Continuous Delivery

- Minimize shock
- Avoid off-hour, high risk, expensive deployments
- Know your rollback plan
- Build in health checks



Feedback Loops

- Understanding and responding to the needs of all customers (internal and external)
- Shorten feedback loops
- Feedback = quality

Types of Tools

- Build tools
- Test tools
- General automation
- Configuration management



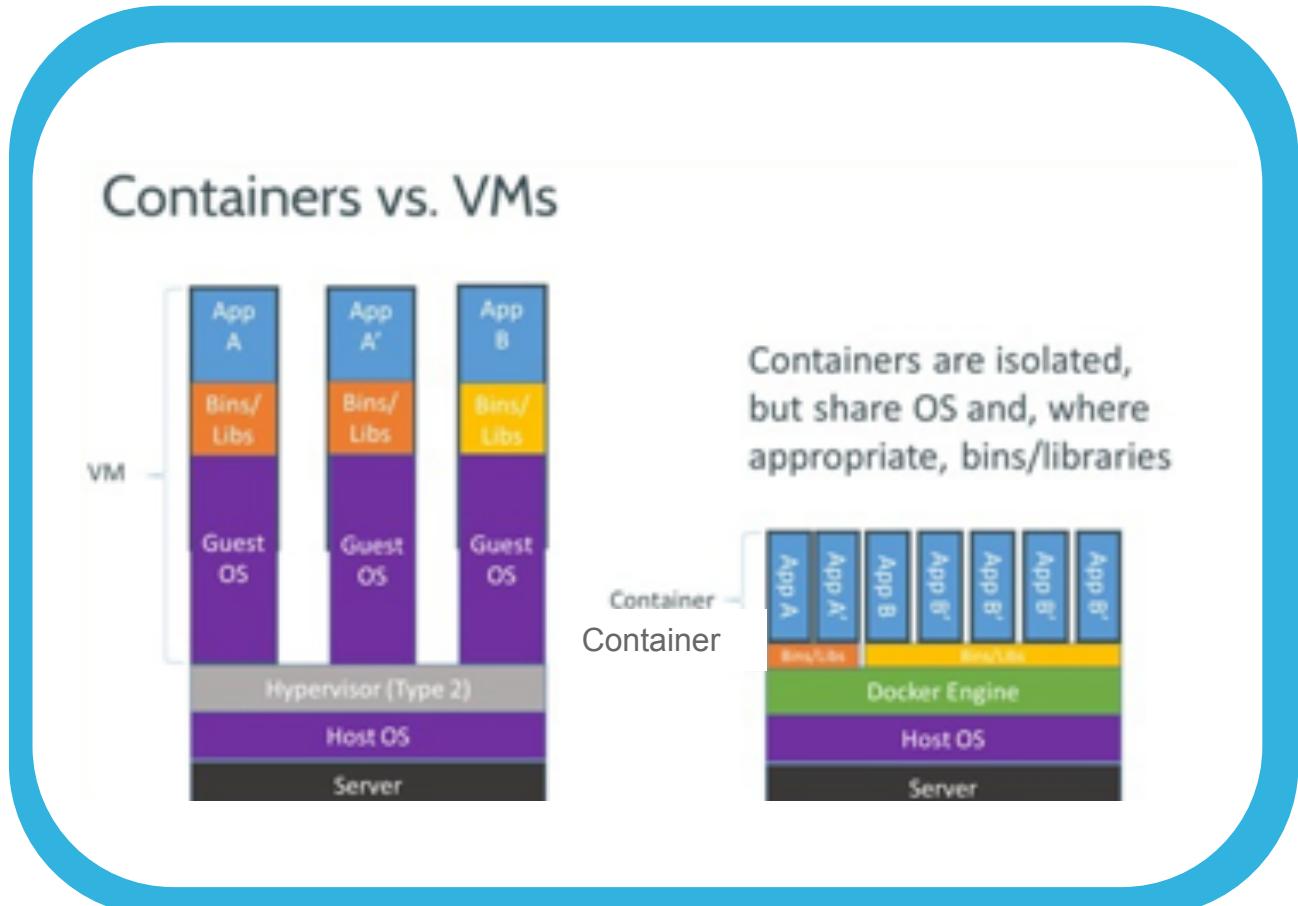
DevOps Related Technology

Virtualization

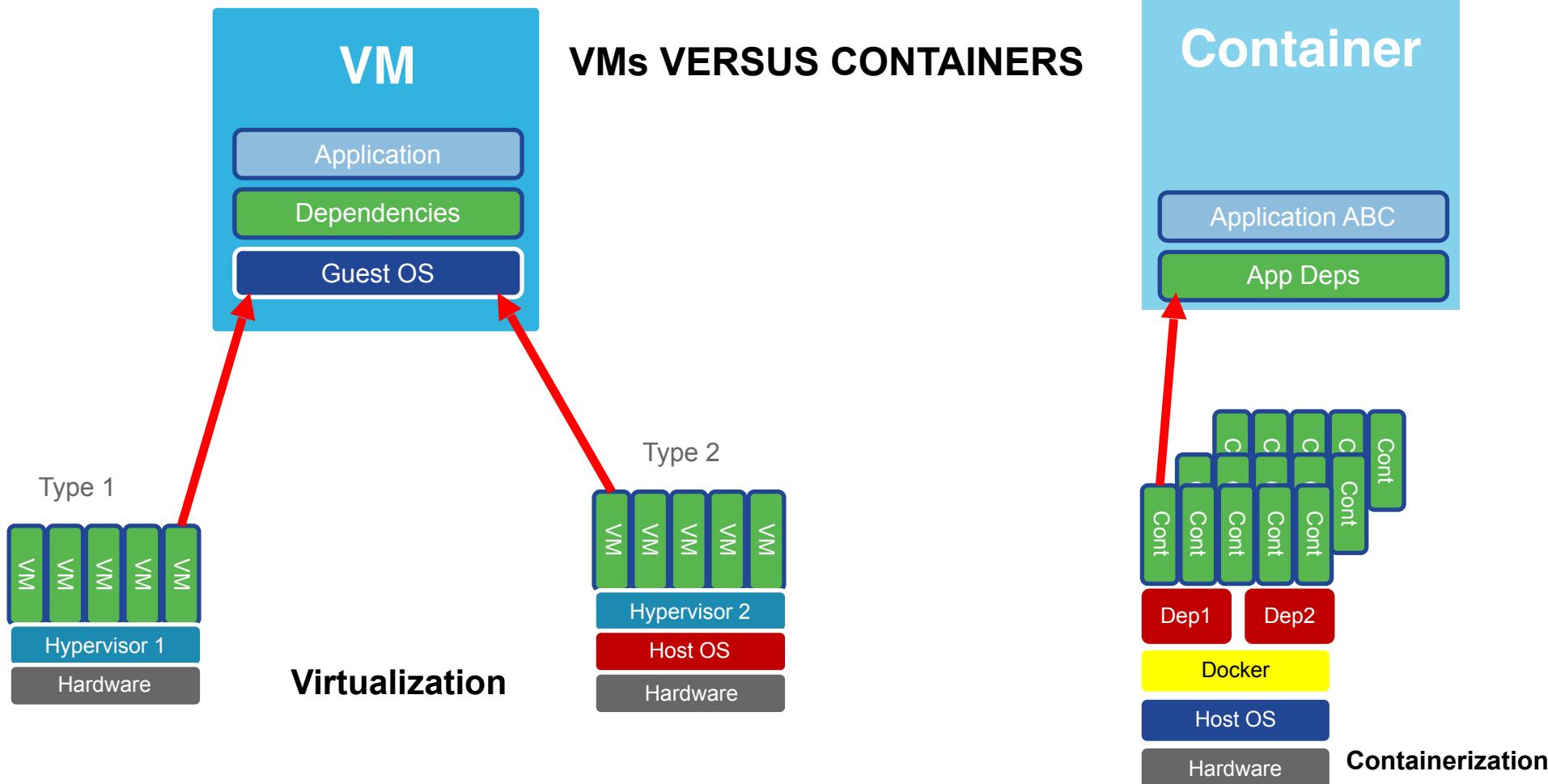
- Been around for a while
- Think VMware ESX
- Virtual Machines

Containers (Docker)

- Open source engine that automates the deployment of any application as a lightweight, portable, self-sufficient container that will run virtually anywhere.
- Based on LXC (Linux Container) and AUFS (Union FS), easy to use.
- Similar to VM as end-user with different features



Docker (What is it?)



Current Container Issues

- Networking
- Service Orchestration
- Security

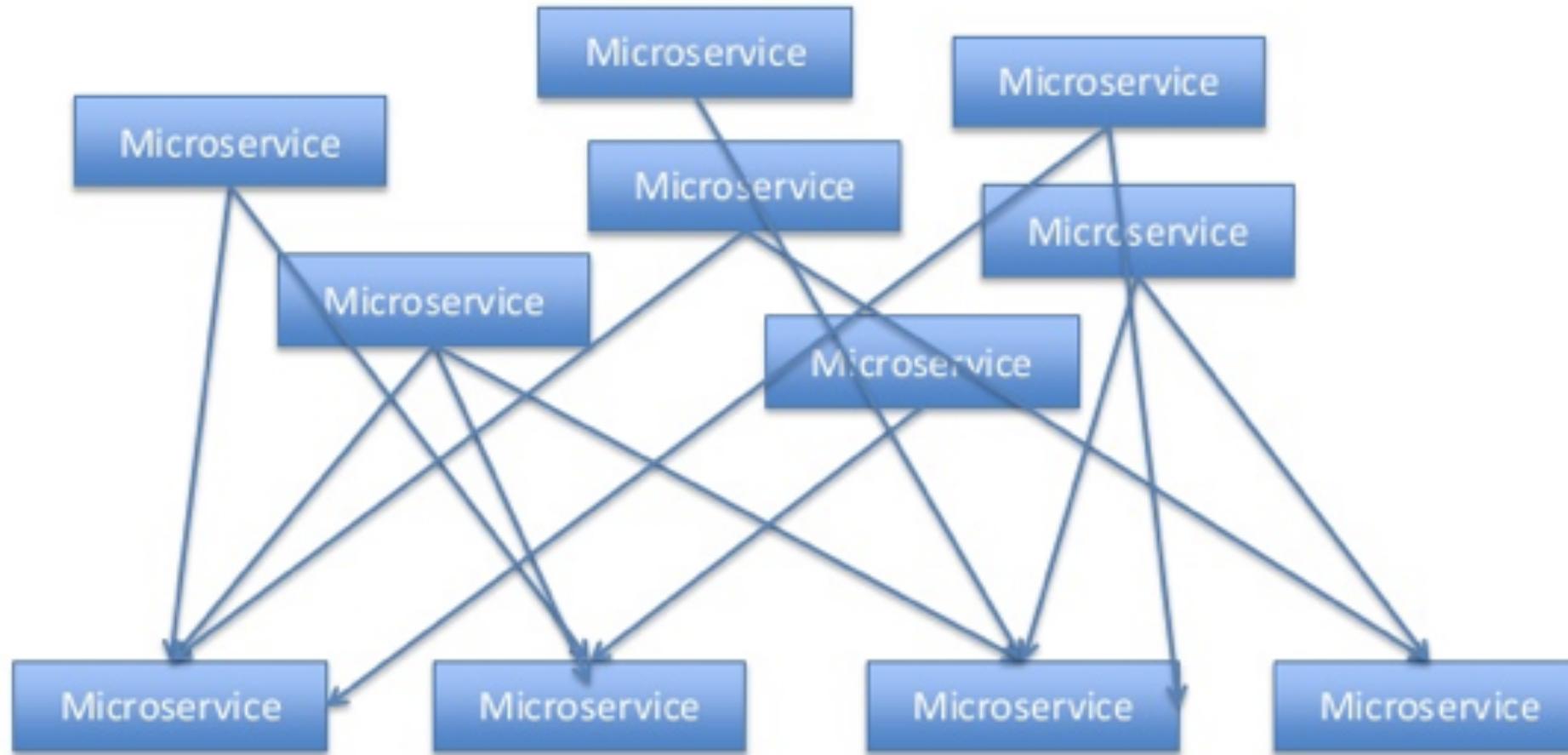
Docker Alternatives

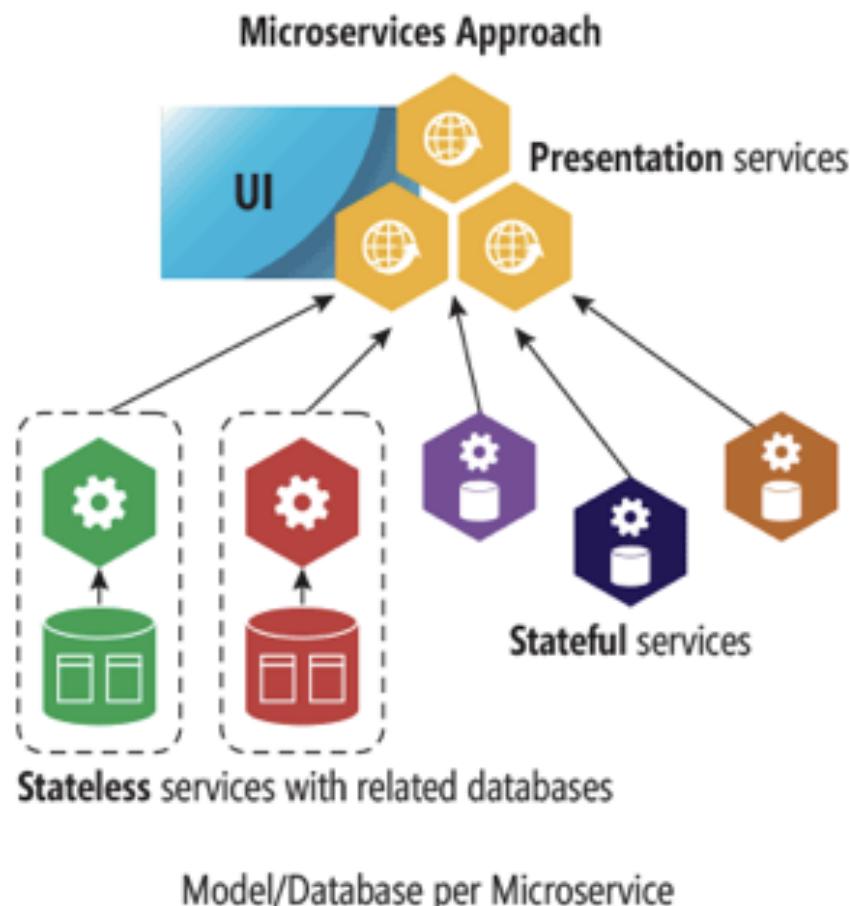
- Rocket
- Microsoft Drawbridge
- LXD (Canonical)

Microservices

- Architectural pattern based on a stateless service model
- Granular services targeted at providing a discrete piece of application functionality
- Couples with the container model promoted by Docker
- Services are elastic and provisioned on demand in a container as needed

Distributed Service Layer Microservices Architecture





Traditional Application

- Single app process or 3-Tier approach
- Several modules
- Layered modules

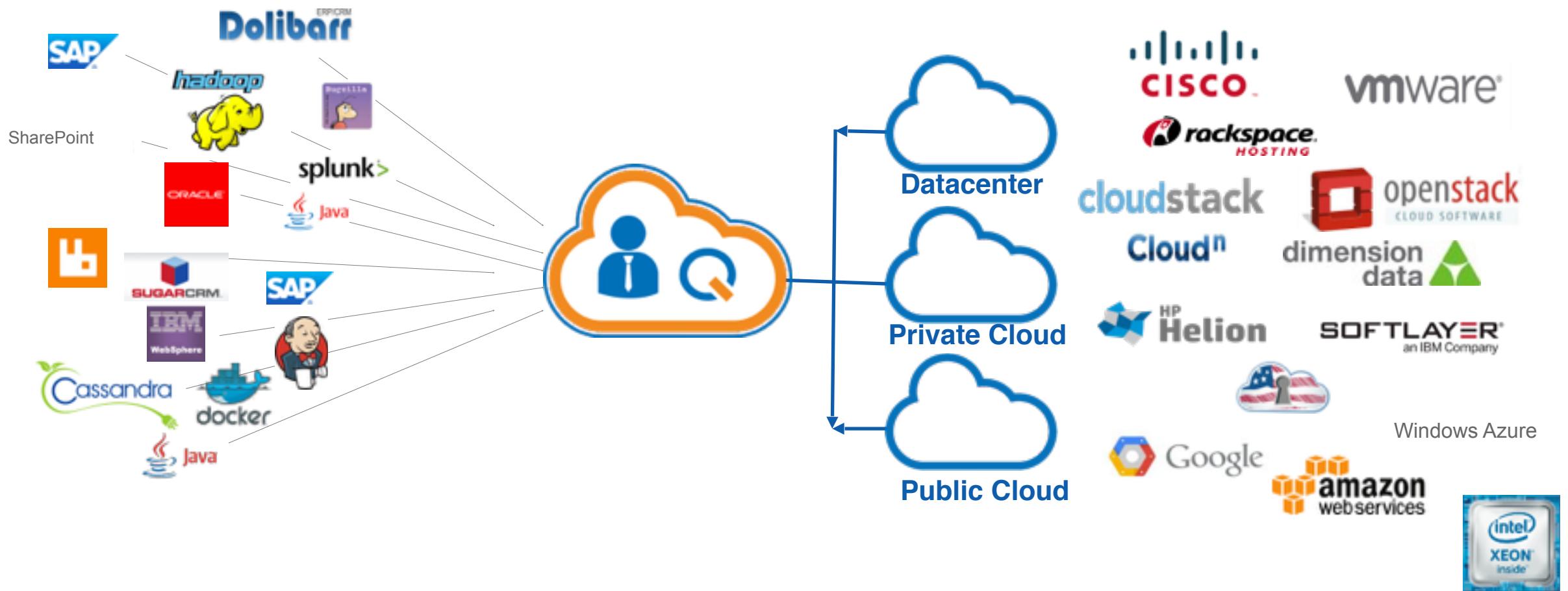
Single App Process



Or



Single Monolithic Database



Common Use Cases

Application Migration & Management

- New and existing applications
- Start with single application, single cloud
- Workload migration. Datacenter consolidation

DevOps and Continuous Delivery

- Self-service on demand environments
- Tool-chain automated deployment
- Hybrid cloud pipeline

Dynamic Capacity Augmentation

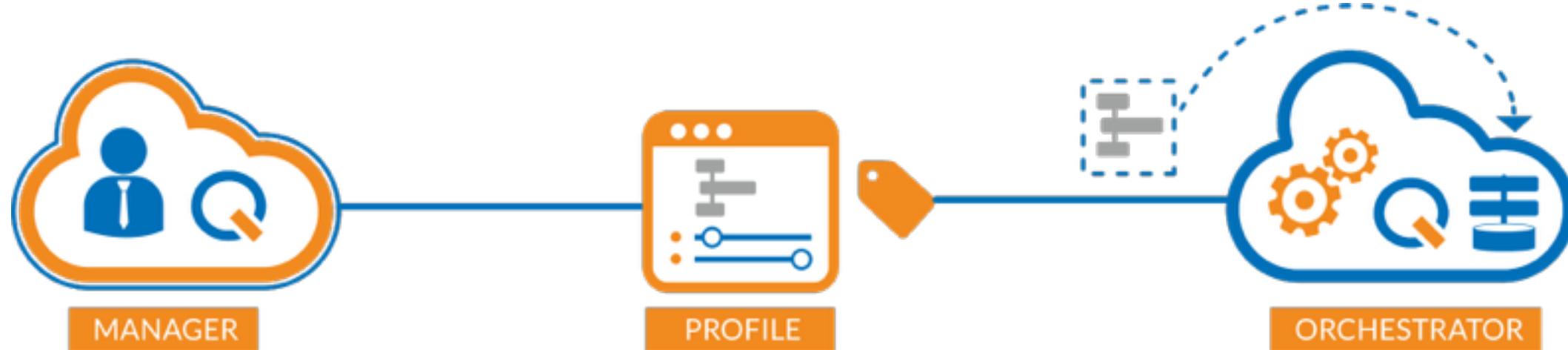
- High performance, batch and cluster
- Horizontal scaling
- Cross-environment bursting

IT as a Service with Governance

- On-demand self-service marketplace
- Single pane of glass – financial controls, usage metering, multi-tenant governance



CloudCenter



CloudCenter

- ✓ Single platform solution
- ✓ Unique application-defined technology
- ✓ Abstracts application from underlying cloud environment
- ✓ Ensures infrastructure adapts to meet the needs of each application

No need to:

- ✓ Write cloud specific scripting
- ✓ Write orchestration workflows
- ✓ Modify application code

CliQr®



SaaS

Software as a Service

Email
CRM
Collaborative
ERP

CONSUME



PaaS

Platform as a Service

Application
Development
Decision Support
Web
Streaming

BUILD ON IT



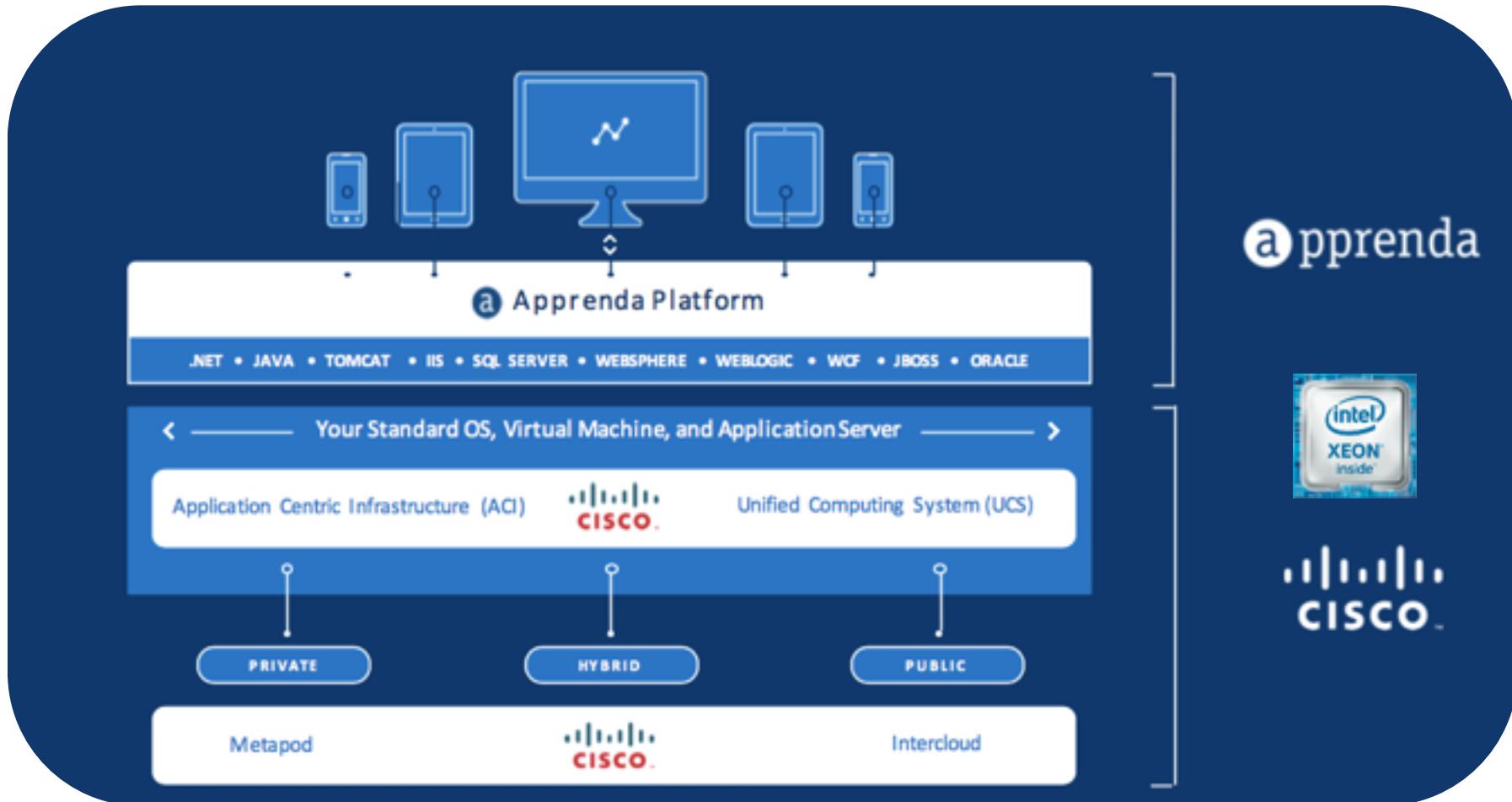
IaaS

Infrastructure as a Service

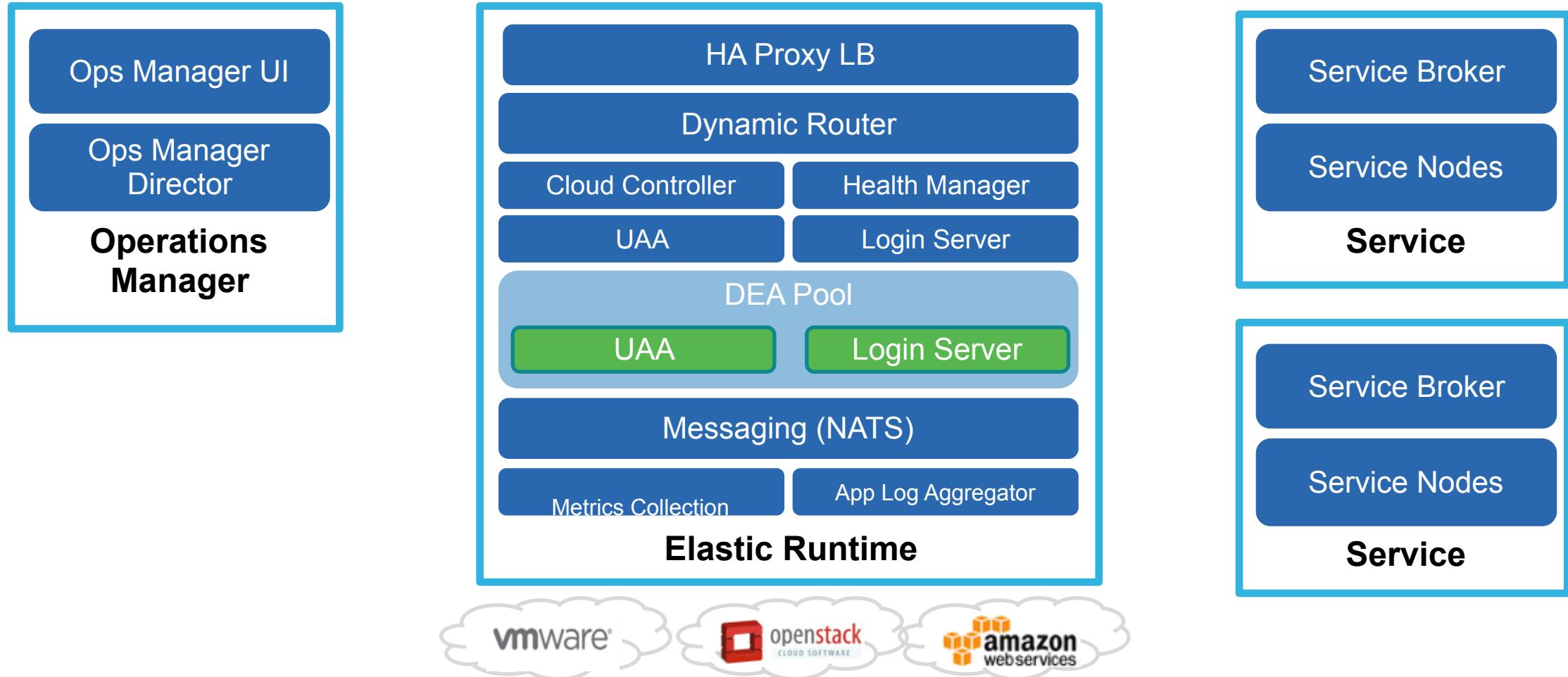
Caching
Legacy | File
Networking |
Technical
Security | SysMgmt

MIGRATE TO IT

a apprenda



Pivotal CF Architecture



Back to Docker...

Docker Command Line and REST Interface

Service Router - NGINX

Service/Container Discovery – Consul, Consul Template, and Registrar

Service Health - Consul

Docker Swarm Cluster and Consul Dynamic DNS

Docker Host



Docker Host



Docker Host



AWS

Docker Machine on Physical Hardware

Google Cloud

VMware vSphere

OpenStack

Core DevOps Technology

Common Elements of the Software Supply Chain

sonarQube



Jenkins

puppet labs

docker

Nexus

JIRA



GitLab

VAGRANT

maven

Apache Tomcat

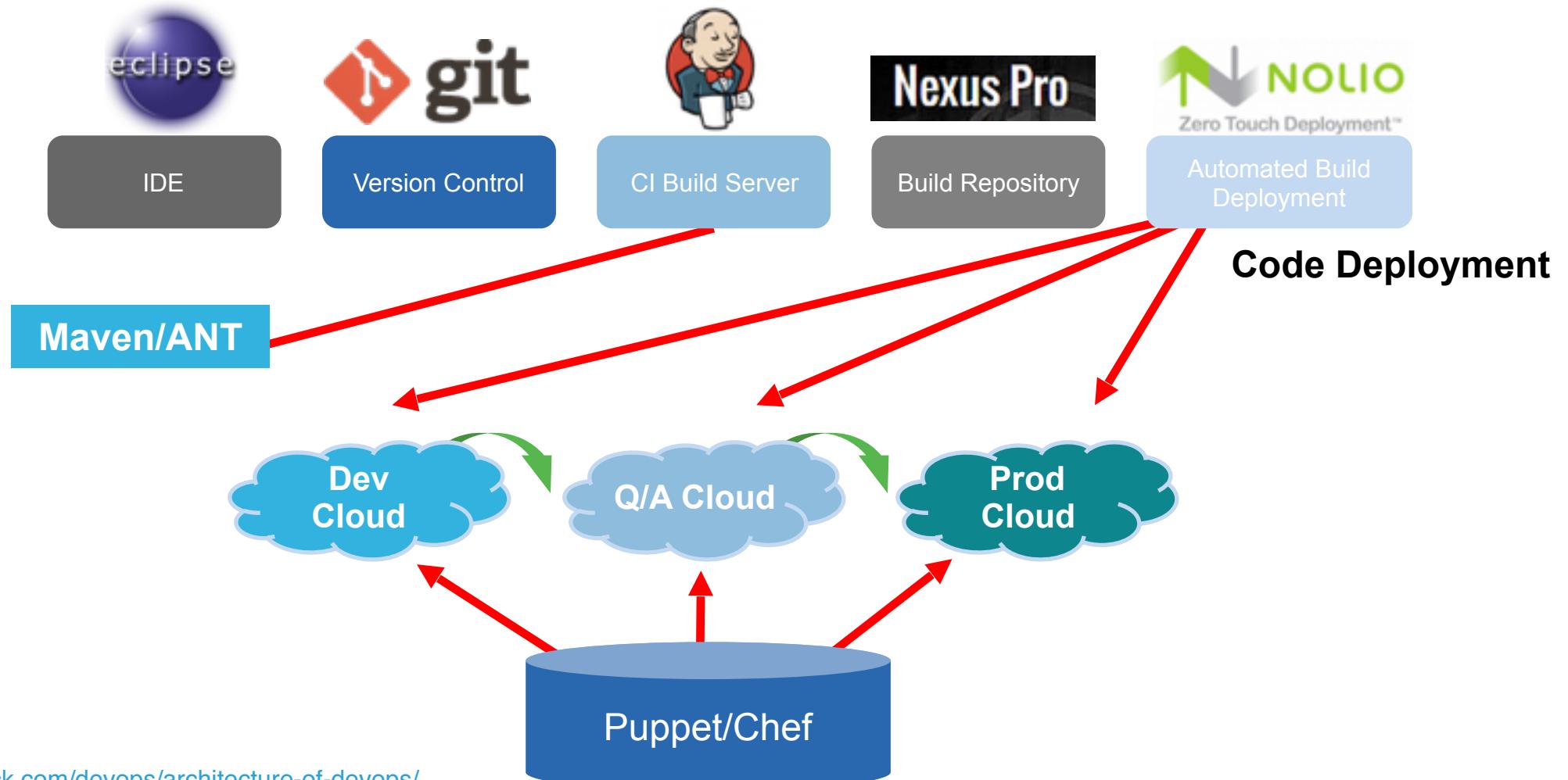
git



CHEF

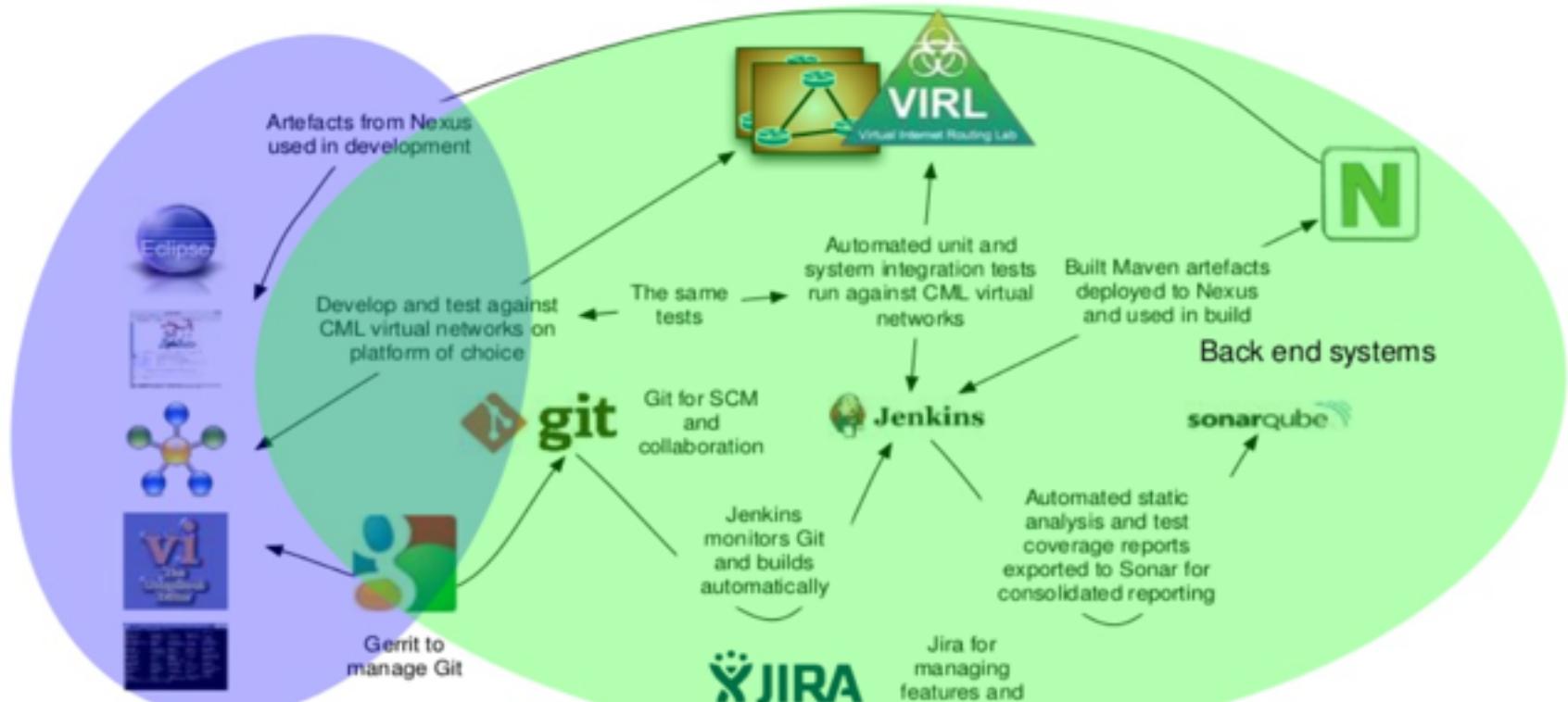
ANSIBLE

Example Reference Architecture for DevOps



SOURCE: <http://agiletrick.com/devops/architecture-of-devops/>

According to Cisco



Develop with
enhanced
tools and
IDEs in café
of choice



General Notes

- CAPS (Chef, Ansible, Puppet, Salt) are mainly for centrally controlling what lives inside a large number of instances. I.e. processes, files, etc.
- Terraform and CloudFormation are mainly for creating instances themselves (and other cloud resources like load balancers etc).



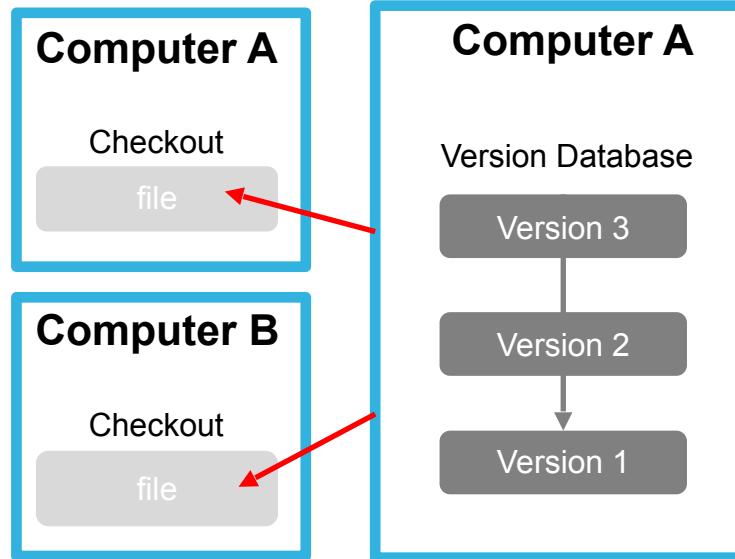
Git

- Source Control
- The backbone for open source



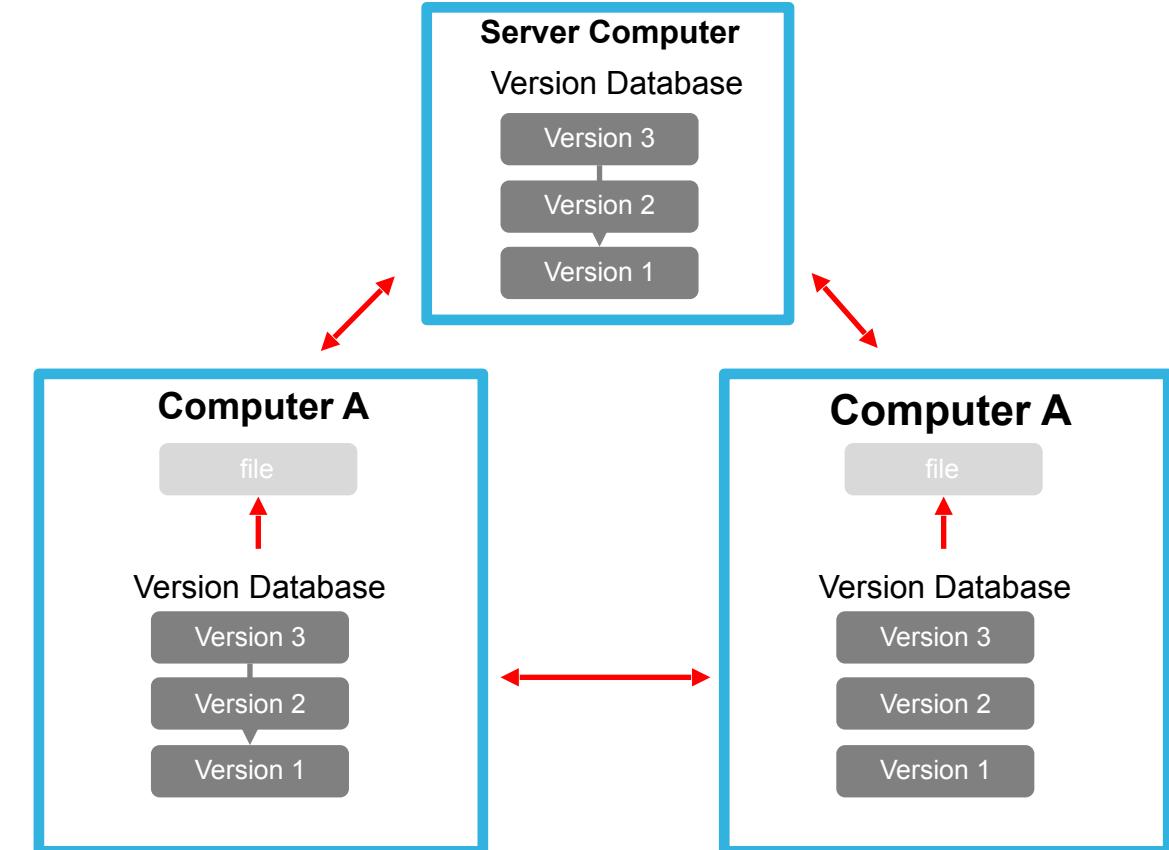
Git Uses a Distributed Model

CENTRALIZED MODEL



(CVS, Subversion, Perforce)

DISTRIBUTED MODEL

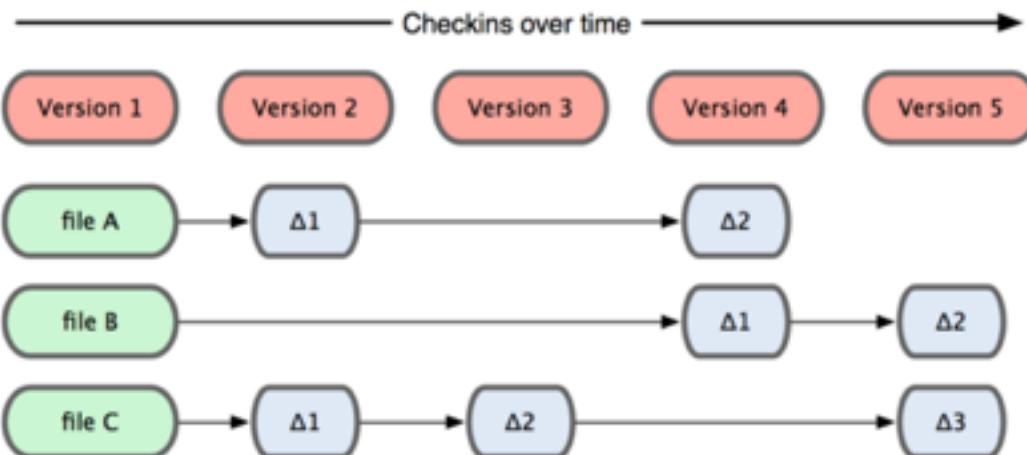


(Git, Mercurial)
Result: Many operations are local

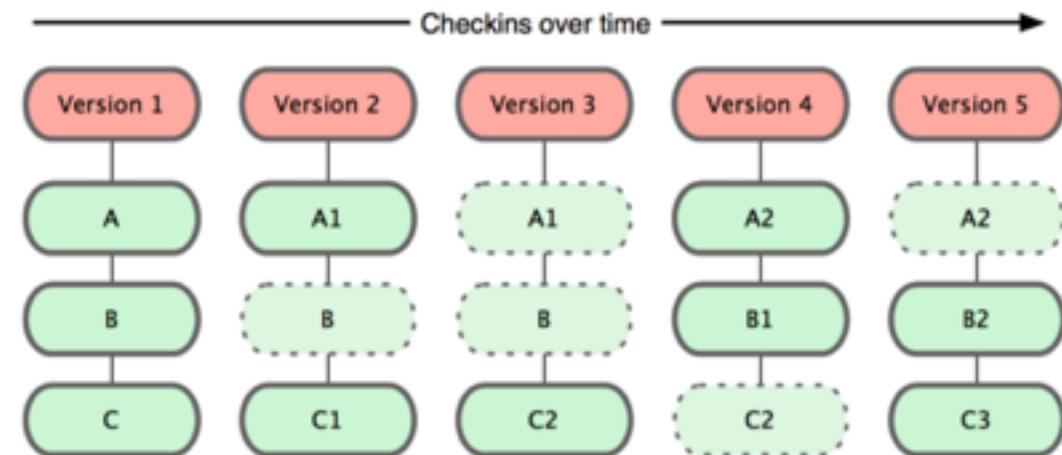


Git Takes Snapshots

SUBVERSION

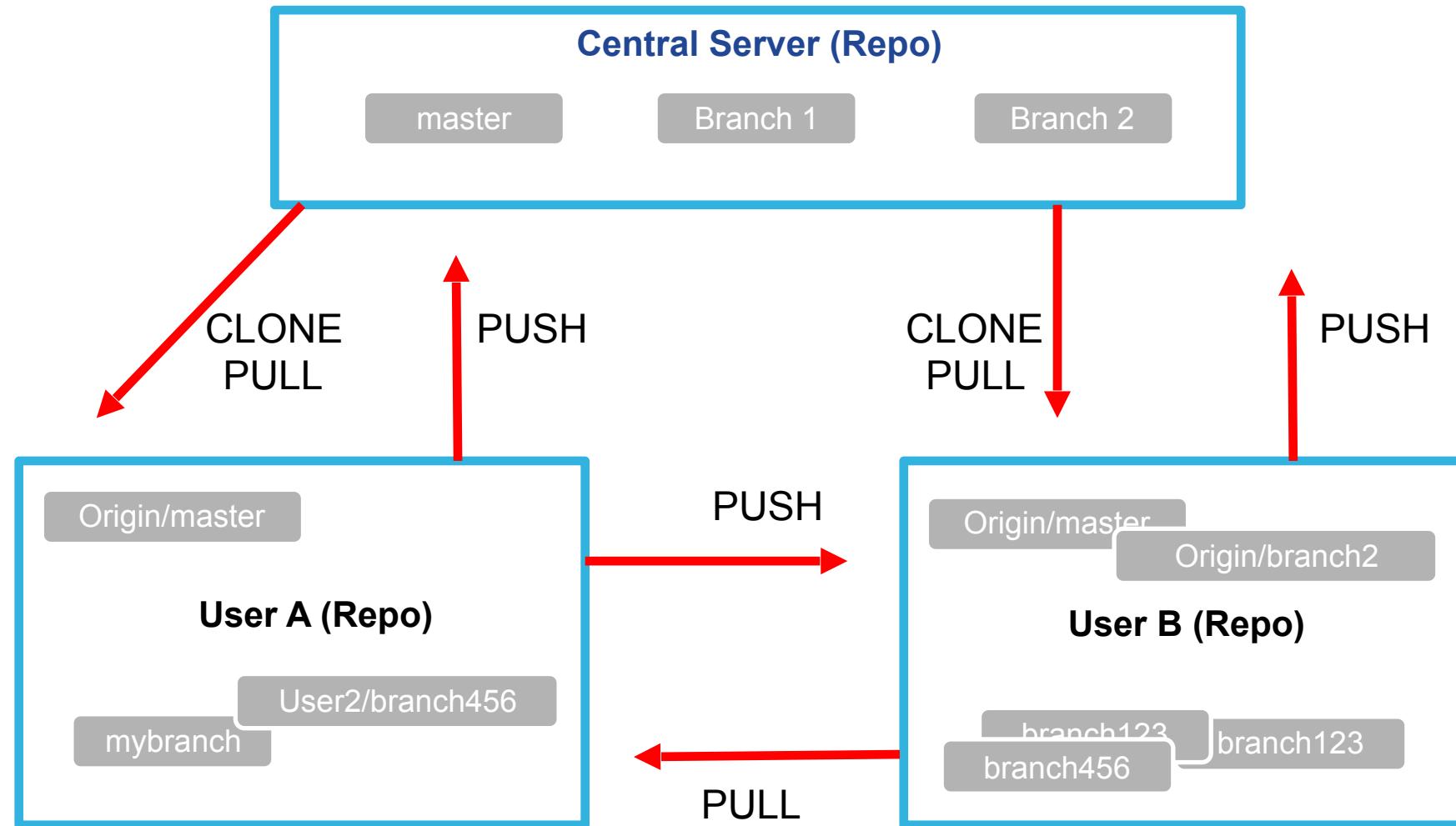


GIT





How Git Does It



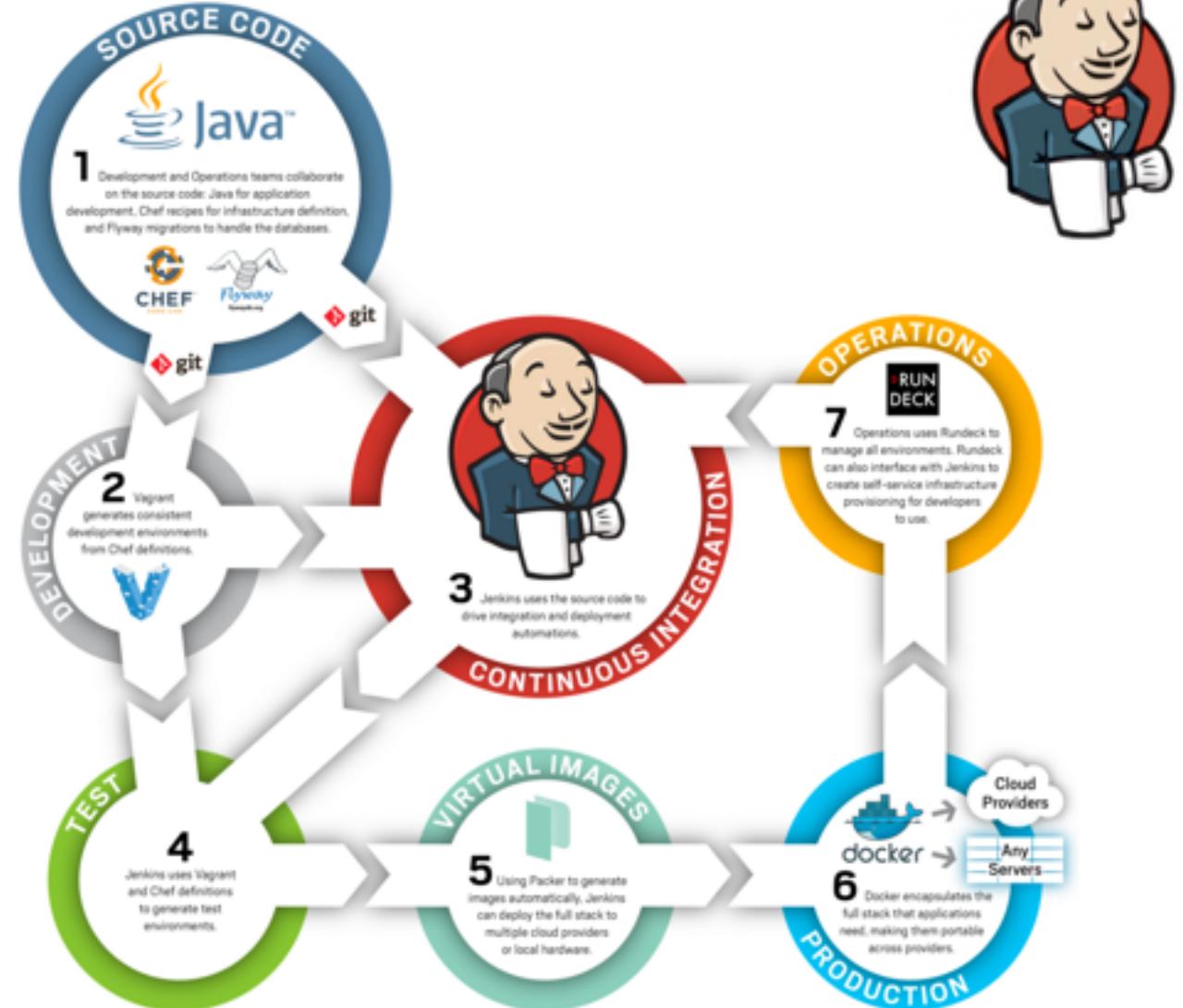
Jenkins



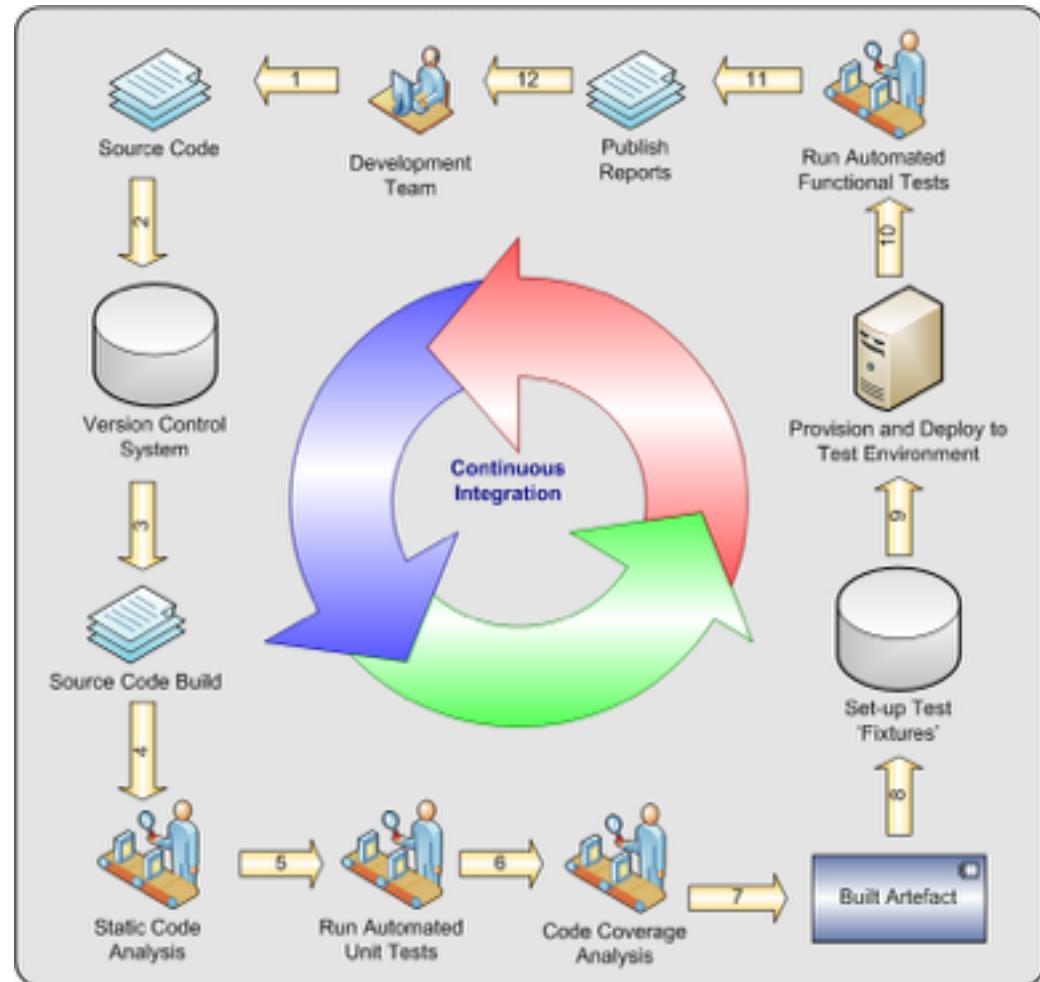
Continuous integration server:

- Coordinate “jobs” to automate the building of applications and environments
- Scales using master/slave architecture
- Integrates into all major DevOps and code build tools

DevOps practices accelerate the rate of releases by increasing collaboration and reducing friction between developers and IT operations professionals. Open source tools help you to define good DevOps strategies and implement continuous deployment for projects of any size.



Typical CI Workflow using Jenkins



Jenkins Pipelines



The screenshot shows the Jenkins Build Pipeline interface. At the top, there is a navigation bar with the Jenkins logo, a search bar, and a "DISABLE AUTO REFRESH" link. Below the navigation bar, the title "Build Pipeline" is displayed next to a cartoon Jenkins mascot icon. A toolbar below the title contains icons for Run, History, Configure, Add Step, Delete, and Manage.

The main area displays four pipeline stages:

- Pipeline #6**: Status is green, indicating success. Last run was on Apr 11, 2014 at 10:42:03 A, taking 14 sec.
- #6 Vagrant Build**: Status is green, indicating success. Last run was on Apr 11, 2014 at 10:42:03 A, taking 14 sec.
- #5 Staging Deployment**: Status is green, indicating success. Last run was on Apr 11, 2014 at 10:42:27 A, taking 21 sec.
- #1 Production Deployment**: Status is green, indicating success. Last run was on Apr 11, 2014 at 10:43:22 A, taking 22 sec.

Green arrows indicate the flow from Stage 6 to Stage 5, and from Stage 5 to Stage 1.

Vagrant



- Provisioning tool for Dev and Test environments
- Why use Vagrant?
 - Quick
 - Easily replicate production on a Dev box
- Many use cases for developers, operations as well as Q/A



Vagrant: Basics

- Command line utility
- Uses a vagrant file to describe the virtual environment you want to set up
- Uses a simple abstraction from underlying complexities:
 - vagrant up
 - vagrant ssh
 - vagrant halt
 - Etc.



Vagrant: Basics (Cont.)

- The Box:
 - Basic building block
 - Uses shared “repo”
- Providers:
 - Supports AWS, VirtualBox, Vmware, etc.



Vagrant: When

- Need to easily provision development environments



Vagrant: Pros

- Initial set up to get running is quick and easy
- Wide availability of boxes to provision your environment



Vagrant: Cons

- Mysterious performance issues
- Some features on certain platforms (cough windows) can be a pain to implement

Puppet: What is Puppet?



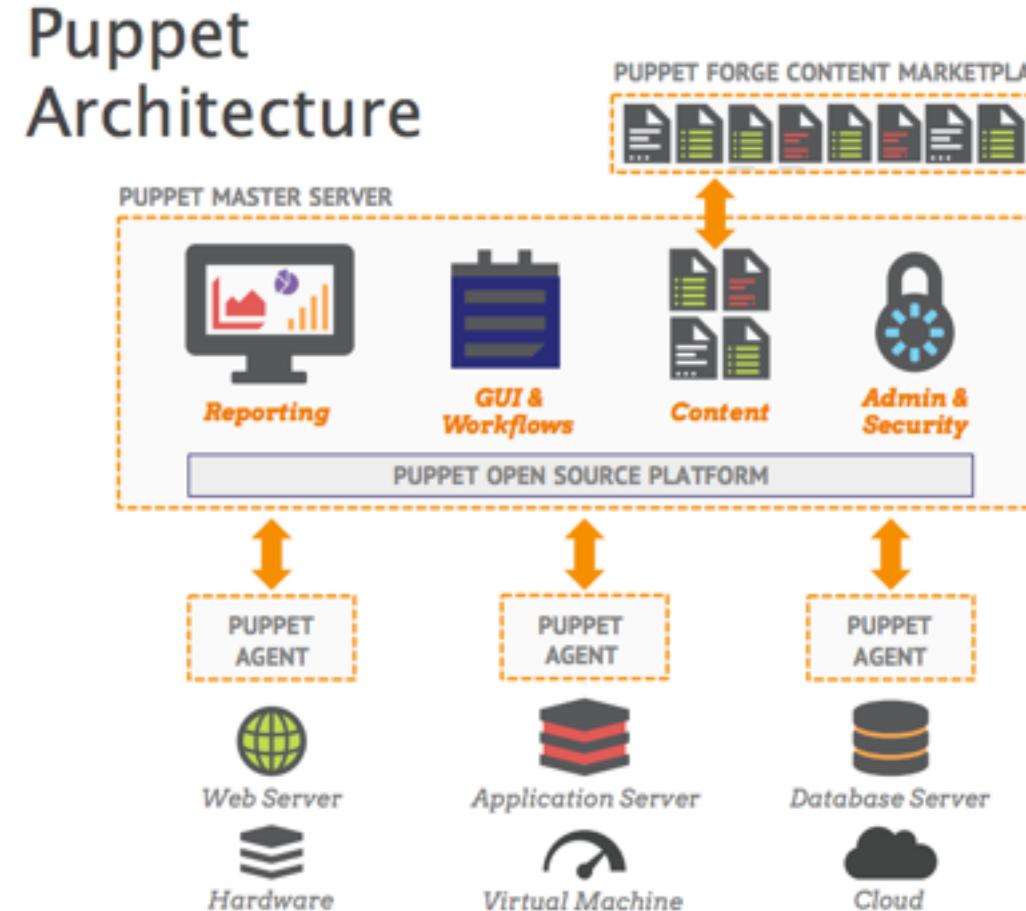
- Think of it as a language
- Describe state, not steps
- Paint a picture of your ideal and most clean system

Puppet

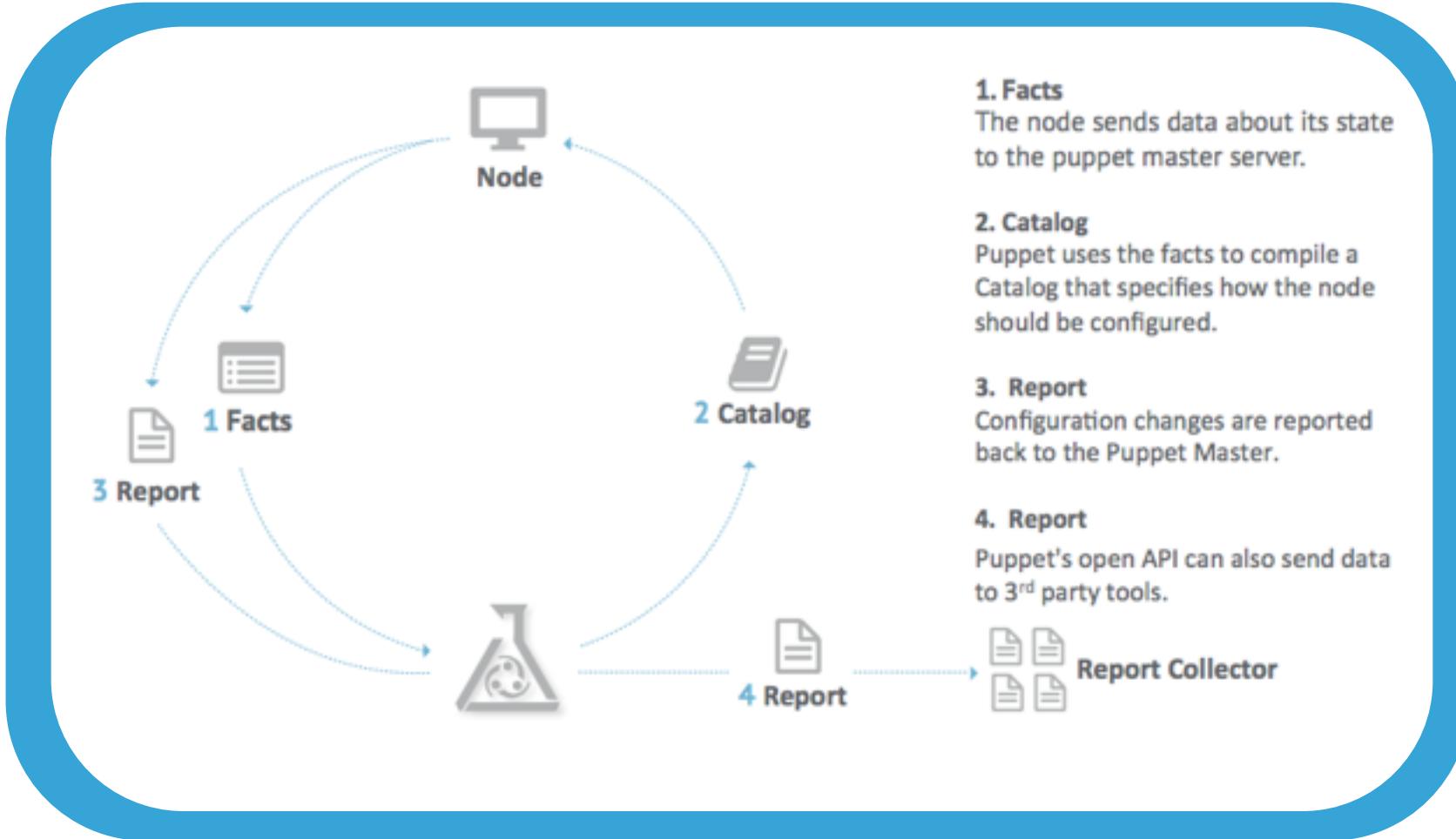


- Automation of System Administration tasks
- Uses a declarative language to automate mundane admin tasks
- Seen as the tool of choice for pure configuration management
- Written in Ruby

Puppet: Architecture



Puppet: Puppet Run



Puppet: When



- Stability and maturity are key factors
- Good for large organizations with a heterogeneous environment and breadth of skills on the team

Puppet: Pros



- Mature interface and runs on nearly every OS
- Simple installation and setup
- Complete Web UI in this space
- Strong reporting capabilities
- Well-established support community



Puppet: Cons

- Advanced tasks will lead you to use the CLI, which is Ruby-based
- Due to the DSL and a non-simplistic design, a Puppet code base can grow large, complex, and will be hard for new team members to become productive on quickly
- Model-driven Pure-Ruby version support is being scaled back
- Versus code-driven approach

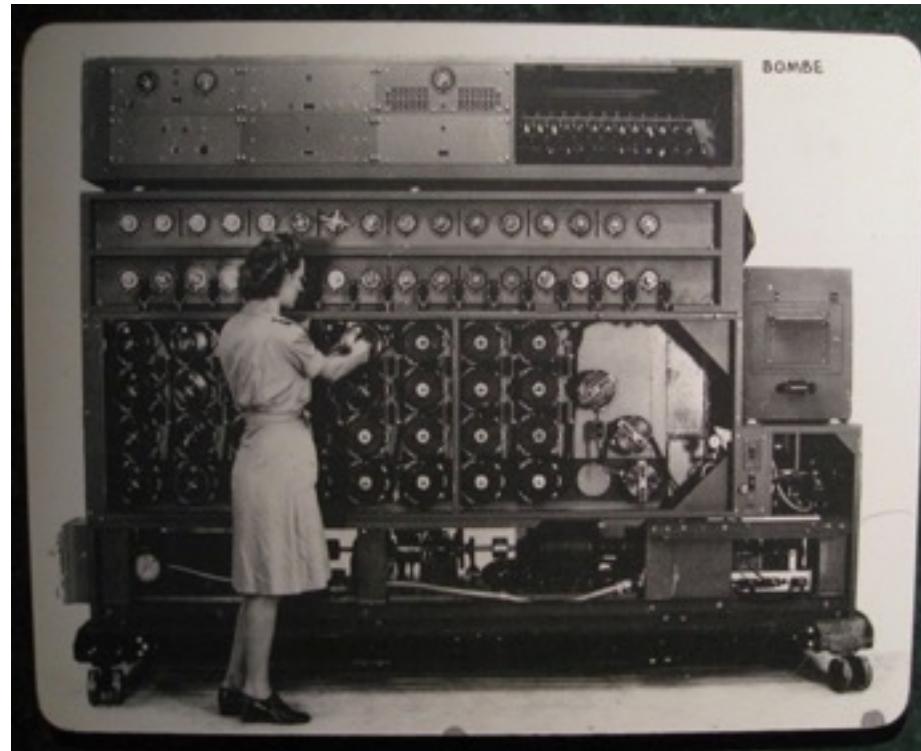


Chef

- Chef is the ninja of DevOps tools
- Comprehensive utility for:
 - provisioning
 - managing
 - automating entire infrastructures
- Uses a client/server architecture to facilitate application of “recipes” to infrastructure components
- Written in Ruby

Chef: Concepts

- Node
- Role
- Resource
- Recipe
- Cookbook
- Runlist



Chef: Run List





Chef: When/Why

- Organizations looking for a more mature solution for a heterogeneous environment
- Good for development-focused teams



Chef: Cons

- Not simple—can lead to large code bases and complex environments
- Doesn't support push functionality
- Steep learning curve



Chef: Cons

- “Knife” tool eases installation burdens
- Large collection of modules and configuration recipes
- Heavy focus on Git gives it strong version control capabilities
- Code-driven approach gives you more control configurations

Saltstack



- CLI-based tool that can be set up as a master-slave model or a non-centralized model.
- Python
- Push method of communication with clients
- Provides for grouping of clients and configuration templates

Saltstack: When



- Scalability and resiliency are a big concern.
- Oriented to system administrators due to its usability



Saltstack: Pros

- After setup, fairly straightforward
- DSL is robust with features
- I/O and configs are consistent-> YAML.
- Strong community
- High scalability and resiliency in the master model
- Transparency is excellent. Easy to see what's happening internally

Saltstack: Cons



- Documentation is weak
- Incomplete web UI
- Non Linux OS support weak
- Difficult to set up and to pick up for new users.

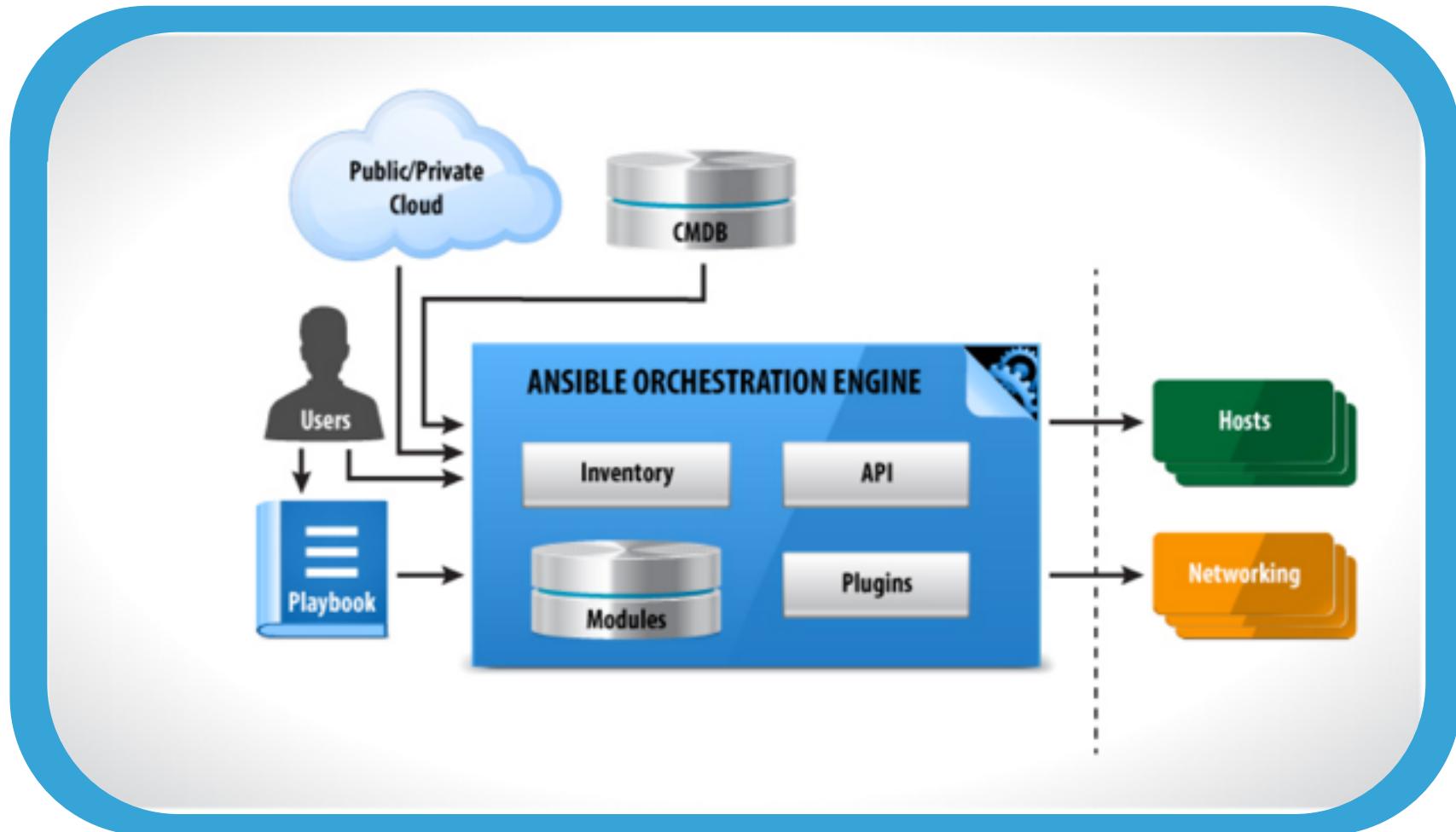
Ansible



- Agentless configuration management tool
- Written in Python
- Multi-node (like chef)
- Seeks to be simple
- Similar to Vagrant



Ansible: Architecture



Ansible: Key Concepts



- Module
- Playbook



Ansible: When/Why

- Getting up and running quickly
- Ease is important to you
- You don't want to install agents on remote nodes or managed servers
- It's good if your focus is more on the system admin side.



Ansible: Pros

- SSH-based, so it doesn't require installing any agents on remote nodes.
- Easy learning curve thanks to the use of YAML.
- Playbook structure is simple and clearly structured.
- Has a variable registration feature that enables tasks to register variables for later tasks
- Much more streamlined code base than some other tools



Ansible: Cons

- Less powerful than tools based in other programming languages.
- Does its logic through its DSL, which means checking in on the documentation frequently until you learn it
- Variable registration is required for even basic functionality, which can make easier tasks more complicated
- Introspection is poor. Difficult to see the values of variables within the playbooks
- No consistency between formats of input, output, and config files
- Struggles with performance speed at times.



Terraform

- Higher level abstraction of CM
- Written in G (golang)
- Focuses on data center wide operations
- Integrates with other CM tools like Chef and Puppet
- From the makers of Vagrant



Terraform: Configuration

Like Vagrant:

- Command line tool
- Uses text files to describe the infrastructure



Teraform: When

- The planning phase plain and simple:
 - Killer feature
- When the holes in a young product are not in areas you need support. (Missing resources)



Terraform: Pros

- Supports many cloud providers and can run on your local machine
- Vendor neutral
- Separate planning and execution phase—killer feature
- Young—stability can be an issue



Terraform: Cons

- Limited support for many AWS components
- Issues with state management—state file sharing between developers is chaos
- DSL is young and missing some functionality



Cloud Foundry

- Provision operating systems and middleware.
- Manage network security safe guards to prevent security threats.
- Manage application connections to external sources including databases and legacy middleware.
- Provides 4 levels of HA, as well as built in load balancing for scale.



Cloud Foundry (Cont.)

- Supports multi-tenant environments—each line of business can operate with a discrete quota and isolated system access.
- Provision next generation data services including NOSQL databases, traditional databases and Hadoop clusters.
- We provide horizontal and vertical scaling for the underlying IaaS so that you can scale your infrastructure in lock step with your Business.
- Provides a built-in log aggregation service.



Cloud Foundry: Open Source Capabilities

Automatic AppServer & OS Configuration with Buildpacks (“just push your app”)



Application Containerization & Cluster Scheduling



Application Network Security Groups



Application to Services Binding and Access



App Health Mng, Load Balancing, Rapid Scaling, Availability Zones



Policy, Identity and Roles Management



Native & Extended Data Services
Mobile and Platform Services



IaaS Provisioning, Scaling & Configuration



Basic logging as a service

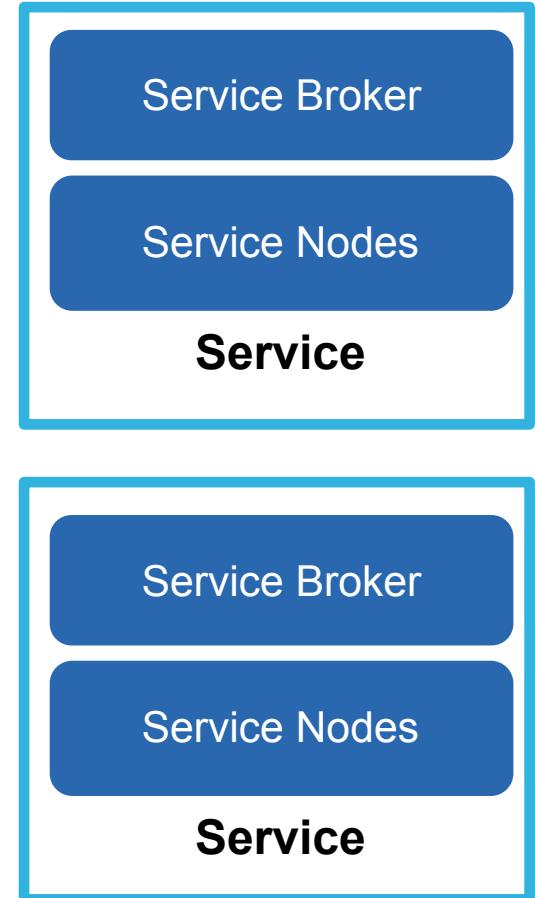
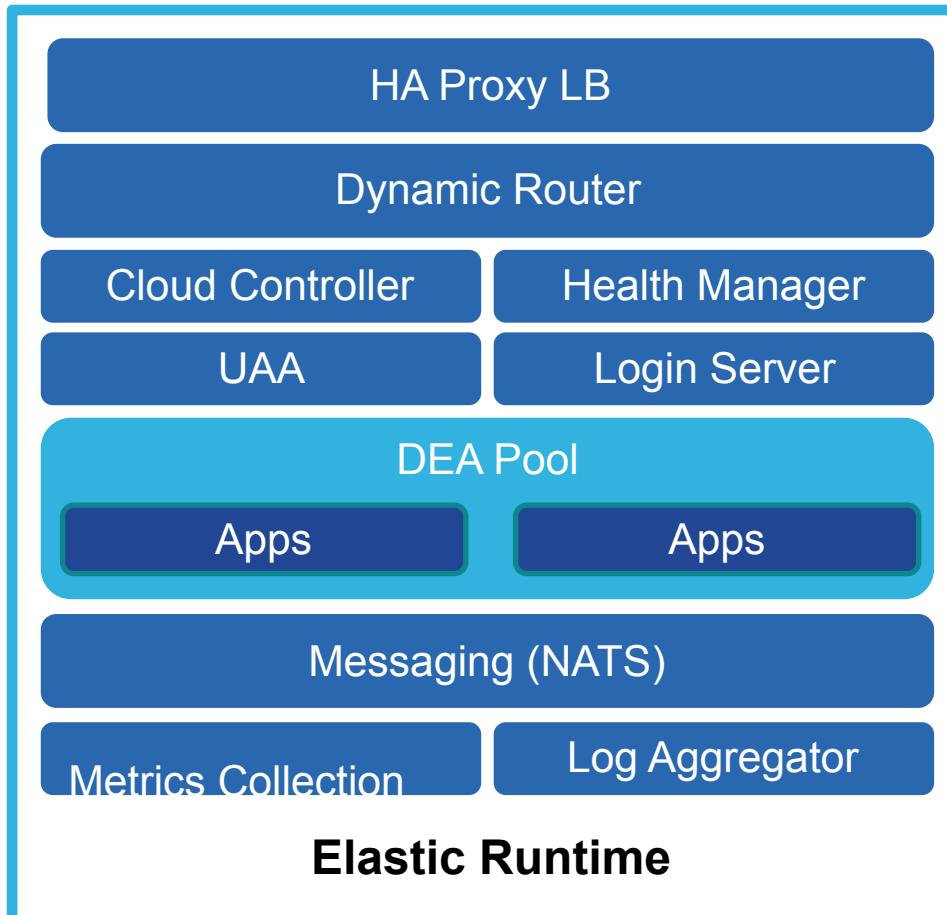


Deploy, Operate, Update & Scale with minimal downtime





Cloud Foundry: Components





Cloud Foundry: When

- You are running on AWS
- Significant number of ready to go resource definitions



Cloud Foundry: Pros

- Support for all AWS components
- No state management issues
- Templates written in son and very easy to understand
- Very stable



Cloud Foundry: Cons

- AWS only and is a hosted service
- Can makes changes without prior notice - lack of transparency
- Issues with rollback mechanism



OpenStack

- Software platform for cloud computing
- Infrastructure-as-a-service (IaaS)
- The software platform consists of interrelated components that control hardware pools of processing, storage, and networking resources throughout a data center.

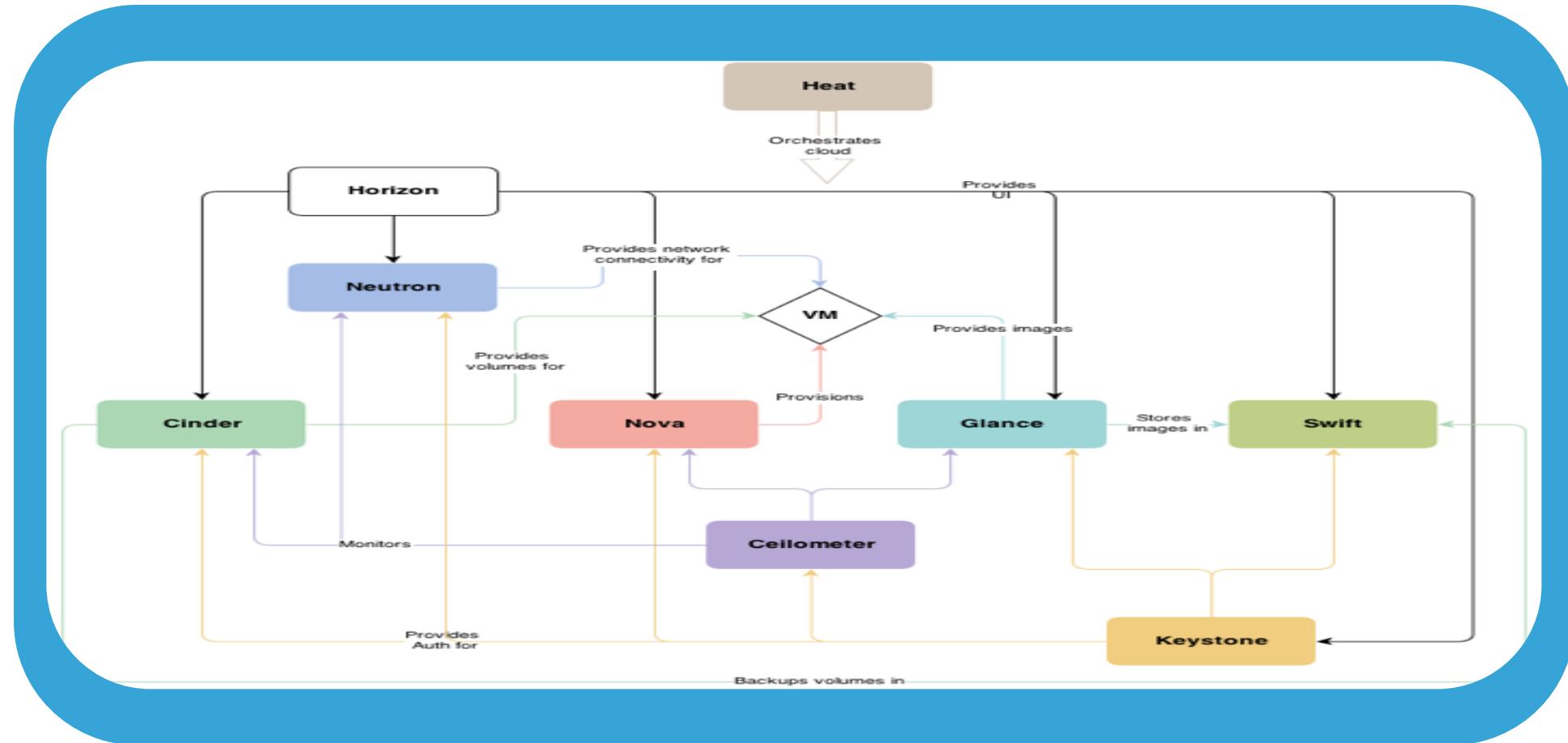
Automation and Orchestration of IT Resources

Solution: OpenStack, the Cloud Operating System

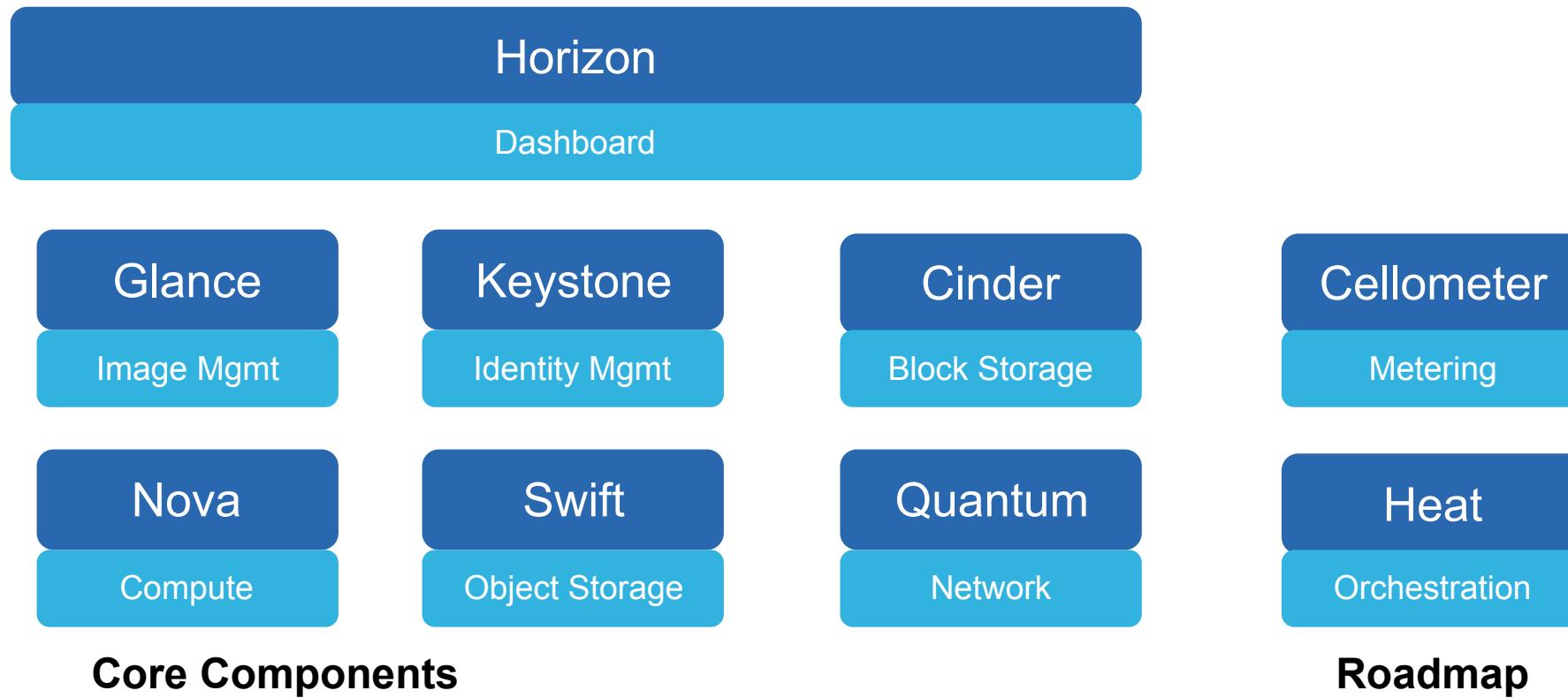
A new management layer that adds automation and control



In a Loosely Coupled Architecture



By Leveraging Various Open Source Projects



Rackspace Private Cloud Reference Architecture

