

Azure SQL Database HA & DR Options

EXPLAINED



Rolf Tesmer

Cloud Solution Architect | Azure | Analytics | AI

Linked In: <https://www.linkedin.com/in/rolftesmer/>

Blog: <https://mrfoxsql.wordpress.com/>

07 Jul 2018



Basic Program

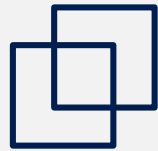
```
10 Azure Cloud Primer
20 Azure SQL DB Primer
30 Exploring Azure SQL DB HA+DR Options
40 Activating HA+DR
50 Wrap Up & Summary
60 IF (A-OK?) THEN BREAK ELSE GOTO 10
```

10. Azure Cloud Primer

Microsoft Azure Cloud Platform



Productive



Hybrid



Intelligent



Trusted

<https://azure.microsoft.com/en-us/overview/what-is-azure/>

Azure regions

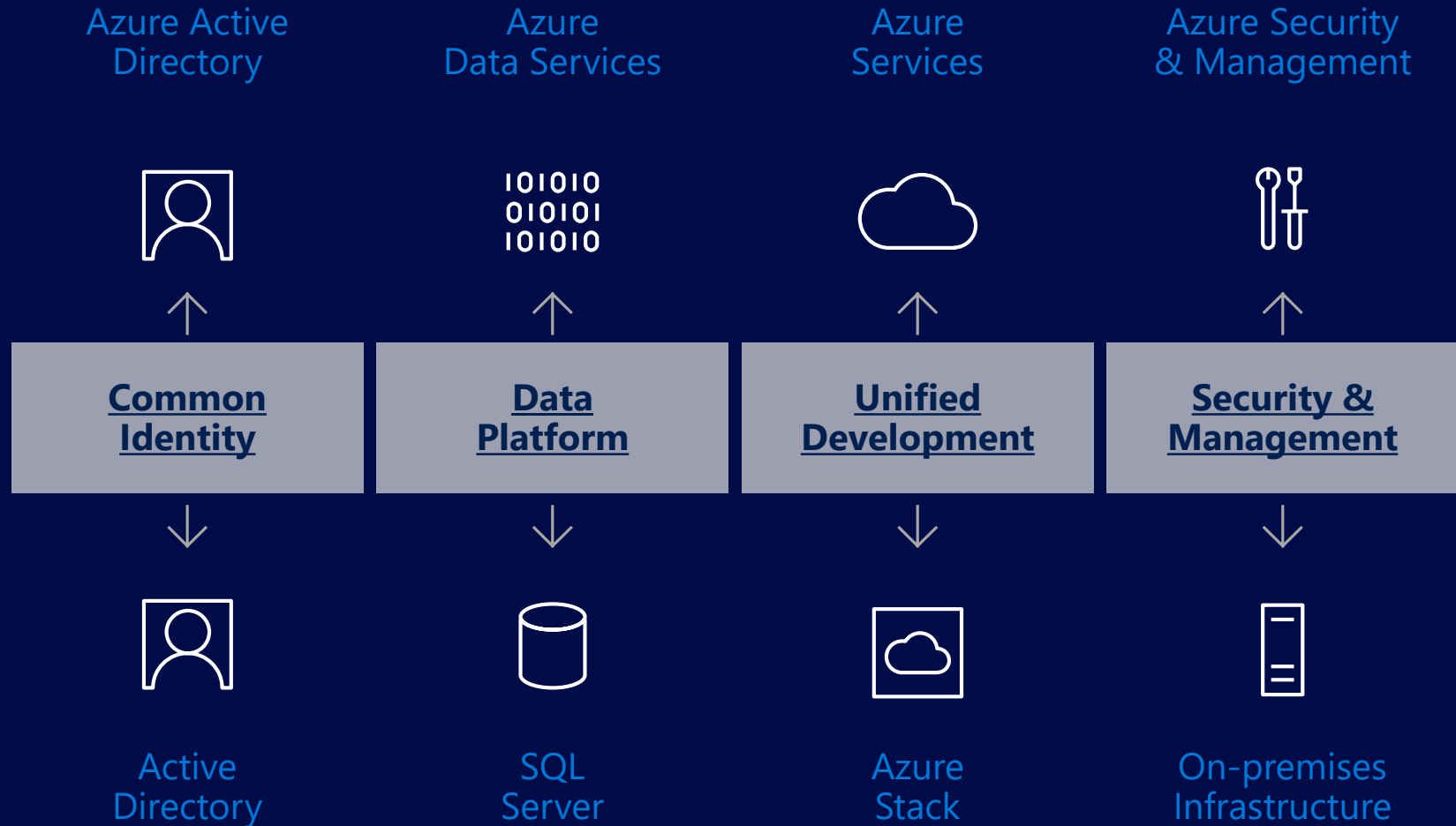
Azure has more global regions than any other cloud provider—offering the scale needed to bring applications closer to users around the world, preserving data residency, and offering comprehensive compliance and resiliency options for customers.

50 regions worldwide **140** available in 140 countries



<https://azure.microsoft.com/en-us/global-infrastructure/regions/>

Azure Hybrid Cloud



<https://azure.microsoft.com/en-us/overview/hybrid-cloud/>

Build and innovate with choice and flexibility

<https://azure.microsoft.com/en-us/overview/productivity/>

DevOps										
Management										
Applications										
App frameworks & tools										
Databases & middleware										
Infrastructure										

Comply with industry and regional requirements

<https://www.microsoft.com/en-us/TrustCenter/Security/default.aspx>

GLOBAL



ISO 27001



ISO 27018



ISO 27017



ISO 22301



SOC 1 Type 2



SOC 2 Type 2



SOC 3



CSA STAR
Self-Assessment



CSA STAR
Certification



CSA STAR
Attestation

US GOV



Moderate
JAB P-ATO



High
JAB P-ATO



DoD DISA
SRG Level 2



DoD DISA
SRG Level 4



DoD DISA
SRG Level 5



SP 800-171



FIPS 140-2



Section 508
VPAT



ITAR



CJIS



IRS 1075

INDUSTRY



PCI DSS
Level 1



CDSA



MPAA



FACT UK



Shared
Assessments



FISC Japan



HIPAA /
HITECH Act



HITRUST



GxP
21 CFR Part 11



MARS-E



IG Toolkit UK



FERPA



GLBA



FFIEC

REGIONAL



Argentina
PDPA



EU
Model Clauses



UK
G-Cloud



China
DJCP



China
GB 18030



China
TRUCS



Singapore
MTCS



Australia
IRAP/CCSL



New Zealand
GCIO



Japan My
Number Act



ENISA
IAF



Japan CS
Mark Gold



Spain
ENS



Spain
DPA



India
MeitY



Canada
Privacy Laws

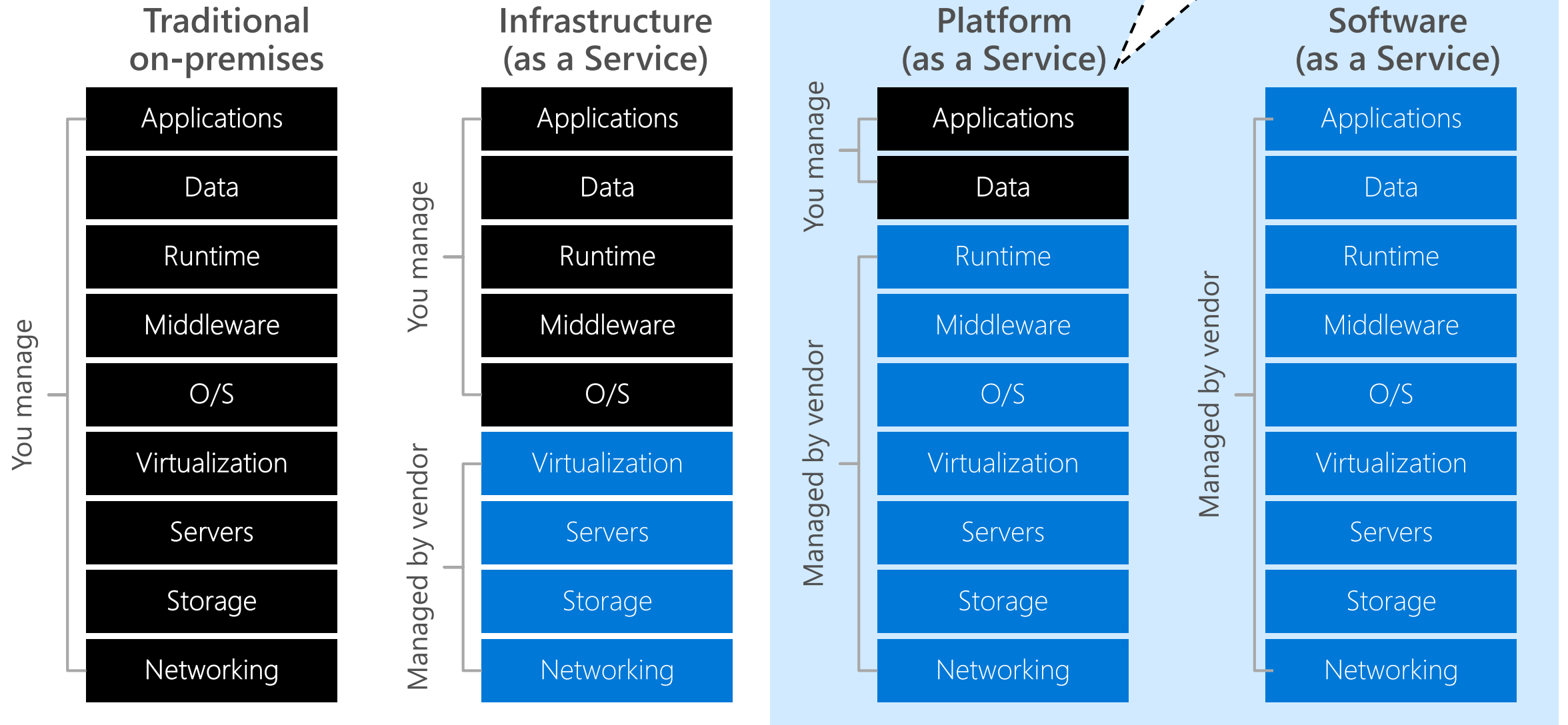


Privacy
Shield



Germany IT
Grundschutz
workbook

Cloud service models



Azure Services – Which One?

<http://azureinteractives.azurewebsites.net/Azure101Cards/default.html>

Compute

- Virtual Machines
- Virtual Machines Scale Sets
- App Service
- Functions
- Container Service
- Container Instances
- Batch
- Service Fabric
- Cloud Services

Networking

- Virtual Network
- Load Balancer
- Application Gateway
- VPN Gateway
- Azure DNS
- Content Delivery Network
- Traffic Manager
- ExpressRoute
- Azure DDoS Protection

Storage

- Storage
- Blob Storage
- Queue Storage
- File Storage
- Disk Storage
- Data Lake Store
- StorSimple
- Backup
- Site Recovery

Enterprise Integration

- Logic Apps
- Service Bus
- API Management
- StorSimple
- SQL Server Stretch Database
- Data Catalog
- Data Factory
- Event Grid

Security + Identity

- Security Center
- Azure Active Directory for Developers
- Key Vault
- Azure Active Directory
- Azure Active Directory B2C
- Azure Active Directory Domain Services
- Multi-Factor Authentication

Developer Tools

- Visual Studio Team Services
- Azure DevTest Labs
- Application Insights
- API Management
- HockeyApp
- Developer Tools and SDKs
- Xamarin
- Storage Explorer

Web + Mobile

- App Service
- Web Apps
- Web Apps for Containers
- Mobile Apps
- API Apps
- Content Delivery Network
- Media Services
- Azure Search

Containers

- Container Service
- Container Instances
- Container Registry
- Service Fabric
- App Service
- Batch

Databases

- SQL Database
- Azure Database for MySQL
- Azure Database for PostgreSQL
- SQL Data Warehouse
- SQL Server Stretch Database
- Azure Cosmos DB
- Table Storage
- Redis Cache

Data + Analytics

- HDInsight
- Stream Analytics
- Event Hubs
- Data Lake Analytics
- Data Lake Store
- Data Factory
- Azure Analysis Services
- SQL Data Warehouse

AI + Cognitive Services

- Machine Learning
- Azure Bot Service
- Cognitive Services
- Bing Web Search API
- Text Analytics API
- Face API
- Computer Vision API
- Custom Vision Service

Internet of Things

- IoT Hub
- IoT Edge
- Stream Analytics
- Time Series Insights
- Azure Cosmos DB
- Event Grid
- Logic Apps

Monitoring + Management

- Site Recovery
- Backup
- Log Analytics
- Application Insights
- Azure Monitor
- Azure Policy
- Microsoft Azure portal

Microsoft Azure Data Services (IaaS & PaaS)

IaaS

SQL Server, Oracle, Mongo, MySQL, ++ in Azure VM



PaaS

Azure Relational Databases

SQL, PostgreSQL, MySQL



Azure NoSQL Databases

CosmosDB



Azure NoSQL Table Storage



Azure Blob / Lake Storage

0100110100
101001001
010001101
0100100101

fully featured RDBMS

transactional processing

rich query

managed as a service

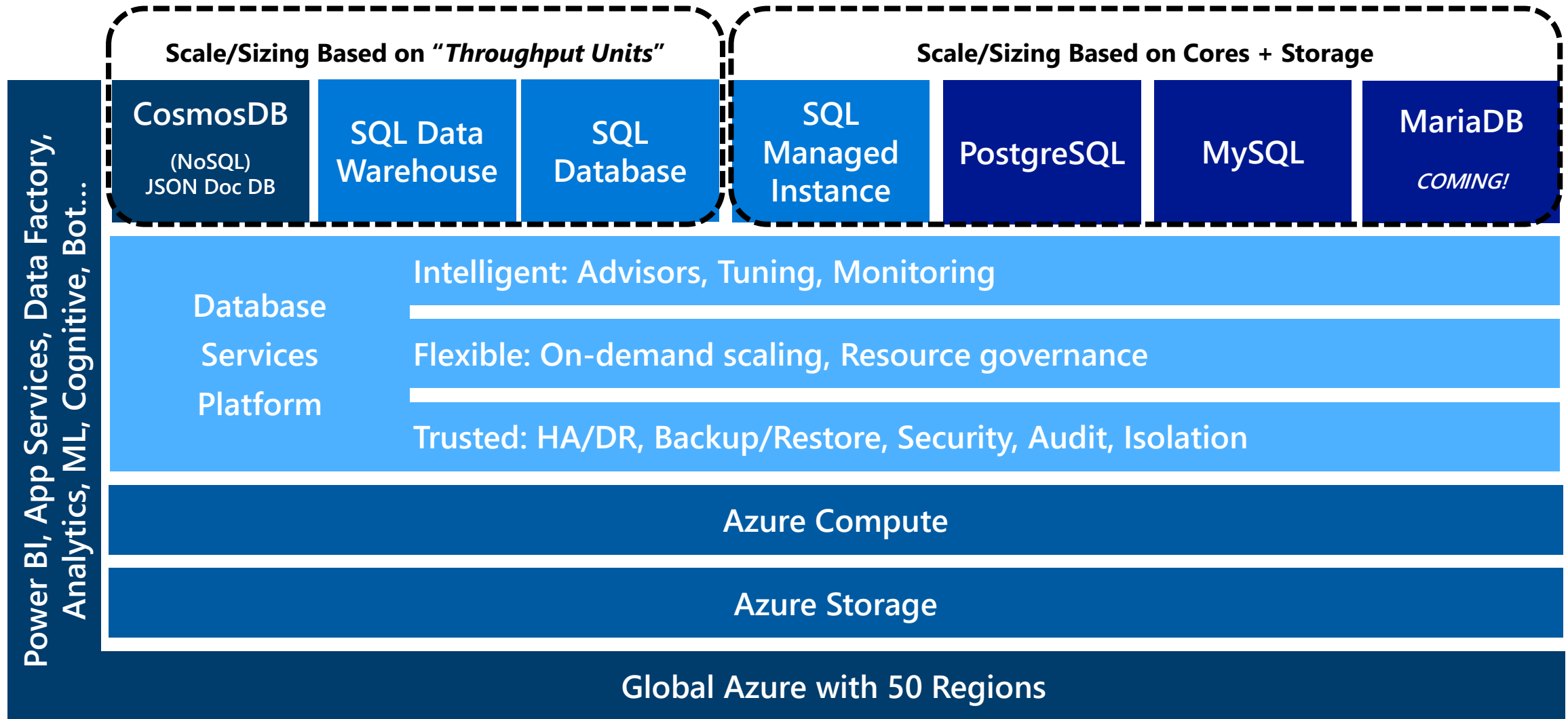
elastic scale

schema-free data model

Internet accessible http/rest

arbitrary data formats

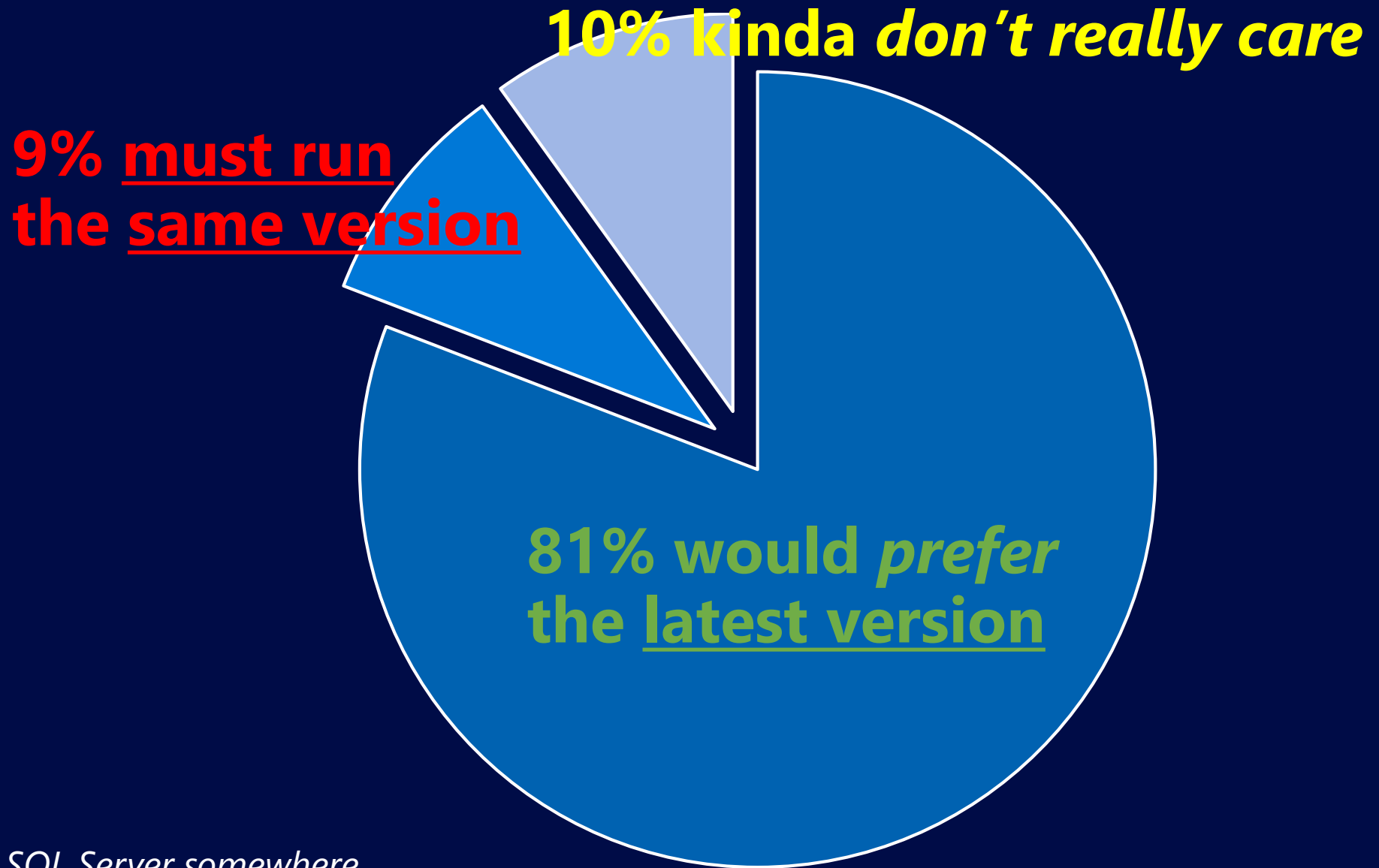
Azure Relational Database Platform (PaaS)



<https://docs.microsoft.com/en-us/azure/architecture/guide/technology-choices/data-store-overview>
<https://docs.microsoft.com/en-us/azure/architecture/data-guide/technology-choices/analytical-data-stores>

20. Azure SQL DB Primer

What about SQL Server Versions then, eh?



Of the 100% that run SQL Server somewhere...

Azure SQL Database

Fully managed database-as-a-service that lets you focus on your business

No More Versions! Compatible with SQL Server 2014, 2016, 2017

Database provisioning on-demand up to 4TB in size

On-line Scalability and elastic performance for all workloads

99.99% availability, zero maintenance

Intelligent: learns and adapts to optimize performance

Secure and compliant to protect sensitive data

Auto backup, long term backup retention, point in time restore

Geo-replication to up to 4 regions with auto-failover (groups)

Geo-restore-from-backup for data protection

Azure
SQL Database



Azure SQL Database Service Tiers

	Basic	Standard	Premium	...
Intended Use	Light transactional workloads	Go-to option for most business applications	Highest throughput and most-responsive applications	
Performance	●	● ● ●	● ● ● ● ●	
Storage	2 GB	250 GB	500 GB – 4 TB	
Availability	99.99%			
Security	SQL/AAD auth, masking/RLS, auditing & threat detection, encryption, vulnerability assessment			
Business Continuity	Restore from automatic backups, geo-replication			
Management	Portal, PowerShell, plus REST and client APIs			

Predictable performance for single databases

Single databases are allocated isolated resources

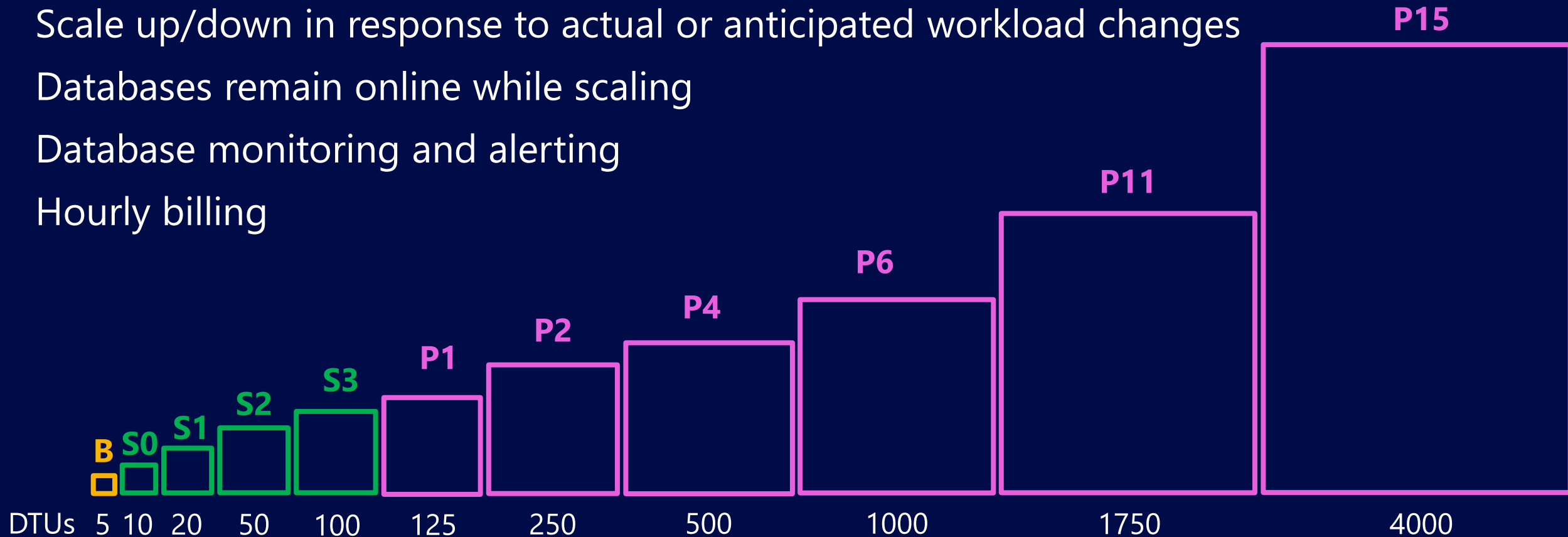
Basic, Standard, and Premium tiers provide increasing performance levels (DTUs)

Scale up/down in response to actual or anticipated workload changes

Databases remain online while scaling

Database monitoring and alerting

Hourly billing

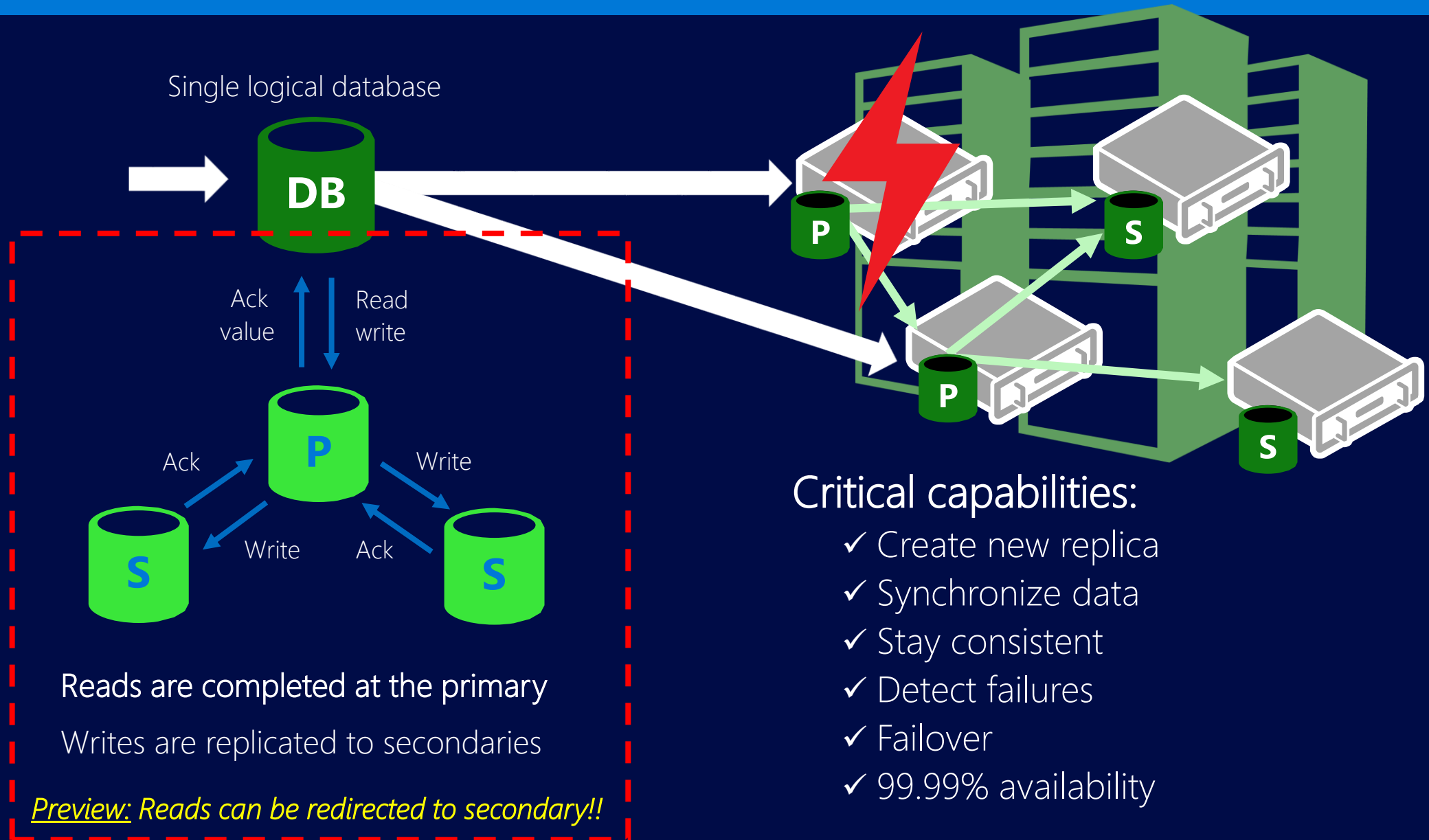


30. Exploring HA & DR Options

Azure SQL DB - Options Table

1. SQL AlwaysOn? (SLA 99.99%) (with RO replicas)
2. Automated backup (with geo-copies)
3. Geo-replication (with RO replicas)
4. Geo-replication (with failover groups)
5. Deployment in Azure Availability Zones (AZ)

#1. Local Region HA - via SQL Always-On OOTB



#2. Automated Backup and Point-in-time restore

Automatic backup

Full backups weekly, differential backup daily, log backups every 5 minutes

Daily and weekly backups automatically uploaded to geo-redundant Azure Storage

Self-service restore

Point-in-time up to a second granularity

REST API, PowerShell, or Portal

Creates a new database in the same logical server

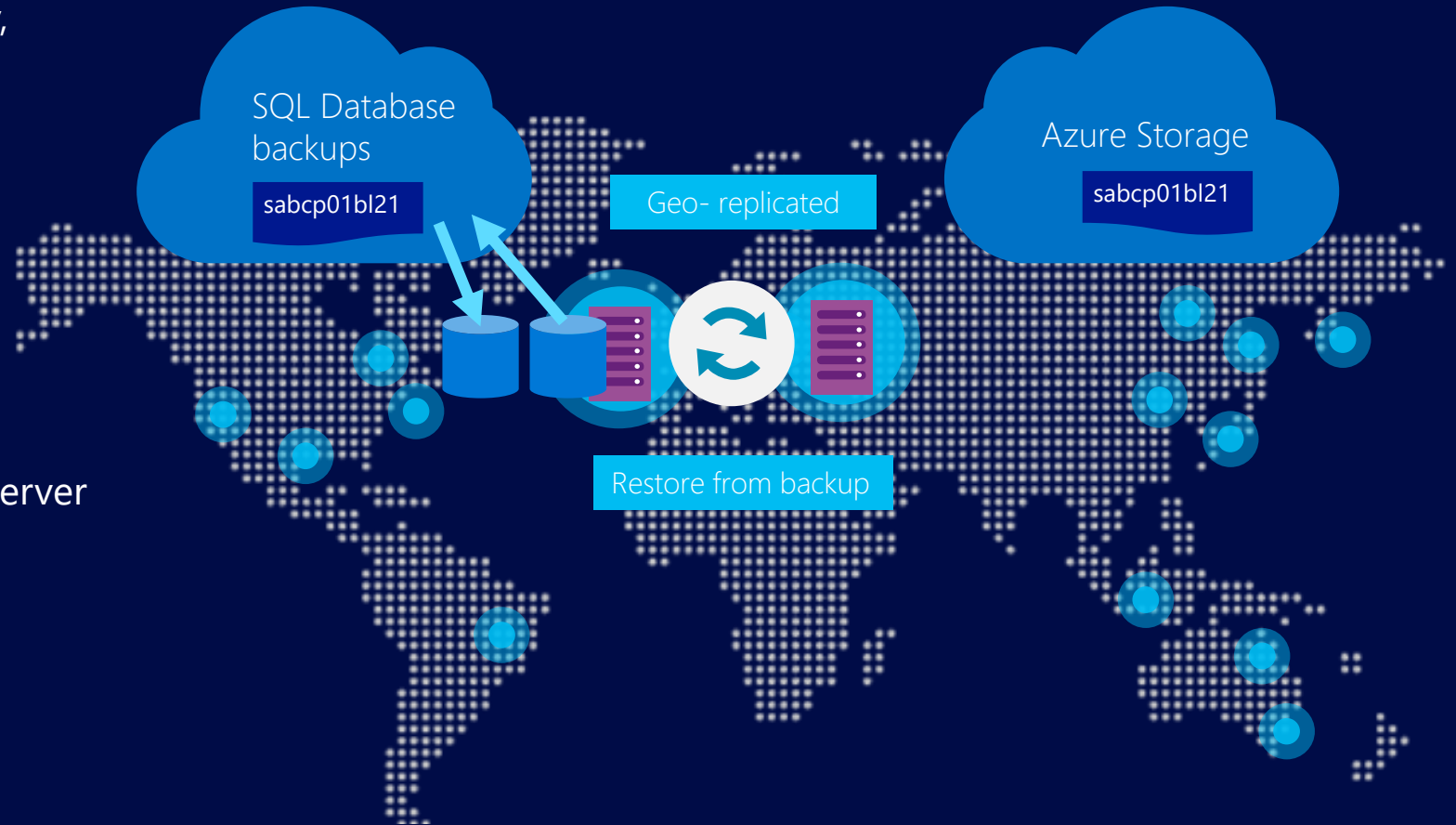
Tiered retention policy

Basic - 7 days

Standard - 35 days

Premium - 35 days

No additional cost to retain backups



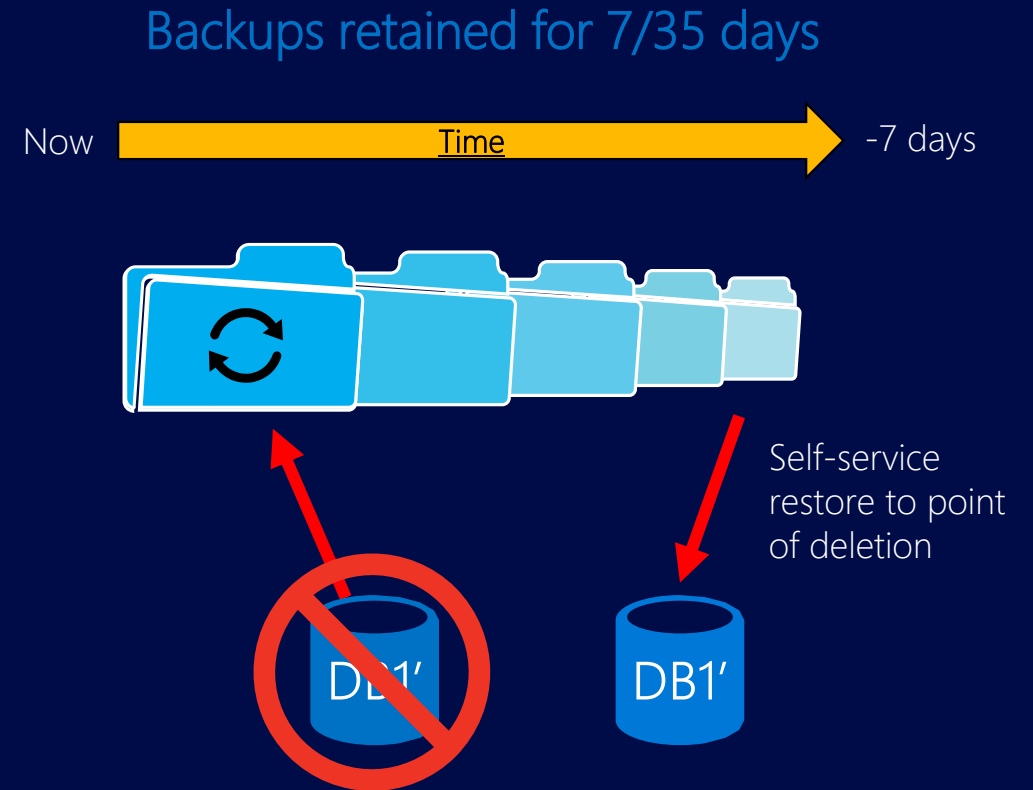
#2.1. Restore deleted database

Recovery after accidental database deletion

Restores the database to the point of deletion
(earlier backups are deleted)

Creates a new database on the server used by
the original database

You can choose to failover to the restored
database or use scripts to recover data



#2.2. Geo-restore protects from disaster

Built-in disaster recovery capability available for every database

- Self-service restore API
- Restores last daily backup
- No extra cost, no capacity guarantee
- $RTO \geq 24h$, $RPO = 24h$
- Database URL will change after restore



#3. Active geo-replication

Mission critical business continuity

Service levels	Basic, Standard and Premium Self Service
Readable Secondaries	Up to 4
Regions available	Any Azure region
Replication	Automatic, Asynchronous
Manageability tools	REST API, PowerShell, T-SQL or Azure Portal
Recovery Time Objective (RTO)	<1 hour
Recovery Point Objective	<5 mins
Failover	On Demand



Up to 4 secondaries

#4. SQL Database Failover Groups

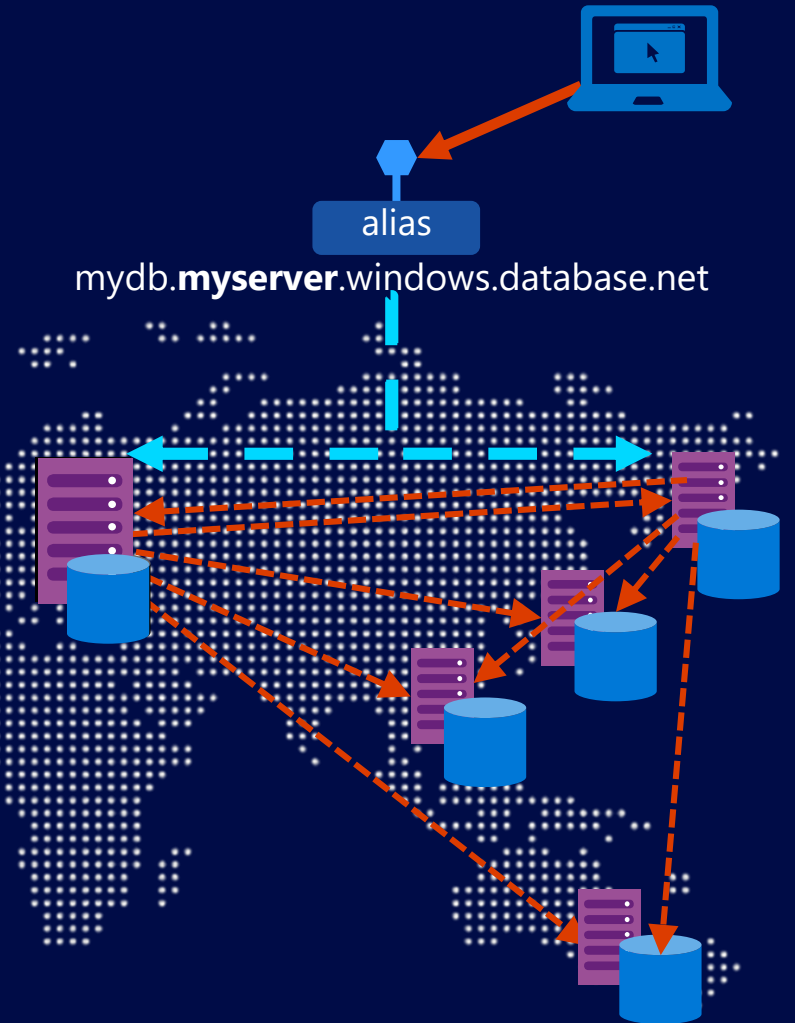
Extends geo-replication

Enable geo-replication for a group of databases within a server

Automatically or manually failover a group of databases supports active-active setup for pools

Provides for Read-write and read-only listener endpoints

All service tiers



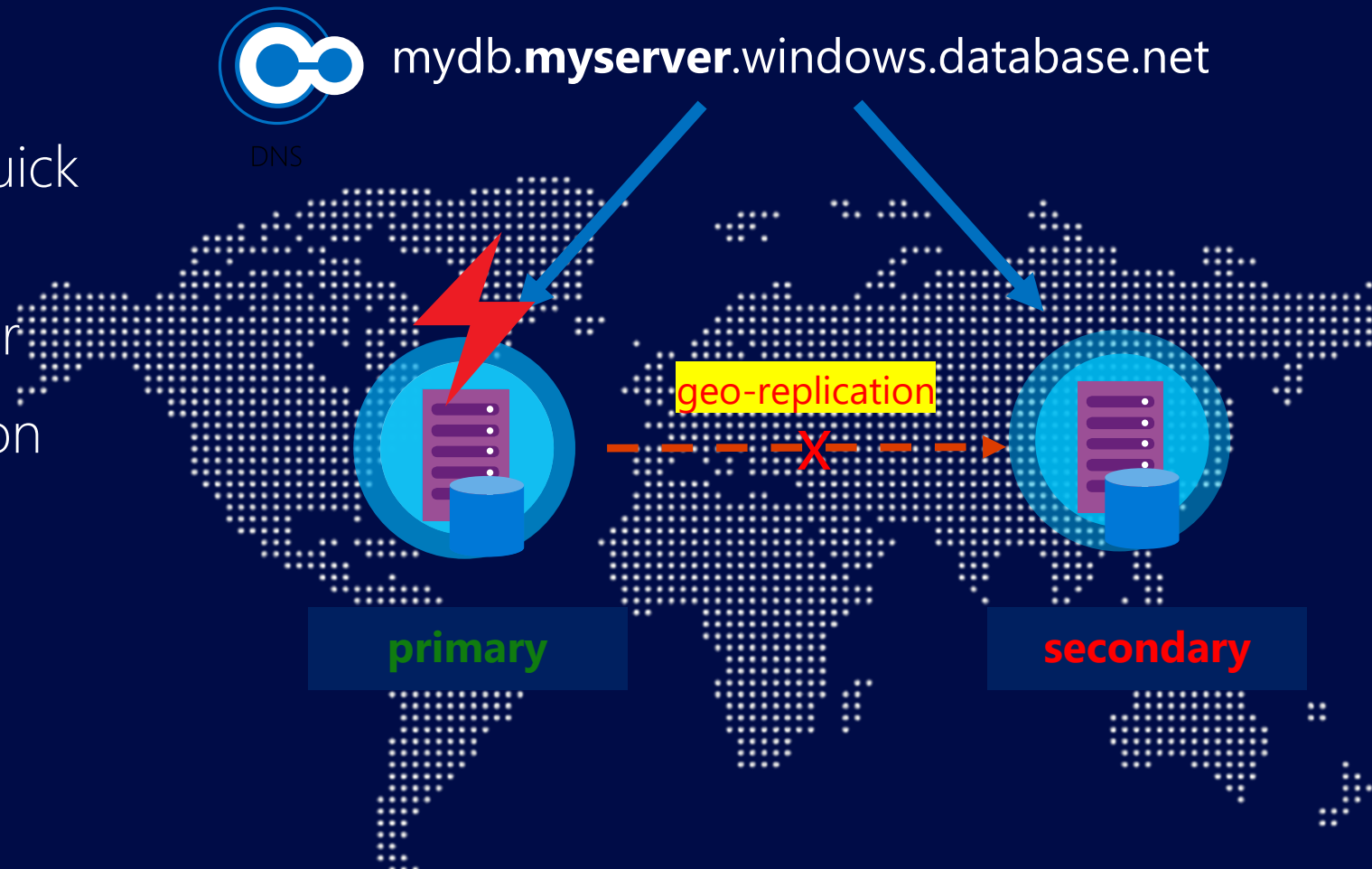
#4.1. SQL Database Failover Groups

Outage in primary region

Allows cross region isolation with quick
with minimal data loss

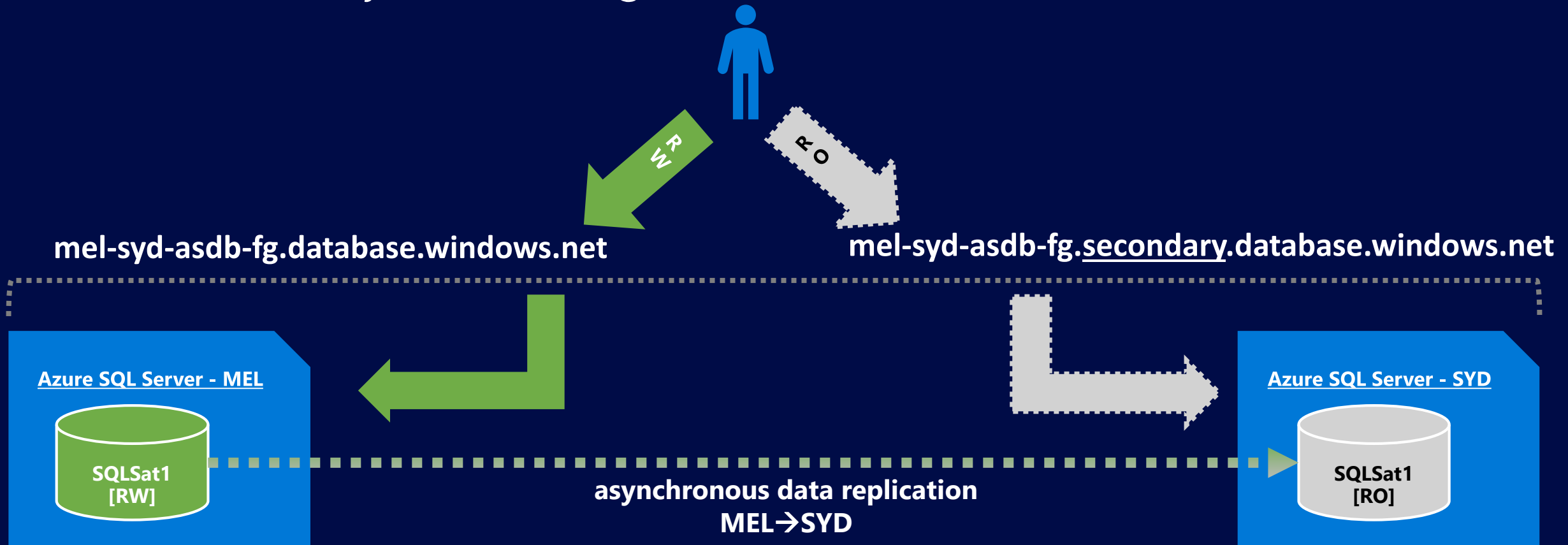
Automatic DNS swap during failover

Failover without changing application
code or connection strings



#4.2. Demo of SQL Database Failover Groups

- *First* - lets check some SQL DB options, and settings...
- *Then next* - lets deploy a new database into our failover group...
- *And then finally* - lets do a geo-failover with some active transactions!



#5. SQL Database in Availability Zones (AZ)

What is an Availability Zone (AZ)?

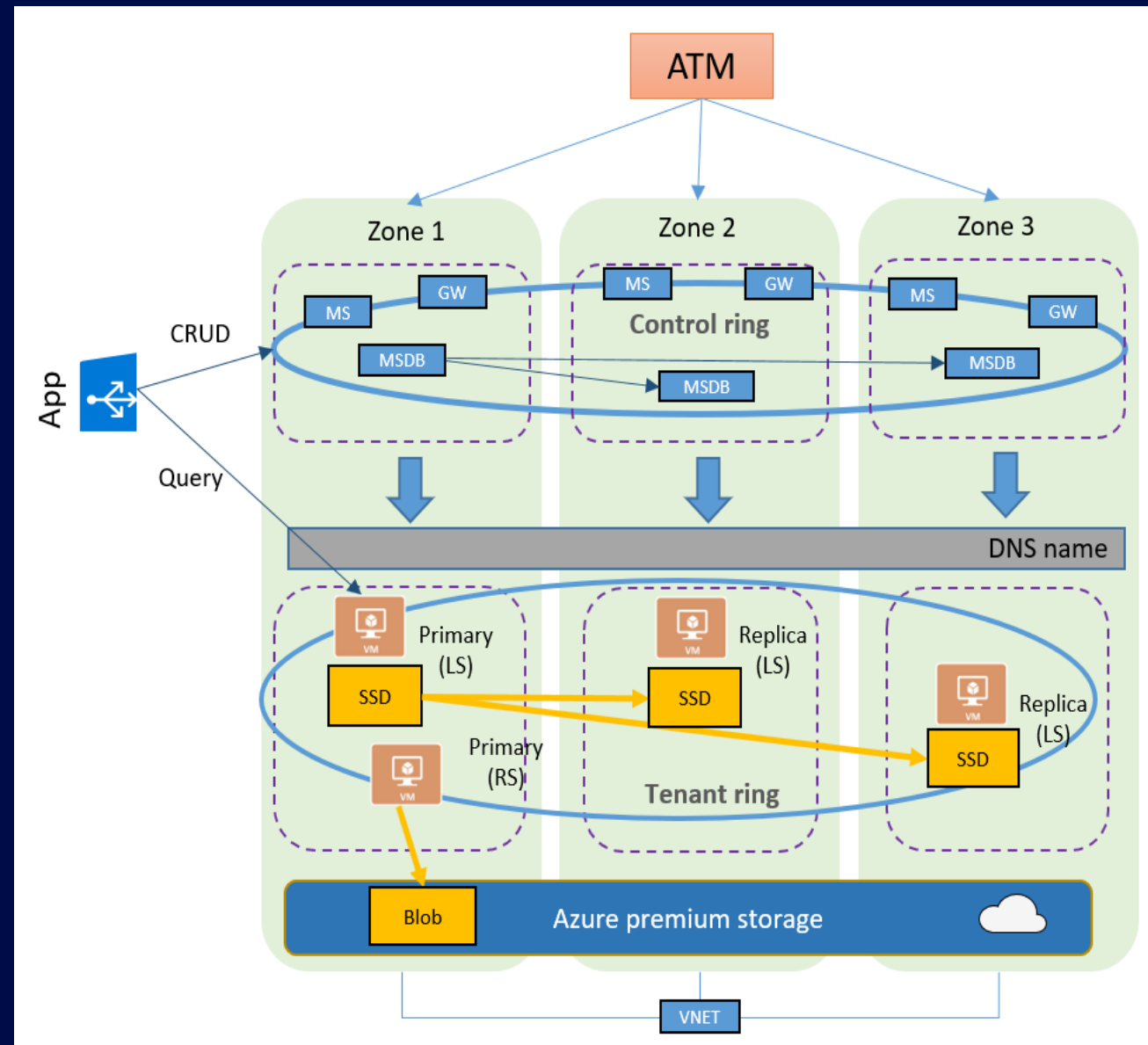
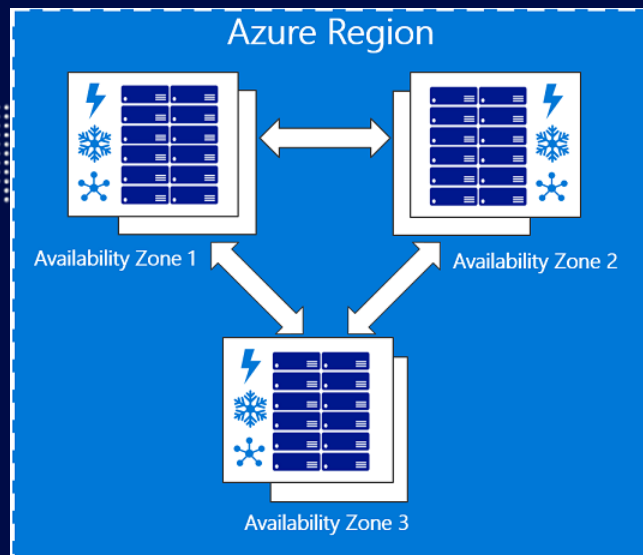
Unique physical location within an Azure region

Always at least 3x AZ in any supported Azure region

Each AZ is made up of at least 1x separate DC

Each DC has separate power, cooling, network, +

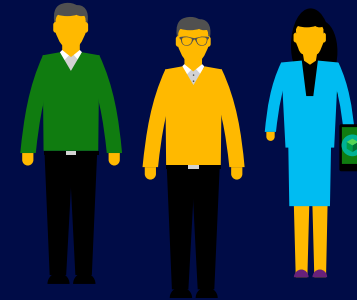
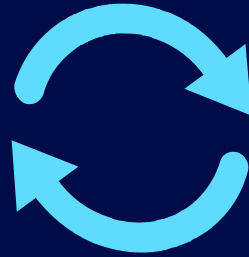
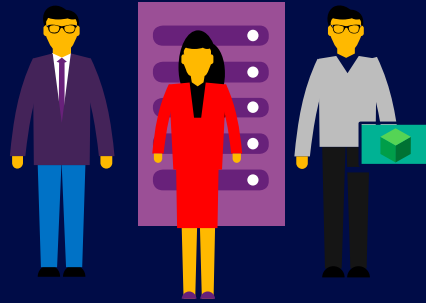
Adds the concept of "Zone Redundancy"



40. Activating HA & DR

Roles and responsibilities

Microsoft



You

Azure SQL Database

- Geo-distributed service
- Customer metadata protection and recovery
- Transparent high availability and data protection from local platform failures
- Automatic geo-distributed backups
- Automatic data synchronization of geo-replicated databases
- Platform compliance testing and certification
- Alert of impacted customers about their servers' degradation during regional failures

Customer (subscription owner)

- Detecting user errors and initiating point-in-time restore
- Planning, database prioritization, and region selection for disaster recovery
- Initiating geo-restore to selected region
- Initiating manual failover of geo-replicated databases
- Your own application DR plans and drills**

So what about validating failover/back?

1. **Firstly** → Azure does most of the heavy lifting
2. **Secondly** → you still need a plan!
3. **Thirdly** → Azure cannot simulate HA/DR failures

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-disaster-recovery>

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-disaster-recovery-drills>

50. Wrap up + Summary

Summary: *The Key Takeaway Points*

- Azure SQL DB provides 99.99% SLA OOTB and includes many HA automation features
- 3-4 extension options to provide DR
- Some DR options allow use of RO replicas
- Don't forget you still need a DR plan!

Appendix and References

Get Azure...?

- **Your Enterprise Agreement (EA)**
 - Various options – Currently being setup and configured for MLC
 - Would be linked to your corporate identity/login/account
- **Azure 30 day free account up to \$260 (time boxed to 30 days)**
 - <https://azure.microsoft.com/en-au/free/>
 - Would be linked to your personal identity/login/account
- **MSDN**
 - There are free monthly Azure credits within MSDN subscriptions. Rolls over month to month
 - <https://azure.microsoft.com/en-us/pricing/member-offers/msdn-benefits-details/>
 - Would be linked to your corporate identity/login/account
- **Research Programs and Grants**
 - Free credits available for specific research programs = <https://www.microsoft.com/en-us/research/academic-program/microsoft-azure-for-research/>
 - Apply for Microsoft Azure for Research Grant = <http://research.microsoft.com/en-us/projects/azure/default.aspx>

Learn Azure...? Free Online-Training

edX – Free online courses on Microsoft Azure

45+ Free Azure Courses = https://www.edx.org/course?search_query=azure

- Introduction to Azure - <https://www.edx.org/course/introduction-microsoft-azure-microsoft-azure201x>
- Architecting Azure Solutions - <https://www.edx.org/course/architecting-microsoft-azure-solutions-microsoft-dev205bx-3>
- Developing Azure Solutions - <https://www.edx.org/course/developing-microsoft-azure-solutions-microsoft-dev233-1>
- Developing Apps and Bots - <https://www.edx.org/course/developing-intelligent-apps-bots-microsoft-dat211x-1>
- Deliver a DW in the Cloud - <https://www.edx.org/course/delivering-data-warehouse-cloud-microsoft-dat220x-0>
- Delivery Big Data Solutions with Machine Learning - <https://www.edx.org/course/developing-big-data-solutions-azure-microsoft-dat228x>
- Provision SQL Databases in Azure - <https://www.edx.org/course/provisioning-databases-azure-sql-server-microsoft-dat219x-0>

Learn Azure...? Free 1x day In-Person Training

<https://azure.microsoft.com/en-us/community/events/?Country=Australia&query=azure+discovery+day>

Azure Discovery Days



Reserve your spot. Accelerate your learning.

Microsoft Azure is a growing collection of integrated cloud services – analytics, computing, database, storage, mobile, networking, the web – to help you move faster, work smarter and achieve more.

Its potential is unlimited if you know how to unlock it. Which is why we offer Azure Discovery Days; free sessions led by Microsoft Azure experts and built to help you extract extra value out of Azure.

Think big, then delve deeper

Each Discovery Day offers an Azure overview, plus primers on security, billing, identity, storage, networking and compute. We'll also cover these core topics.

- Administer Azure via the Azure Portal & PowerShell
- Create & configure VMs in Azure to connect securely to On-Premises
- Monitoring & Recovery Services
- Monitoring and operational Insights
- Automation and Azure Quick Start Templates
- MyApps portal & Self Service capabilities
- Multi Factor Authentication
- Protecting, encrypting, and tracking documents

Pick your city. Start your journey.

Learn Azure...? Patterns, Blogs and Feedback

***Need Azure Patterns and Guidance?* Check out the Azure Architecture Centre - !**

- <https://docs.microsoft.com/en-au/azure/architecture/>
 - Reference Architectures - <https://docs.microsoft.com/en-us/azure/architecture/reference-architectures/>
 - Application Architectures - <https://docs.microsoft.com/en-us/azure/architecture/guide/>
 - Azure Design Patterns - <https://docs.microsoft.com/en-au/azure/architecture/patterns/>
 - Azure Service Roadmap - <https://azure.microsoft.com/en-us/roadmap/>
 - Data Architecture Guide - <https://docs.microsoft.com/en-us/azure/architecture/data-guide/>

***Need Azure Updates?* Subscribe to the Global Azure Blog & Update Feed - !**

- Blog - <https://azure.microsoft.com/en-us/blog/>
- Updates - <https://azure.microsoft.com/en-us/updates/>

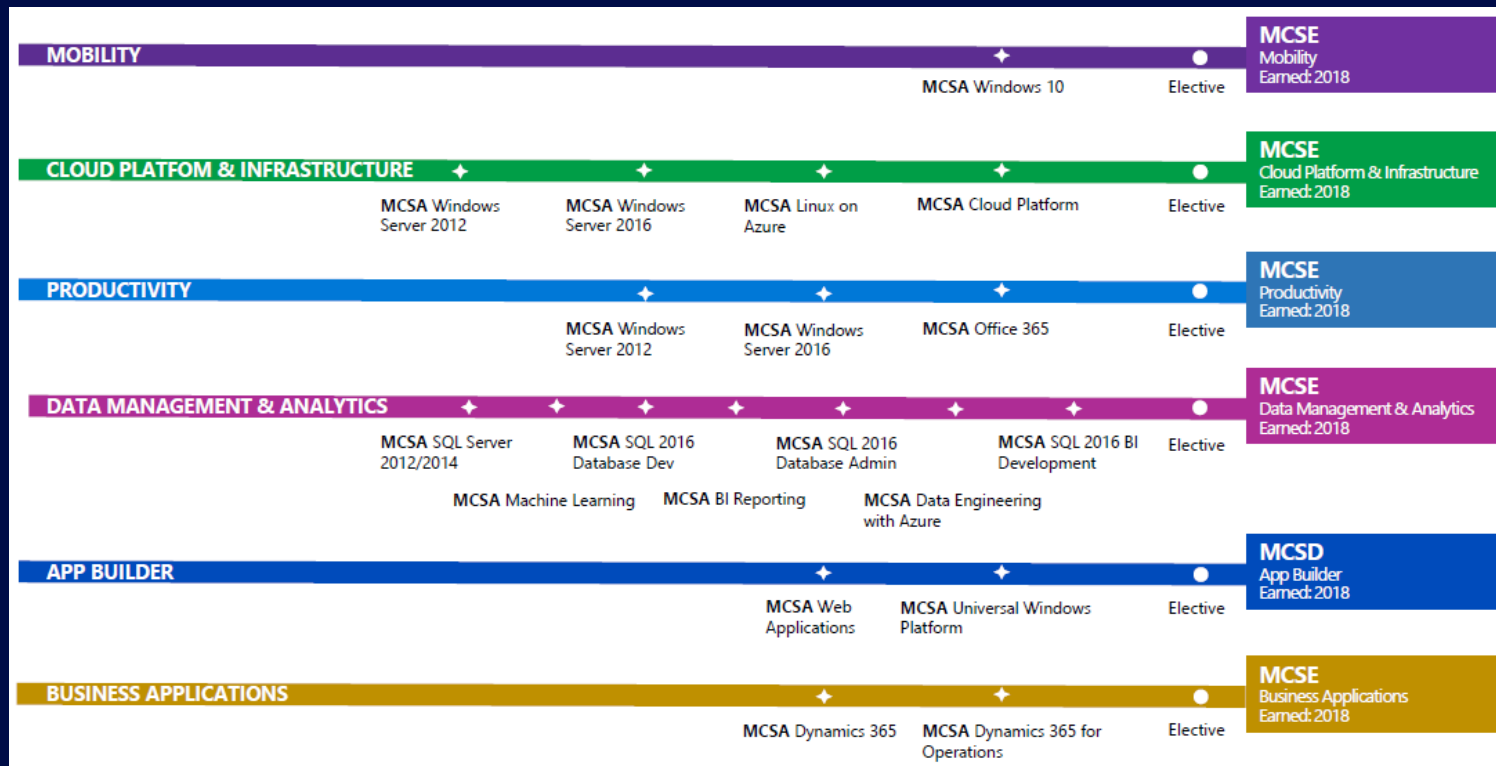
***You Have a Cool New Azure Idea?* Submit it to Azure Ideas & Feedback - !**

- <https://feedback.azure.com/forums/34192--general-feedback>

Certify in Azure...?

Azure Certifications

- Overview - <https://www.microsoft.com/en-au/learning/certification-overview.aspx>
- Detailed Guide - https://download.microsoft.com/download/2/B/F/2BFA3E78-546B-4C71-9EC3-2CB7751444BF/MCP_Cert_Paths_01_01_18.pdf

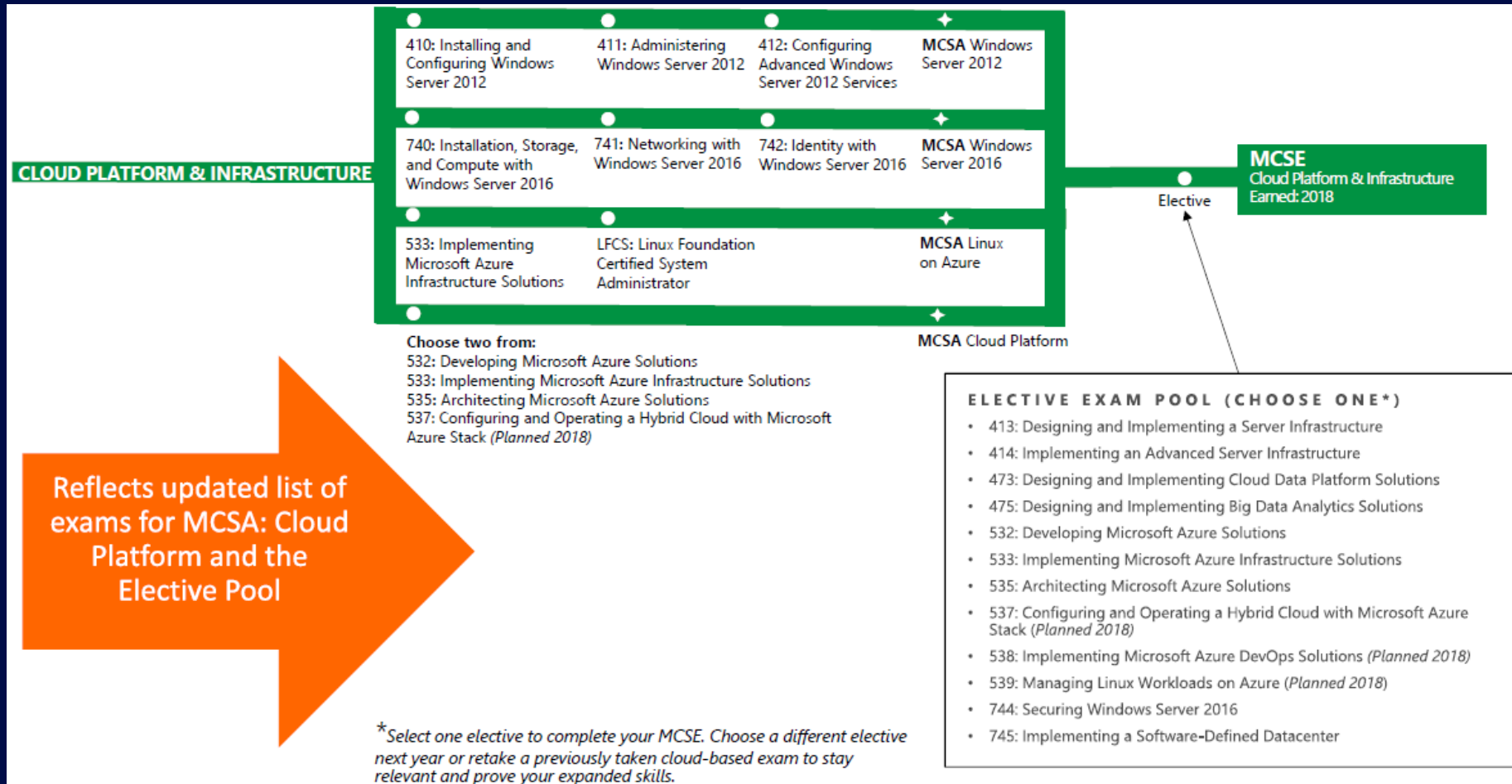


Recommended

Recommended

Certify in Azure...?

MCSE Cloud Platform & Infrastructure



Certify in Azure...?

MCSE Data Management & Analytics

