



# SQL Server on AWS

## *Lessons Learned From The Field*

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# Where can I run my SQL Server workloads on AWS?



## Amazon Relational Database Service (Amazon RDS)

Managed service with up to 96 vCPU, 488 -GB RAM, and 16-TB storage



## Amazon Elastic Compute Cloud (Amazon EC2)

Self-managed virtual machine with up to 128 vCPU, 4-TB RAM, and 400-TB storage

# Options for Deploying SQL Server on AWS



## Amazon RDS for SQL Server

- **Consider RDS first**
- Focus on business value tasks
- High-level tuning
- Schema optimization
- No in-house DB expertise
- Auto Host Replacement
- Multi-AZ Always On Support
- Read Replicas **NEW!!**
- SQL Component Services:
  - *Integration Services (in preview)*
  - *Analysis Services (in preview)*

Scaling
High Availability
Database Backups
DBMS Patching
DBMS Install/Maintenance
OS Patching
OS Install/Maintenance
Power, HVAC, net

AWS managed



## SQL Server on Amazon EC2

- Need full DB control
- BYOL For Licensing
- Replication
- Clustering
- Multi-Region AGs
- Distributed AGs
- RDS Options not available
- SQL Component Services:
  - *Reporting Services*
  - *Data Quality Services*
  - *Master Data Services*

Scaling
High Availability
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DBMS Patching
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OS Install/Maintenance
Power, HVAC, net

Customer managed

# SQL Server Features at a Glance



## Amazon RDS



## Amazon EC2

<b>Versions Supported:</b>	2012, 2014, 2016, 2017, 2019	All
<b>Editions Supported:</b>	Express, Web, Standard, Enterprise	All
<b>High Availability:</b>	AWS-managed with Always On Support	Self-managed; Always On, Mirroring...
<b>Encryption:</b>	Encrypted Storage using AWS KMS (all editions); TDE Support	
<b>Authentication:</b>	Windows & SQL Authentication	
<b>Backups:</b>	Managed Automated Backups	Maintenance Plans & 3 <sup>rd</sup> Party Tools
<b>Maintenance:</b>	Automated Software Patching	Self-managed
<b>Licensing Options:</b>	License Included (no free passive use rights)	License Included -or- Bring Your Own License
<b>SQL Component Services:</b>	SSIS ( <i>in preview</i> ), SSAS ( <i>in preview</i> )	SSRS, MDS, DQS

# License Optimization with Optimize CPUs



- Control active vCPUs and Hyper-Threading status when launching new EC2 instances
- Reduce the number of SQL Server licenses

Instance Type	Total vCPUs	Active vCPUs with Optimize CPUs	SQL Server license savings
r4.4xlarge	16	8	50%
r4.8xlarge	32	8	75%

\*Sample licensing example only

# Microsoft Licensing Strategy

## 1 License-included for Windows Server and SQL Server

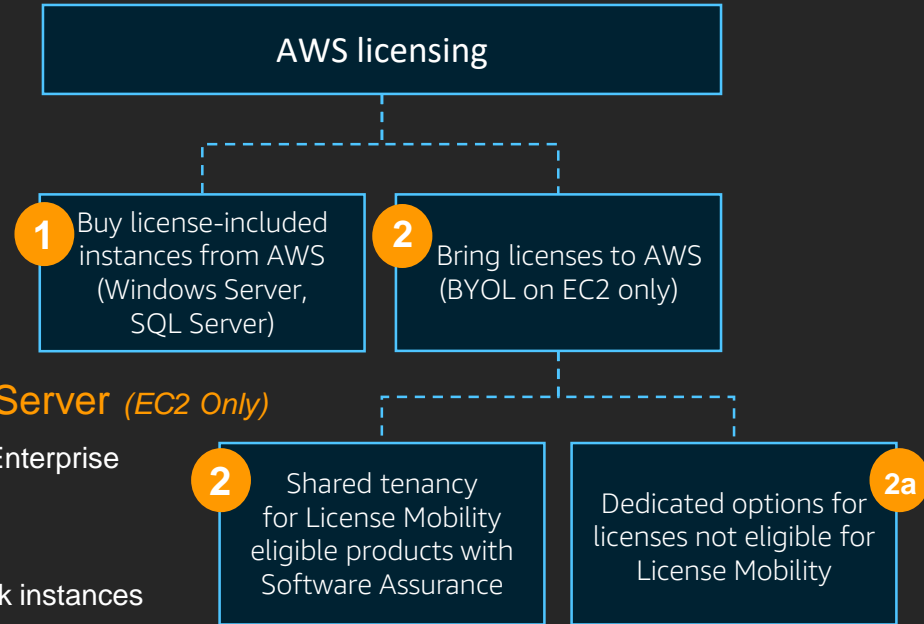
- Use for highly elastic workloads
- Great option for auto scaling up and down
- Can be used for SQL on RDS and EC2

## 2 Shared tenancy with License Mobility (EC2 Only)

- Leverage your existing SQL investment in AWS
- BYOL Passive instances do NOT require a SQL license

## 2a Dedicated Hosts for Windows Server and SQL Server (EC2 Only)

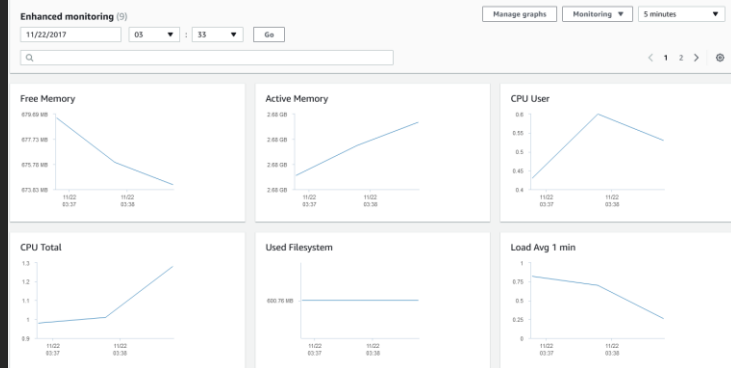
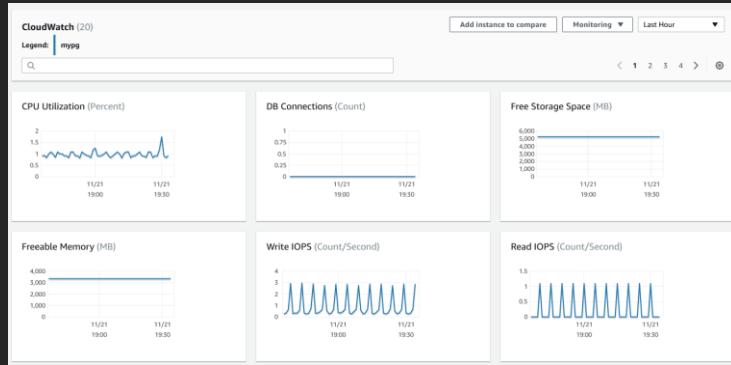
- BYOL for Windows Server Datacenter and SQL Server Enterprise maximize virtualization benefits (up to WinSrv 2019)
- SQL can still be any version at this time
- License just the dedicated host physical cores, then stack instances





# Common Questions For RDS SQL Server

# How do I monitor my Amazon RDS database?



Operating system process list Monitoring

Process list

Filter process list

1 2 3 4

NAME	VIRT	RES	CPU%	MEM%
postgres [3213]	1.04 GB	52.74 MB	0	1.33
postgres: rdsadmin rdsadmin localhost(28320) idle [1771]	1.14 GB	8.04 MB	0	0.2
postgres: logger process [3214]	67.42 MB	1.69 MB	0	0.04
postgres: checkpointer process [3216]	1.04 GB	26.22 MB	0	0.66
postgres: writer process [3217]	1.04 GB	9.51 MB	0	0.24

## Monitoring Options

Amazon CloudWatch metrics & alarms

Upload DB logs directly to CloudWatch Logs

Enhanced Monitoring for Amazon RDS

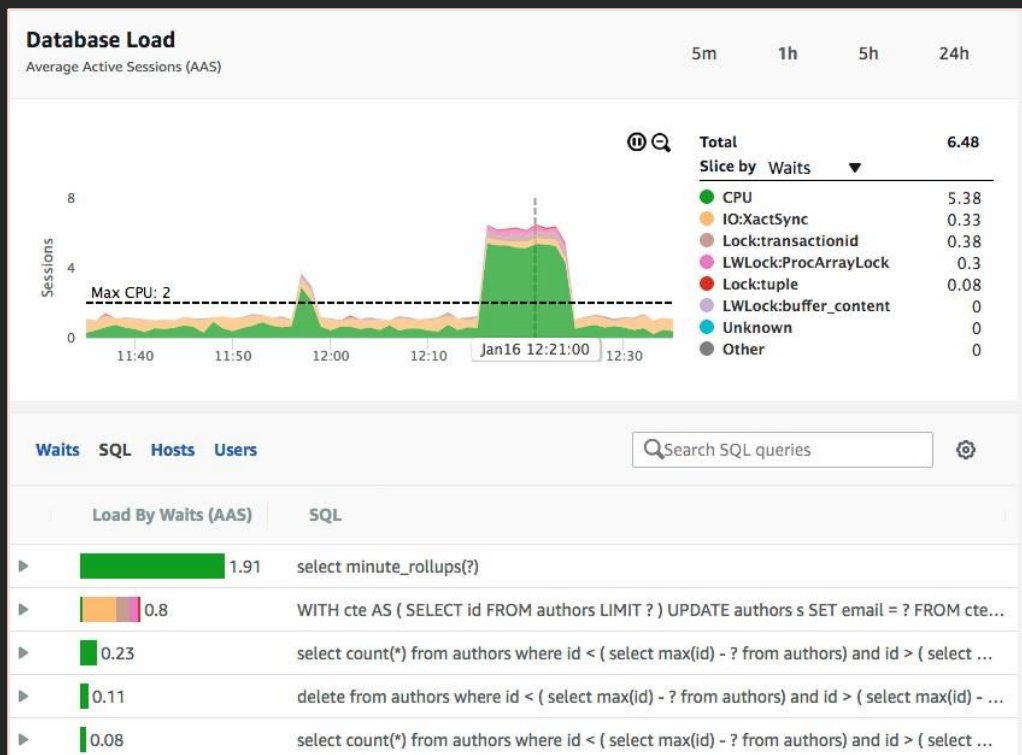
- Access to over 50 CPU, memory, file system, and disk I/O metrics
- As low as 1-second intervals

Integration with third-party monitoring tools



# How do I improve database performance?

## Introducing Amazon RDS Performance Insights



### DB load

- Average active sessions

### Identifies database bottlenecks

- Easy
- Powerful
- Top SQL/most intensive queries

### Identifies source of bottlenecks

### Enables problem discovery

### Adjustable timeframe

- Hour, day, week, and longer

# How do I know when service events happen?

RDS uses SNS to receive notification when an event occurs

## Notifications can be:

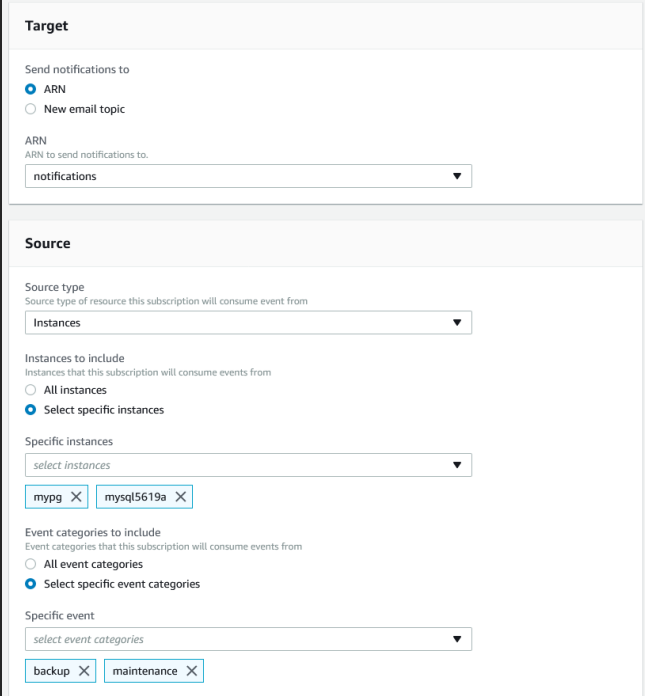
- Email, text message, or call to an HTTP endpoint

## Six different source types:

- DB instance, DB parameter group, DB security group, DB snapshot, DB cluster, DB cluster snapshot

## 17 different event categories:

- Availability, backup, deletion, configuration change, etc.



The screenshot shows the AWS SNS console configuration for a subscription. It is divided into two main sections: Target and Source.

**Target Section:**

- Send notifications to:**  ARN,  New email topic
- ARN:** ARN to send notifications to. A dropdown menu shows "notifications".

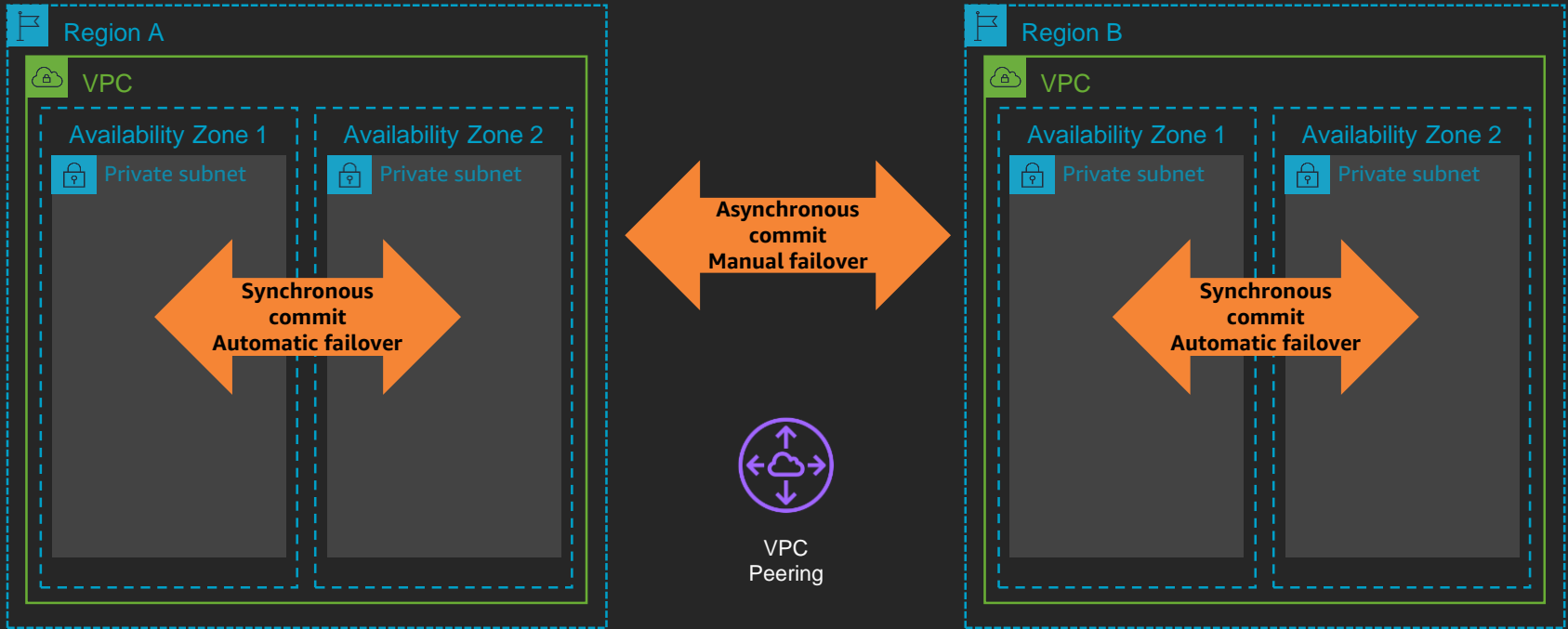
**Source Section:**

- Source type:** Source type of resource this subscription will consume event from. A dropdown menu shows "Instances".
- Instances to include:** Instances that this subscription will consume events from.  All instances,  Select specific instances
- Specific instances:** A dropdown menu shows "select instances". Below it, two tags are visible: "mypg" and "mysql5619a".
- Event categories to include:** Event categories that this subscription will consume events from.  All event categories,  Select specific event categories
- Specific event:** A dropdown menu shows "select event categories". Below it, two tags are visible: "backup" and "maintenance".

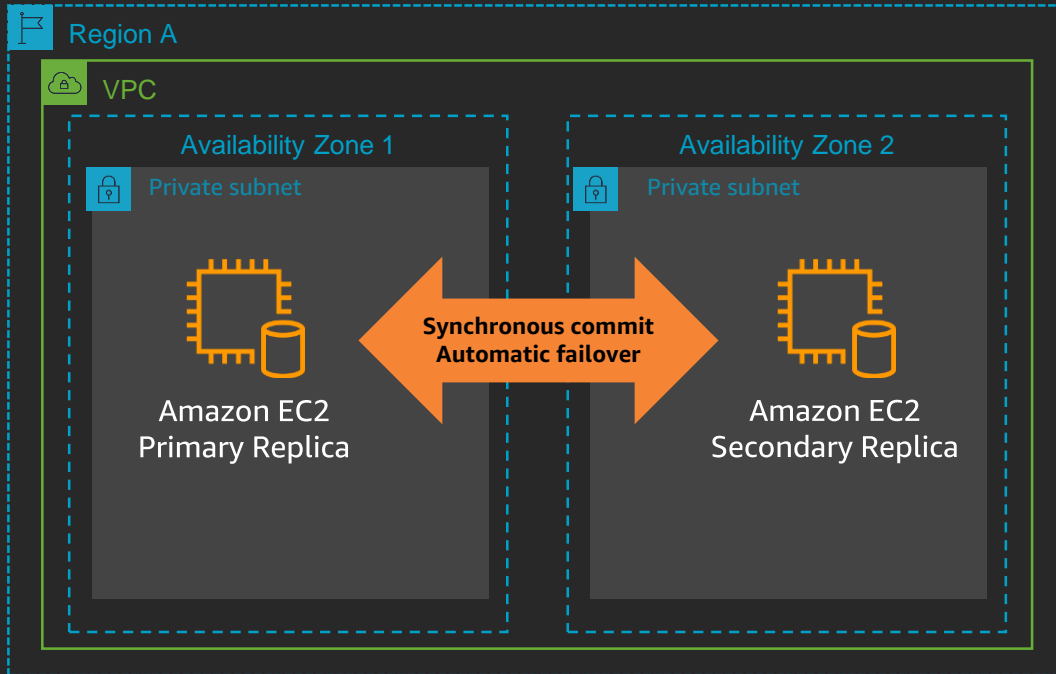
The background features a complex network of glowing blue and red lines, resembling a data network or circuit board. A bright, multi-colored light source (yellow, green, and blue) is visible on the right side, creating a lens flare effect. The overall color palette is dark blue and black, with the text in white.

# SQL Server HA / DR Designs

# High Availability and Disaster Recovery

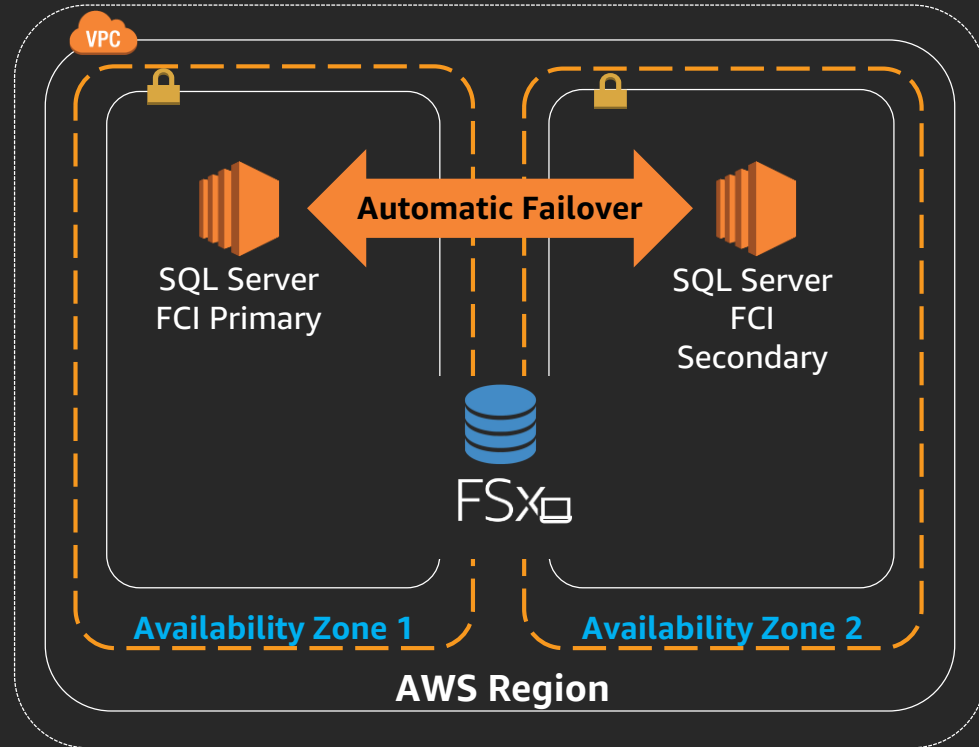


# Amazon EC2 Multi-AZ Always On Availability Group



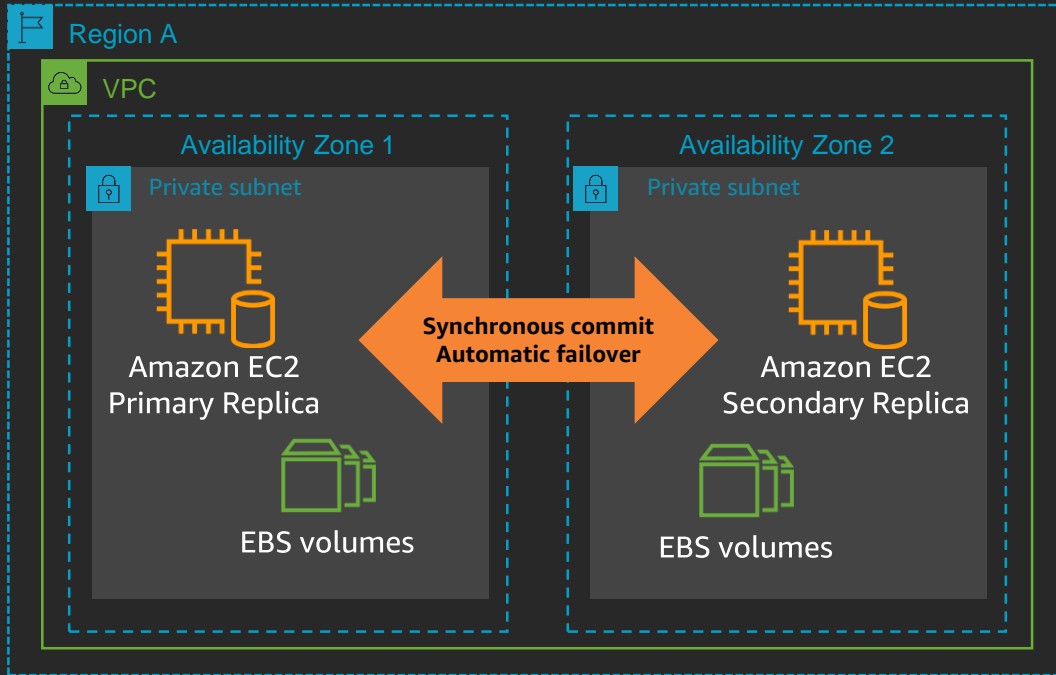
# Amazon FSx simplifies SQL Server HA deployments

With Amazon FSx there is no need to deploy, manage, and pay license fees for storage replication software solutions



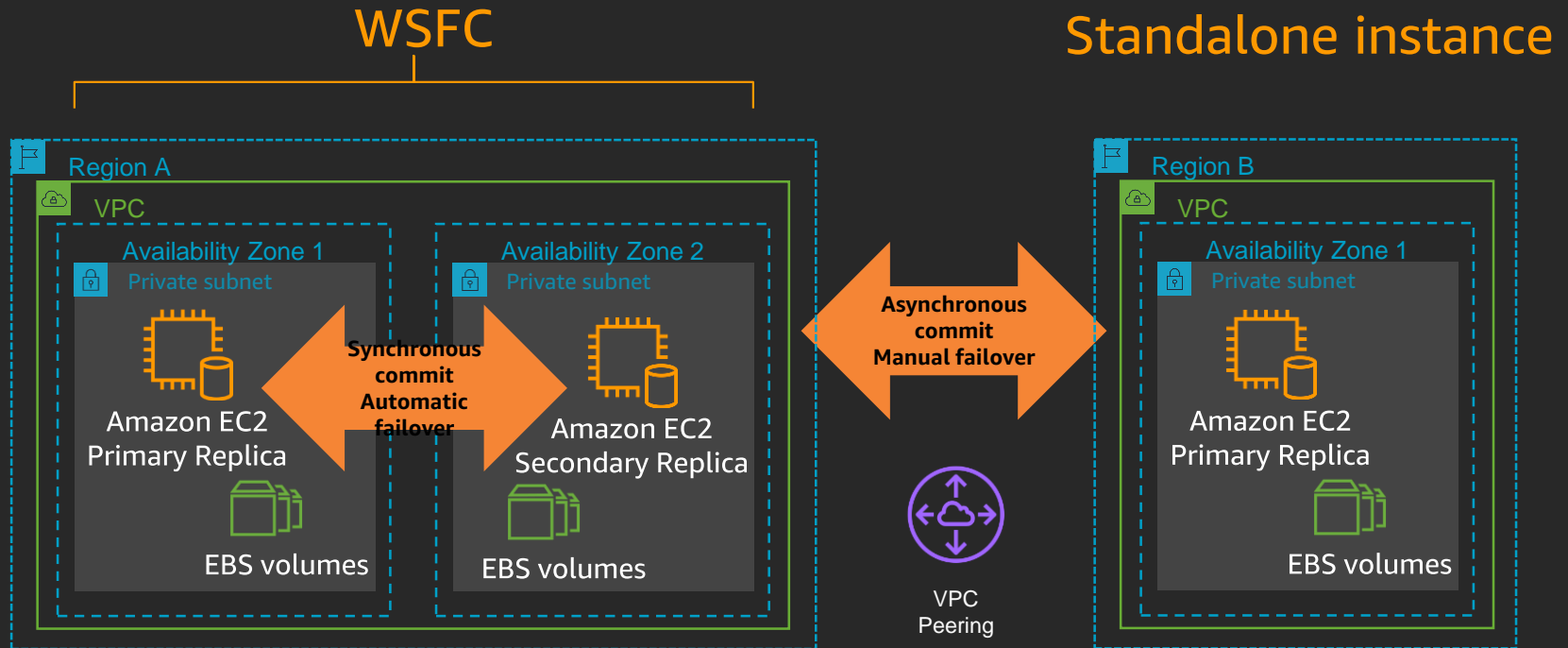
# Amazon EC2

## Multi-AZ failover cluster instances with SIOS DataKeeper



# Amazon EC2

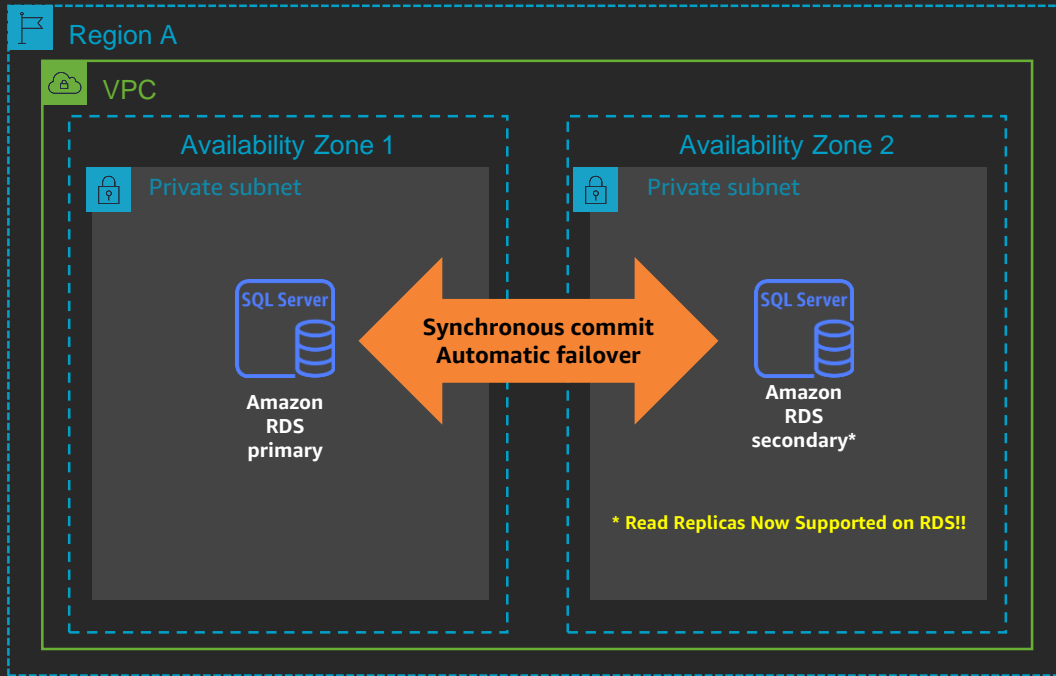
## Multi-Region disaster recovery with SIOS DataKeeper





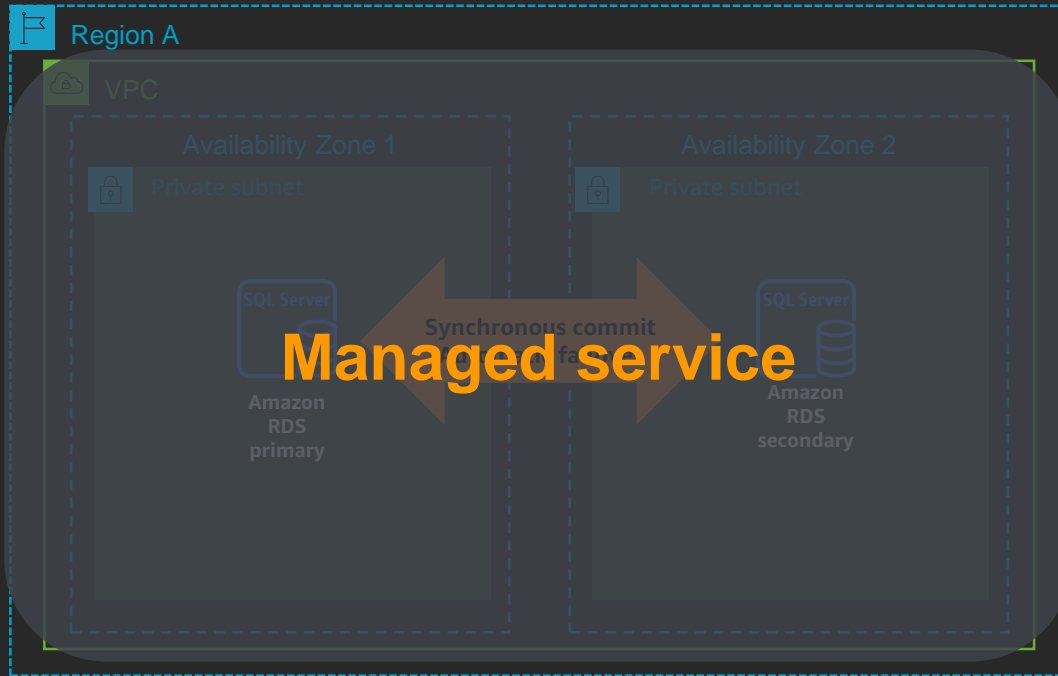
# Amazon RDS

## Multi-AZ SQL Server



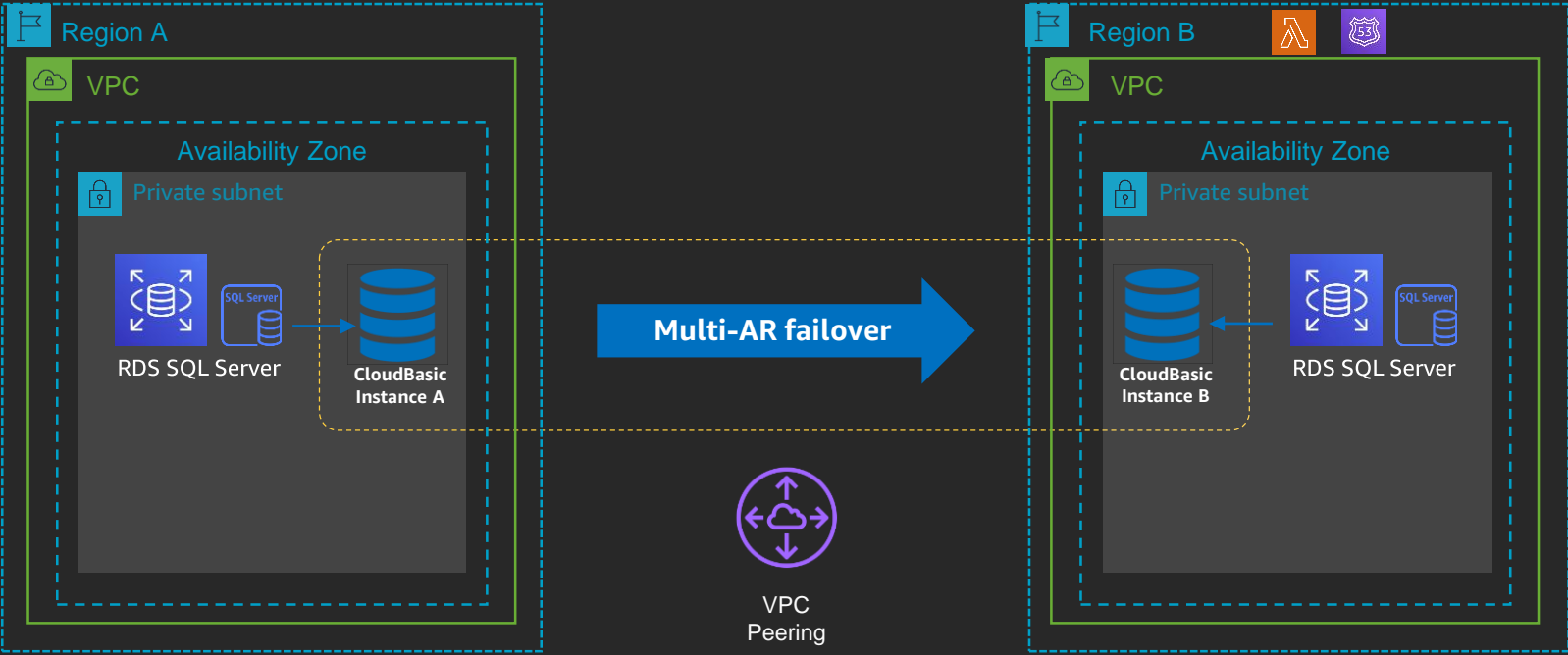
# Amazon RDS

## Multi-AZ SQL Server



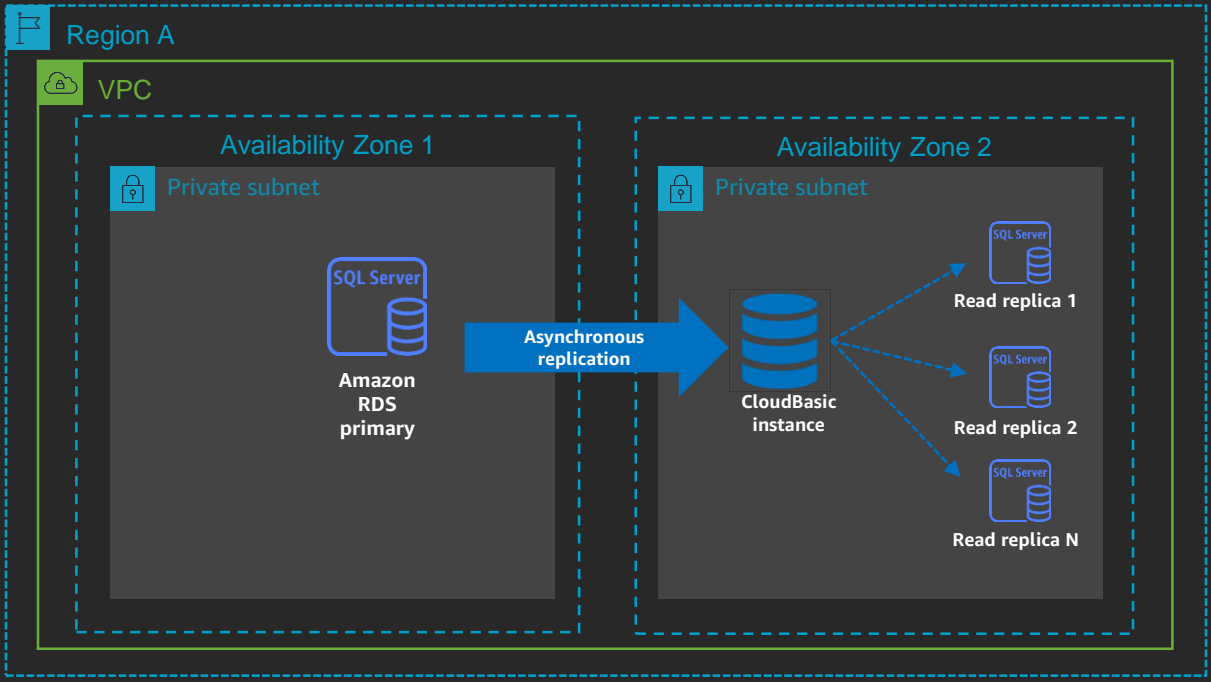
# Amazon RDS

## Multi-Region SQL Server Availability with CloudBasic



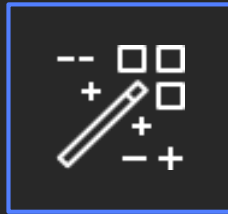
# Amazon RDS

## Multi-AZ SQL Server Read Replicas with CloudBasic



# AWS Launch Wizard for SQL Server

**Guided experience to size, configure, and deploy SQL Server Always on solutions on Amazon EC2.**



## AWS Launch Wizard



**Simple**

Easy GUI based interface for deployment



**End-to-end**

Size, deploy and configure your workload



**Tailored**

Workload is customized to your needs



**Automated**

Deployment is automated through a few easy steps



**Based on Best Practices**

Follows Well-Architected framework

# AWS Launch Wizard for SQL Server



## AWS Launch Wizard

Storage and Compute [Info](#)

AWS Launch Wizard > Deployments > test1016

### test1016

[Deployment Events](#) | [Summary](#)

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#### Details

Deployment name test1016	Key pair name SQL_Demo	Status Completed	Date created Wed Oct 16 2019
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#### Events

Event type	Description	Timestamp	Provisioning status	Cause of failure
Validation	Validate input specifications.	10/16/2019, 2:09:52 PM	Completed	-
Provisioning SQLHA resources	Creates the infrastructure for the application deployment	10/16/2019, 2:19:28 PM	Completed	-
Create AD stack	Creates the infrastructure for the application deployment	10/16/2019, 2:19:36 PM	Completed	-
Create RDGW stack	Creates the infrastructure for the application deployment	10/16/2019, 2:44:22 PM	Completed	-
Create SQL stack	Creates the infrastructure for the application deployment	10/16/2019, 2:44:23 PM	Completed	-
Create application resource group	Creates a resource group with all the application resources	10/16/2019, 3:57:51 PM	Completed	-
Setup WSFCAD permission	Configures the WSFC nodes with a SQL server database and creates AlwaysOn availability group	10/16/2019, 3:57:58 PM	Completed	-
Setup availability group	Configures the WSFC nodes with a SQL server database and creates AlwaysOn availability group	10/16/2019, 4:02:16 PM	Completed	-

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Back up   Gb





# Manage SQL Server License Usage with AWS License Manager

# AWS License Manager help for managing usage limits

Define rules for your licensed software from Microsoft, Oracle, IBM, SAP and others licenses and usage limits

Windows Server on AWS  
Show the license limiting by vCPU, physical cores, physical sockets, or number of instances

On-premises SQL Server  
Choose whether to enforce a license limit

The screenshot shows the AWS License Manager console. The top navigation bar includes the AWS logo, 'Services', 'Resource Groups', and user information. The main content area is titled 'Configuration settings' and includes a 'License configuration settings' section. Below this is a 'Search inventory' section with a search bar and a table of resources.

Resource ID	Resource type	Platform name	Platform version
i-0291e952a33b09339	EC2Instance	Microsoft Windows Server 2016 Datacenter	10.0.14393
i-02d0edb4fd58ab39b	EC2Instance	Microsoft Windows Server 2016 Datacenter	10.0.14393
i-0d6a9952780efaa1e	EC2Instance	Amazon Linux AMI	2018.03
mi-0145639d21b2dc3f4	ManagedInstance	Amazon Linux Bare Metal	2012.03

Below the table, there is a 'Number of vcpus' field set to 10 and an 'Enforce license limit' checkbox which is checked. The 'Next' button is highlighted in orange.

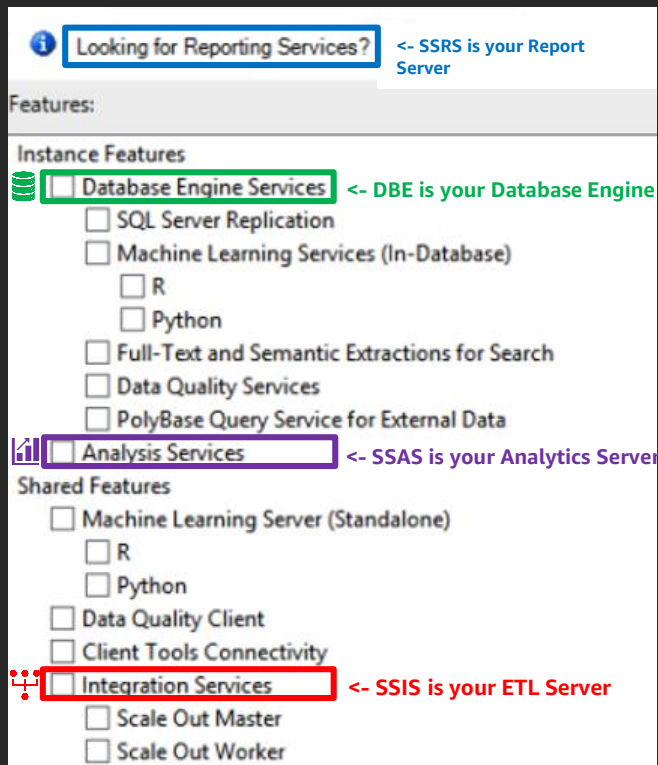




# The Birth of the SQL Monolith

# It's All Free If The DB Is Licensed Already, Right?

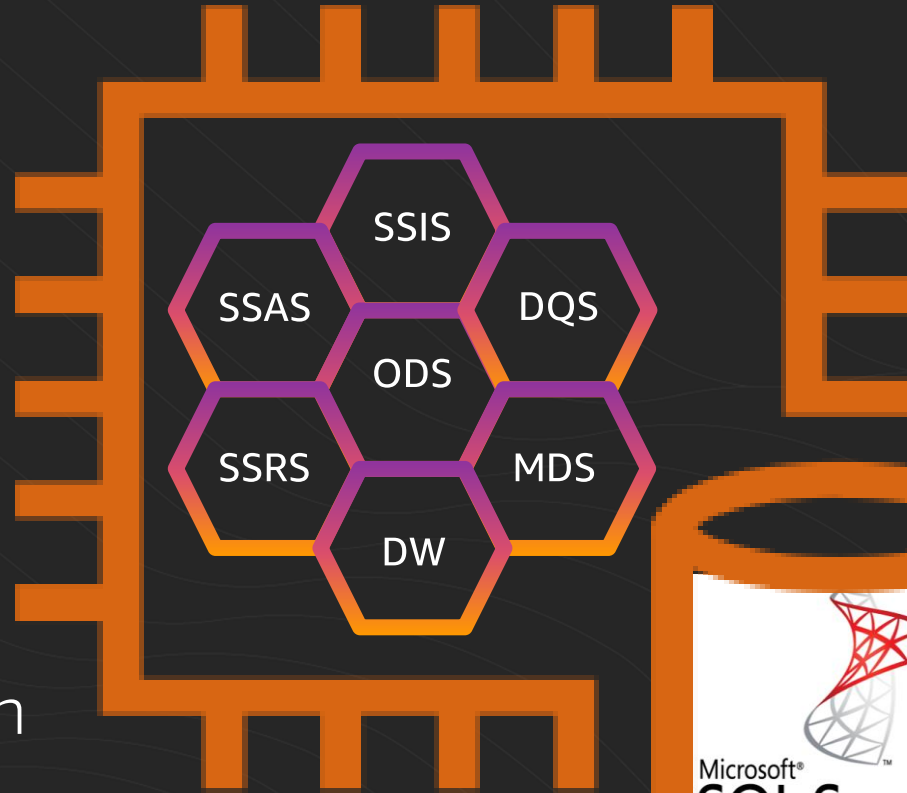
Just Check Mark **Everything** By Default When Installing SQL? **NO!!**



- Yes, installing ALL of these “SQL Components” on the same server doesn’t require additional licenses if it’s already big enough and licensed by the DB server, however:
  - Individually, you can usually use **Standard Edition** for each SQL component if they were on separate servers. Collectively, you’ll almost always require **Enterprise Edition** when you Total up the Cores, RAM, or capabilities of all the Components
  - Each of these components have unique **CPU, RAM, IO** and **Growth** patterns, but the **entire box requires scaling** when just one component needs more resources which happens very often and becomes **extremely expensive**
  - **ETL (SSIS) , Report Servers (SSRS), and Analysis Servers (SSAS)** could be moved to *separate servers / virtual machines* or even cloud based *managed services* that offer metered based pricing. **SSIS** is typically only run a few hours a day to prep the reporting, so it’s unnecessary to pay for SQL licensing as if it’s needed 24/7

The reality is, there are no free lunches. You can install and run the **add'l component** software for free on a big enough box that’s licensed for the **DB engine**, but what if you had another option to run managed services for everything except what’s in **green**, which is just what’s storing data, and only had to license that many cores. How small of a server would you need to accomplish that?

# What Is A SQL Server Monolith



**MONOLITH**

Does  
everything

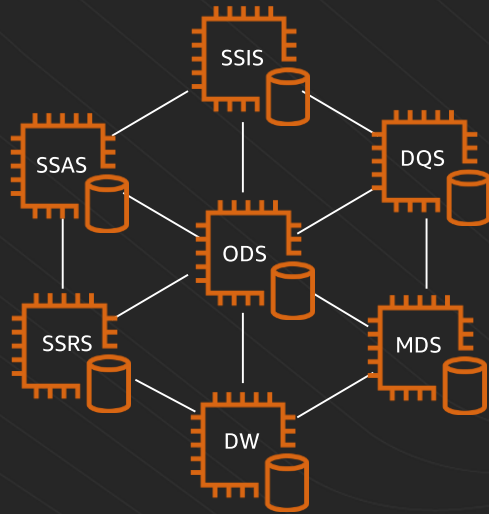
From a Monolith  
Instance...

Microsoft  
SQL Server



# SQL Server Workload Type Separation Has Significant Benefits

To **Workload-based Instances**



**Workload-based Instances**

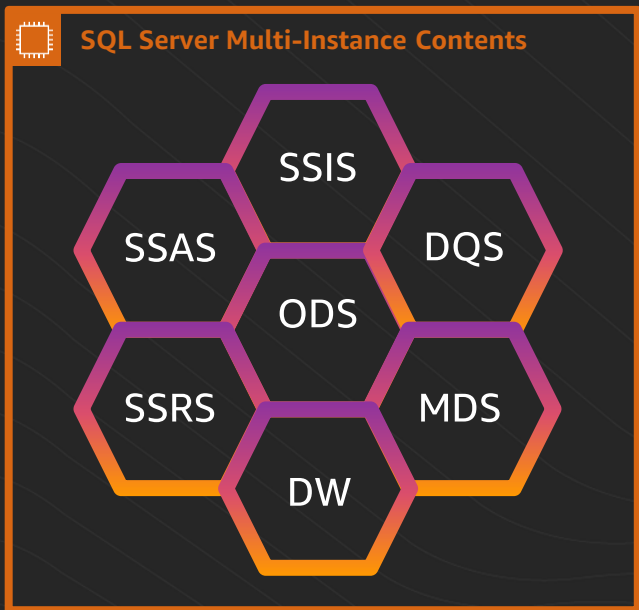
*Each instance sized to its workload's needs*

- Mix between SQL Standard and Enterprise editions based on the components features being used
- Individual workloads will likely have different HA/DR SLAs, eliminating oversizing
- Each workload can scale independently, eliminating a lot of unnecessary compute and licensing cost
- Scale Compute, Memory, Networking, and Storage independently from other workloads
- Create the opportunity to use Spot Instances, where applicable, to save up to 90% on the instance cost

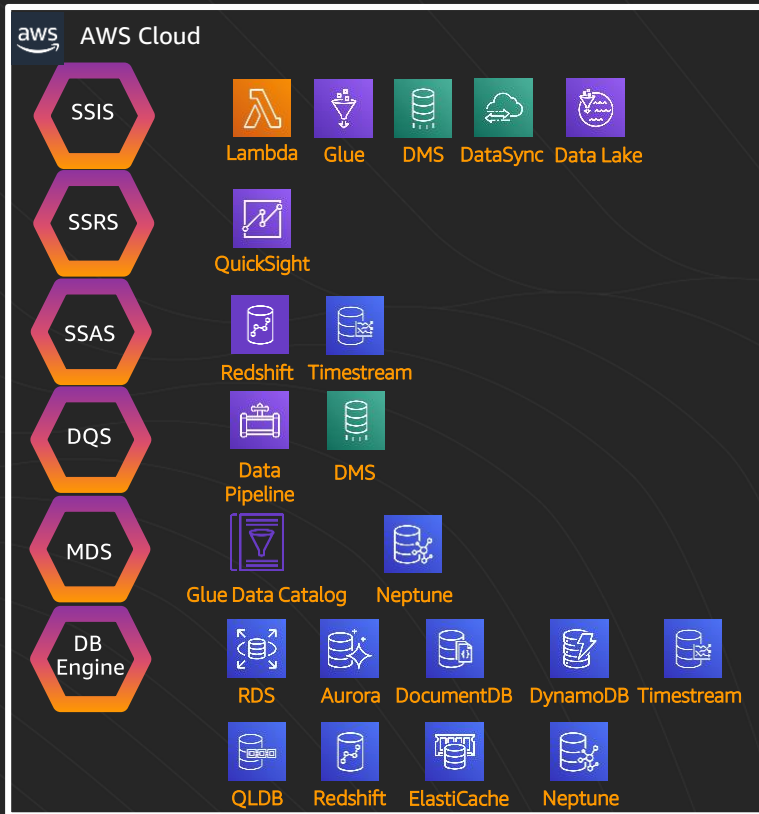
# Leverage AWS Managed Services Wherever Possible

*AWS Managed Services are already Highly Available, simplifying architecture/design and can significantly reduce overall cloud spend*

## SQL Monolith



## Options For Breaking Apart a Monolith



# AWS Has The Broadest Selection of Purpose-Built Databases



## Relational

Referential integrity, ACID transactions, schema-on-write

Lift and shift, ERP, CRM, Finance

Amazon EC2 SQL Server, Amazon RDS SQL Server, Amazon RDS, Amazon Aurora



## Key-value

High throughput, low-latency reads and writes, endless scale

Real-time bidding, shopping cart, social, catalog

Amazon DynamoDB

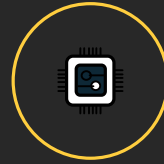


## Document

Store documents and quickly access querying on any attribute

Content management, personalization, mobile

Amazon DocumentDB



## In-memory

Query by key with microsecond latency

Leaderboards, real-time analytics, caching

Amazon ElastiCache



## Graph

Quickly and easily create and navigate relationships between data

Fraud detection, social networking, recommendation engine

Amazon Neptune



## Time-series

Collect, store, and process data sequenced by time

IoT applications, event tracking

Amazon Timestream



## Ledger

Complete, immutable, and verifiable history of all changes to application data

Systems of record, supply chain, healthcare, financial

Amazon QLDB

### Common use cases

### AWS service(s)



Here to help you build