



Running SQL Server workload on AWS

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9/24/2019

Choose the best service for your needs

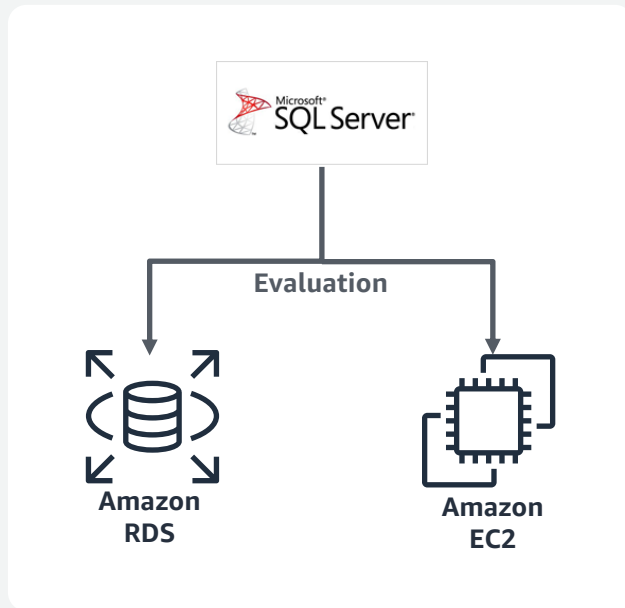
Amazon RDS SQL Server

Cloud-native solution

Focus on:

- Business value tasks
- High-level tuning tasks
- Schema optimization

No in-house database expertise



SQL Server on Amazon EC2

Need control over:

- DB instance & OS
- Backups, Replication
- Clustering
- **sysadmin** role

Need to use features, size or performance options not available in Amazon RDS

Options for deploying SQL Server on AWS



Amazon RDS for SQL Server

Your Responsibility:

- App Optimization and Tuning
- Deployment Orchestration

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

 AWS managed

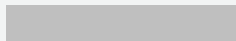


SQL Server on Amazon EC2

Your Responsibility:

- App Optimization and Tuning
- Deployment Orchestration
- Monitoring and Recovery
- High Availability
- Backups
- DB & OS Patching

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

 Customer managed

SQL Server features at a glance

	Amazon RDS for SQL Server	SQL Server on Amazon EC2
Versions Supported:	2008 R2 , 2012, 2014, 2016, 2017	All**
Editions Supported:	Express, Web, Standard, Enterprise	All**
High Availability:	AWS-managed	Self-managed; AlwaysOn, Mirror, Log Ship
Encryption:	Encrypted Storage using AWS KMS (all editions); TDE Support	
Authentication:	Windows & SQL authentication	
Backups:	AWS-Managed automated backups	Maintenance plans & 3rd party tools
Maintenance:	Automatic software patching	Self-managed

RDS for SQL Server

- You are DBO of all your databases
 - No SA access
- You must purchase licenses from AWS (No BYOL, even with SA)
- SSIS/SSAS/SSRS run on a separate instance
- Limitations on the number of databases per server:

Instance Class Type	Single-AZ	Multi-AZ with DBM	Multi-AZ with Always On AGs
db.*.large	30	30	30
db.*.xlarge to db.*.16xlarge	100	50	75
db.*.24xlarge	100	50	100

Performance planning

- SQL Server workloads typically benefit from large amounts of memory (caching)
 - Consider db.R4 - Memory Optimized instances
 - Edition and licensing may impact DB instance class options
- DB instances can be modified to change the DB instance class
 - Requires a reboot (or failover in Multi-AZ)
 - Can scale compute capacity with the workload, if practical
- DB instance can also be modified to change storage
 - Can modify size, type, and PIOPs
 - Size modifications available within minutes
 - Storage performance degraded during optimization

Storage & I/O performance

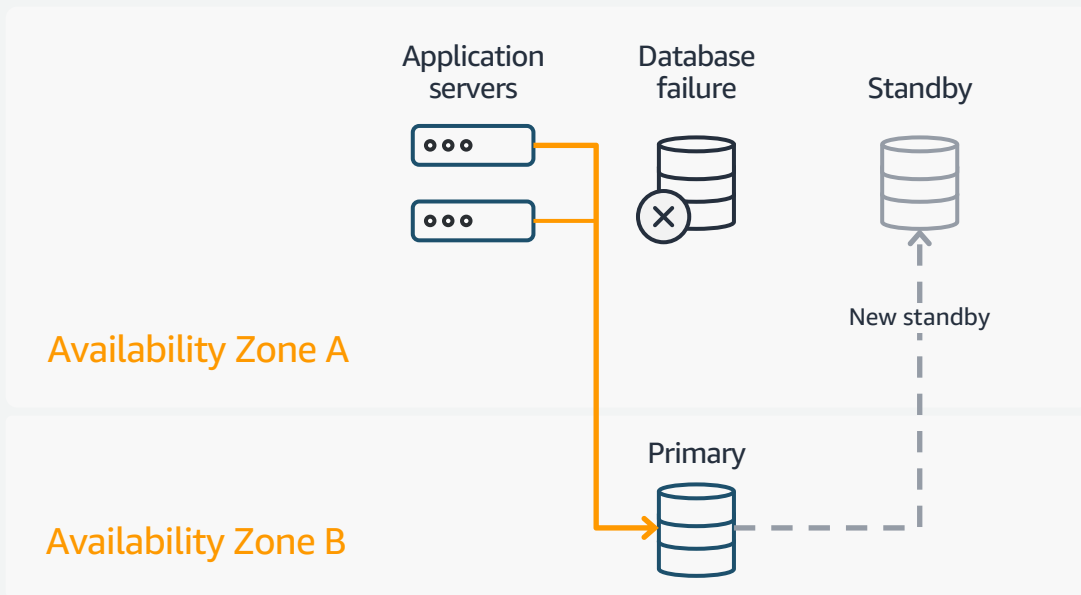
Amazon RDS			Amazon EC2			
Type	Size	Performance	Size	Performance	Burst Capacity	Pricing Model
General Purpose (SSD)	20 GiB – 16 TiB (min. 100 GiB recommended)	3 IOPS/GiB; max 16,000 IOPS; max. 250 MiB/s	1 GiB–16 TiB	3 IOPS/GiB; max 16,000 IOPS; max. 250 MiB/s	Yes, up to 3000 IOPS per volume, subject to credits (< 1 TiB in size)	Allocated storage
Provisioned IOPS (SSD)	100 GiB – 16 TiB (min. 200 GiB for Standard edition & up)	Up to max. 64,000 IOPS**	4 GiB–16 TiB	Max. 64,000 IOPS; max. 1,000 MiB/s*	No, fixed allocation	Allocated storage; Provisioned IOPS

* Nitro-based instance types, ½ for other instance types.

Amazon RDS Multi-AZ

Fault tolerance across multiple data centers:

- Automatic failover (typically, 1-2 minute)
- Requires 3 AZs (principal and secondary + witness)
- Leverages SQL Server DB Mirroring, or AlwaysOn Available Groups for Enterprise Edition 2016+*
- Consider mirroring impact on change heavy workloads

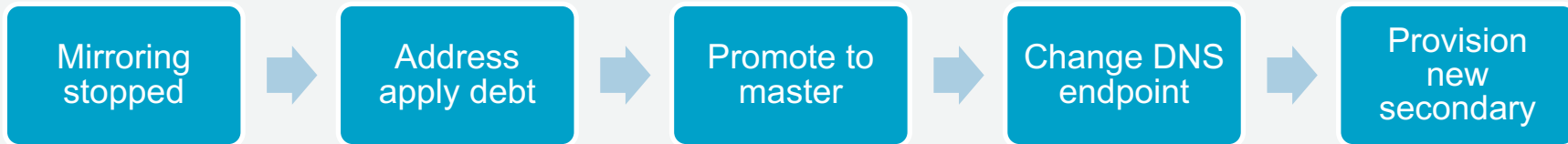


Amazon RDS Multi-AZ in depth

Failure scenarios mitigated:

- Loss of availability in primary AZ
- Loss of network connectivity to principal DB node
- Compute unit or storage failure on principal DB node

Failover process:



- Implement retry logic at the application layer – trigger manual failover to test
- Use AlwaysOn Multi-AZ availability group listener, and multi-subnet failover for faster failover

Database health at a glance

Amazon RDS comes with comprehensive monitoring built-in:

Amazon CloudWatch Metrics



Monitor core (CPU, memory) and transactional (throughput, latency) metrics

Enhanced Monitoring



Additional database-specific metrics at up to 1 second granularity

Performance Insights



Query and wait level performance data

Also use SQL Server Profiler & Tuning Advisor to trace query performance

Reliability

- **Automated backup and recovery**
 - Maximum retention: 35 days
 - Restore to any second, typically up to the last 5 minutes
 - Full DB instance snapshots & restore
- **Backup & Restore using .bak files**
 - Leverages SQL Server's native backup functionality
 - Full backups supported, limited support for differentials
 - Multi-part restore supported (new in 2019)

Manage the RDS SQL Server configuration

Parameter Groups

- Centralized management of DB engine parameters
- Ability to consistently apply configurations to DB instances
- Auditability of configuration
- Sensible defaults work for most use cases
- Ability to create custom parameter groups

Option Groups

- Used for enabling additional features
- Ability to create custom option groups
- Supported options:
 - Transparent Data Encryption (TDE) in Enterprise Edition only
 - S3 Backup & Restore

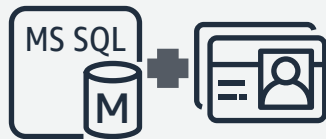
Using Windows Authentication

- Join RDS for SQL Server to a domain
- Domain provided by AWS Directory Services
 - Directory as a managed service
 - Deploy a Microsoft AD directory
 - Fully managed AD forest
 - Primary and secondary domain controllers in different AZs
 - Ability to establish forest trusts

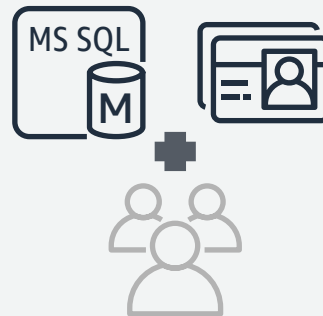
RDS for SQL Server deployment patterns



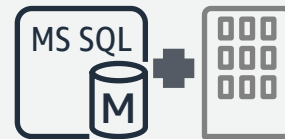
Standalone DB
Instance



Microsoft AD
integrated DB
Instance



Integration
with existing
Active
Directory
Infrastructure



Hybrid on-
premise and
AWS
deployment

Securing SQL Server on AWS

Layer	Controls
Network topology	Amazon VPC: Control subnets, AZ specificity (DB subnet groups), route tables and NACLs
Firewall	Security groups: Restrict instance traffic
Public access	Avoid it or limit it
Encryption	Forced SSL supported; Encrypted DB instances using AWS KMS , TDE, column-level, encrypt before saving
Resource control	Use AWS Identity and Access Management (IAM) to control instance lifecycle permissions, grant least privileges
Data access	Native SQL Server capabilities, SQL & Windows Auth.
Audit	Use AWS CloudTrail to log AWS API invocations Use SQL Server Audit to audit database and server operations



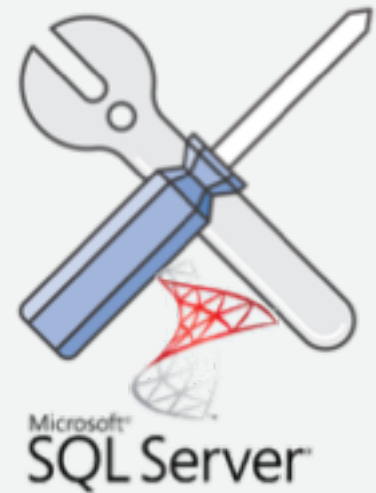
SQL Server Audit – **NEW** feature

SQL Server Audit supported for the following editions/versions:

- All supported by SQL Server except SQL Server 2008 R2
- Starting 2016 SP1 ALL editions for Database Level Audits
 - Server Level audits always supported for all editions
- Exports the audit records to your S3 bucket or on local EBS volume
- You can then process the records using normal SQL Server tools

Amazon RDS SQL Server tooling

- Manage using common tools: SQL Server Management Studio, sqlcmd, etc.
- Data source or target only for SSAS, SSIS and SSRS
- Maximum 30 databases per Amazon RDS instance
- Amazon RDS does not provide desktop, Administrator or file-system access to DB instances
- Not supported: Maintenance Plans, Database Mail, MSDTC
- Limited support for Linked Servers available



Migrating data to & from Amazon RDS

1

.BAK File Save & Restore

Leverages SQL Server's native backup functionality

2

AWS Database Migration Service

Minimize downtime during migrations, migrate between different DB platforms, Schema Conversion Tool

3

AWS Marketplace

Third-party data import and export tools and solutions



Thank You

More Information

Microsoft SQL Server on AWS

<https://aws.amazon.com/windows/products/sql/>

Deploying SQL Server on AWS (whitepaper)

https://d0.awsstatic.com/whitepapers/RDS/Deploying_SQLServer_on_AWS.pdf

Amazon RDS for SQL Server Supported Features

<http://amzn.to/2dHsNEU>

Implement Linked Servers with Amazon RDS

<http://amzn.to/2rdwlo3>

Implementing Microsoft Windows Server Failover Clustering and SQL Server AlwaysOn Availability Groups in the AWS Cloud

<http://docs.aws.amazon.com/quickstart/latest/sql/welcome.html>