SQL Server Availability

SQL 2016 new innovations

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## Mission-critical performance

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<td>Greater T-SQL surface area, terabytes of memory supported, and higher number of parallel CPUs</td>
<td>Sensitive data remains encrypted at all times, with ability to query</td>
<td>With SQL 2016 Standard Edition</td>
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<td>Real-time obfuscation of data to prevent unauthorized access</td>
<td>Distributed Availability Groups, automatic replica seeding, distributed transactions, automatic failover, load balancing, manageability</td>
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<td>TDE support for storage of In-Memory OLTP tables</td>
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<td>Enhanced auditing for OLTP with ability to track history of record changes</td>
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Mission-critical availability

- Reliable
  - Detects failures reliably
  - Handles multiple failures at once
- Integrated
  - Provides unified, simplified solution
  - Streamlines deployment, management, and monitoring
- Flexible
  - Reuses existing investments
  - Offers SAN/DAS environments
- Efficient
  - Allows use of HA hardware resources
  - Supports Fast, transparent failover
AlwaysOn

Failover Cluster Instances for servers

- Failover on SQL Server instance level
- Shared storage (SAN/SMB)
- Failover can take minutes based on load
- Multi-node clustering
- Passive secondary nodes

Availability Groups for groups of databases

- Failover on database level
- Direct attached storage
- Failover takes seconds
- Multiple secondaries
- Active secondaries
Failover Cluster Instances

- Server failover
- Shared storage
- Multi-node clustering
- Passive secondary nodes
- Failover in minutes
Availability Groups

Multi-database failover
Direct attached storage
Multiple secondaries
Active secondaries
Failover in seconds
Availability Groups + Failover Clustering

AlwaysOn:
Failover Cluster Instances and Availability Groups work together to ensure data is accessible despite failures.
Basic Availability Groups
Basic Availability Groups

Available in SQL Server 2016 Standard Edition or higher

Provides failover support for single database

Replaces database mirroring feature (now deprecated)

Single replica for primary database, using either synchronous or asynchronous commit mode

Support for hybrid environments, spanning on-premises or Azure

Enhancements in Always On Availability Groups
Greater scalability
- Load-balancing readable secondaries
- Increased number of automatic failover targets
- Log transport performance

Improved manageability
- DTC support with limitations
- Database-level health monitoring
- Group Managed Service Account
- Domain-independent Availability Groups

Improvements in Always On Availability Groups

Unified HA solution

- AG_Listener
- New York (Primary)
- Hong Kong (Secondary)
- New Jersey (Secondary)

Asynchronous data movement
Synchronous data movement
Load balancing in readable secondaries

In SQL 2014, read-only transactions routed by the Listener went to first available secondary.

Read-only routing lists can be configured to round-robin among specific set of secondaries (for each primary).

Availability
Database-level failover trigger

In SQL Server 2014, Availability Groups only monitor health of the instance.

Database can be offline or corrupt, but will not trigger failover as long as instance itself is healthy.

SQL Server 2016: Option to also monitor health of databases in Availability Group.

Databases going offline trigger change in health status.

You can now configure AlwaysOn Availability Groups for failover when database goes offline.

This change requires setting DB_FAILOVER option to ON in CREATE AVAILABILITY GROUP (Transact-SQL) or ALTER AVAILABILITY GROUP (Transact-SQL) statements.
gMSA support

Group Managed Service Accounts (gMSA)
- Automatically set domain scope for Managed Service Accounts
- Automatic password rotation
- Much more secure than regular domain accounts
- Enables cross-system security context

Why would I want a gMSA?
- No need to manually change passwords on all AlwaysOn instances

How does it work?
- Passwords are managed by domain

What versions will it be supported in?
- Supported in SQL Server 2014 and SQL Server 2016
Cross-Database Transactions and Distributed Transactions

Support for cross-database transactions within the same SQL Server Instance

Cross-database transactions within the same SQL Server instance are not supported for Always On Availability Groups

Support for distributed transactions

Distributed transactions are supported with Always On Availability Groups between databases hosted by two different SQL Server instances. It also applies to distributed transactions between SQL Server and another DTC-compliant server.

Availability Groups must be running on Windows Server 2016 or Windows Server 2012 R2. For Windows Server 2012 R2 you must install the update in KB3090973.

Availability Groups must be created with the CREATE AVAILABILITY GROUP command and the WITH DTC_SUPPORT = PER_DB clause.

Distributed transactions are not supported for database mirroring.

More than two auto-failover targets

Increasing scale of solution

Increasing resiliency

Now any sync secondary can be target for automatic failover

Total of three (up from two) auto-failover targets
Domain-independent Availability Groups

Environments supported:
- Cross domains (with trust)
- Cross domains (no trust)
- No domain at all

Cluster management via PowerShell only

SQL management as normal

Use of certificate-secured endpoints like DBM
Summary: Enhanced Always On

Capability
For scalability, SQL Server 2016 adds in load balancing of readable secondaries
Increases number of auto-failover targets from two to three

Benefits
Log transport performance has been improved
Support for Distributed Transaction Coordinator (DTC): Enrolled transactions for Availability Group databases with limitations
Database-level health monitoring
gMSA: Domain-level accounts that are automatically managed
Backup enhancements
Database Recovery Advisor

SQL Server Management Studio Database Recovery Advisor facilitates construction of restore plans that implement optimal correct restore sequences.

- Restore-plan algorithm: Improved for complex restore scenarios
- Point-in-time restores: Simplified restoration of database to given point in time, and automatically includes backups relevant to desired restore point
Backup to Azure block blobs

Backup to Azure (SQL Server 2012)

Benefits:
- Near “bottomless” storage
- Off-site, geo-redundant
- No device management
- Remote accessibility

Limitations:
- Backup size up to 1 TB
- Restore speed

Backup to Azure block blobs (SQL Server 2016)

2x cheaper storage
- Backup striping and faster restore
- Maximum backup size is 12 TB+
- Granular access and unified credential story (SAS URIs)
- Supports all existing backup/restore features (except append)
Managed Backup

In SQL Server 2016, Managed Backup to Microsoft Azure uses new block blob storage for backup files

Stripe backup sets, enabling backup file sizes up to 12.8 TB

Other changes and enhancements to Managed Backup:

- Managed Backup used for system databases
- Support for databases in full, bulk logged, and simple recovery model
- Support for both automated and custom scheduling of backups
- Customized backup schedules – full backup and log backup
Backups and Stretch Databases

Backup of Stretch DB is a “shallow” backup only (backup/restore of local SQL Server hot data only)

Stretch DB feature ensures remote data is transactionally consistent with local data after each restore

Upon completion of local restore, SQL Server reconciles with remote using metadata
