SQL Server Cloud Service

SQL 2016 new innovations

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## Hyperscale features

**Stretch Database**
Stretch operational tables in a secure manner into Azure for cost-effective historic data availability. Works with Always Encrypted and Row-Level Security.

**High availability**
Distributed availability groups add flexibility to HA/DR. Add Azure Replica Wizard makes it easy to implement.

**Enhanced backup to Azure**
Enhanced backup includes faster restore times and 50% reduction in storage. Supports larger DBs with block blobs and custom backup schedule with local staging.

## Simplicity

**Easy migration of on-premises SQL Server**
Simple point-and-click migration to Azure

**Suite of advisors for upgrading to SQL Server 2016**
SQL Server 2016 Upgrade Advisor in the adoption of new SQL Server features

## Consistency

**Common development, management, and identity tools**
Including Active Directory, Visual Studio, Hyper-V, and System Center

**Consistent experience from SQL Server on-premises to Microsoft Azure IaaS and PaaS**
### Hyperscale features

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| Stretch operational tables in a secure manner into Azure for cost-effective historic data availability. Works with Always Encrypted and Row-Level Security. | Easy migration of on-premises SQL Server  
Simple point-and-click migration to Azure                                                                                       | Common development, management, and identity tools  
Including Active Directory, Visual Studio, Hyper-V, and System Center                                                                                                                                 |
| High availability | Suite of advisors for upgrading to SQL Server 2016  
SQL Server 2016 Upgrade Advisor in the adoption of new SQL Server features                          | Consistent experience from SQL Server on-premises to Microsoft Azure IaaS and PaaS                                                                 |
| Enhanced backup to Azure | Enhanced backup includes faster restore times and 50% reduction in storage. Supports larger DBs with block blobs and custom backup schedule with local staging. |                                                                                                                       |
Ever-growing data, ever-shrinking IT

Massive tables (hundreds of millions/billions of rows, TBs size)
Users want/need to retain data indefinitely
Cold data infrequently accessed but must be online
Datacenter consolidation
Maintenance challenges
Business SLAs at risk

What to do?
Expand server and storage
Move data elsewhere
Delete

Hybrid solutions
Stretch SQL Server into Azure

Securely stretch cold tables to Azure with remote query processing

**Capability**

Stretch large operational tables from on-premises to Azure with the ability to query

**Benefits**

Cost-effective online cold data

Entire table is online and remains queryable from on-premises apps

No application changes

Support for Always Encrypted and Row-Level Security

Stretching history tables of Temporal Tables a great scenario
Stretch Database architecture

How it works

Creates a secure linked server definition in the on-premises SQL Server

Targets remote endpoint with linked server definition

Provisions remote resources and begins to migrate eligible data, if migration is enabled

Queries against tables run against both local database and remote endpoint

On-premises instance

Remote endpoint

Linked servers

Internet boundary

Local database

Local data

Eligible data

Remote data

Azure
Typical workflow to enable Stretch Database

-- Enable local server
EXEC sp_configure 'remote data archive', '1';
RECONFIGURE;

-- Provide administrator credential to connect to
-- Azure SQL Database
CREATE CREDENTIAL <server_address> WITH
  IDENTITY = <administrator_user_name>,
  SECRET = <administrator_password>

-- Alter database for remote data archive
ALTER DATABASE <database name>
  SET REMOTE_DATA_ARCHIVE = ON (SERVER = server name);
GO

-- Alter table for remote data archive
ALTER TABLE <table name>
  ENABLE REMOTE_DATA_ARCHIVE
  WITH ( MIGRATION_STATE = ON );
GO;

High-level steps

Configure local server for remote data archive

Create a credential with administrator permission

Alter specific database for remote data archive

Create a filter predicate (optional) to select rows to migrate

Alter table to enable Stretch for a table

Stretch Wizard in SQL Server Management Studio makes all this easy (does not currently support creating filter predicates)
Queries continue working

Business applications continue working without disruption

DBA scripts and tools work as before (all controls still held in local SQL Server)

Developers continue building or enhancing applications with existing tools and methods
Advanced security features supported

- Data in motion always via secure channels (TLS 1.1/1.2)
- Always Encrypted supported if enabled by user (encryption key remains on-premises)
- Row-Level Security and Auditing supported
Backup and restore benefits

DBAs only back up/restore local SQL Server hot data

StretchDB ensures remote data is transactionally consistent with local

Upon completion of local restore, SQL Server reconciles with remote using metadata operation, not data copy

Time of restore for remote not dependent on size of data
Current limitations that block stretching a table

- Tables with more than 1,023 columns or more than 998 indexes cannot be stretched
- FileTables or FILESTREAM data not supported
- Replicated tables, Memory-optimized tables
- CLR data types (including geometry, geography, hierarchyid and CLR user-defined types)
- Column types (COLUMN_SET, Computed columns)
- Constraints (Default and check constraints)
- Foreign key constraints that reference the table in a parent-child relationship. You can stretch the child table (for example Order_Detail)
- Full text indexes
- XML indexes
- Spatial indexes
- Indexed views that reference the table
### Order History

<table>
<thead>
<tr>
<th>Name</th>
<th>SSN</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jane Doe</td>
<td>cm61ba906fd</td>
<td>2/28/2005</td>
</tr>
<tr>
<td>Jim Gray</td>
<td>ox7ff654ae6d</td>
<td>3/18/2005</td>
</tr>
<tr>
<td>John Smith</td>
<td>i2y36cg776rg</td>
<td>4/10/2005</td>
</tr>
<tr>
<td>Bill Brown</td>
<td>nx290pldo90l</td>
<td>4/27/2005</td>
</tr>
<tr>
<td>Sue Daniels</td>
<td>ypo85ba616rj</td>
<td>5/12/2005</td>
</tr>
<tr>
<td>Sarah Jones</td>
<td>bns51ra806fd</td>
<td>5/22/2005</td>
</tr>
<tr>
<td>Jake Marks</td>
<td>mci12hh906fj</td>
<td>6/07/2005</td>
</tr>
<tr>
<td>Eric Mears</td>
<td>utb76b916gi</td>
<td>6/18/2014</td>
</tr>
<tr>
<td>Rachel Hogan</td>
<td>px61hi9306fj</td>
<td>7/1/2014</td>
</tr>
<tr>
<td>Sam Johnson</td>
<td>ol43bi506gd</td>
<td>7/12/2014</td>
</tr>
<tr>
<td>Michelle Burns</td>
<td>tx83hal916fi</td>
<td>7/29/2014</td>
</tr>
<tr>
<td>David Simon</td>
<td>43b99241</td>
<td>8/10/2014</td>
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</table>

### Summary: Stretch SQL Server into Azure

**Capability**

Stretch cold database tables from on-premises SQL Server databases to Azure with remote query processing.

**Benefits**

- Cost-effective historical data
- Entire table is online and remains queryable from on-premises apps
- Transparent to applications
- Support for Always Encrypted and Row-Level Security
High availability
Enhanced Always On Availability Groups

Unified HA solution

Greater scalability
- Load-balancing readable secondaries
- Increased number of automatic failover targets
- Log transport performance

Improved manageability
- DTC support with limitations (see Mission Critical section for details)
- Database-level health monitoring
- Group Managed Service Account
- Domain Independent Availability Groups
Domain Independent Availability Groups

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

On-premises databases can use AG with:
- Azure Blob Storage
- Azure VM with SQL Server 2016
Simplified Add Azure Replica Wizard

Automatic listener configuration

Previously listener configuration in Azure was manual

SQL Server 2016

Allows configuring availability group listener in Azure

Clients can connect to Azure replica after failover using listener name
Simplified Add Azure Replica Wizard

Add Azure Replica Wizard adds a replica of your databases to Azure Blob Storage

Group listener is created and configured within the wizard

Clients can seamlessly connect to the Azure replica after failover, as soon as the wizard completes its setup and without additional complex steps
Enhanced backup
Enhanced backup to Azure

Managed backup
Granular control of the backup schedule
Local staging support for faster recovery and resiliency to transient network issues
Support for system databases
Support for simple recovery mode

Backup to Azure block blobs
Cost savings on storage
Significantly improved restore performance
More granular control over Azure Storage

Azure Storage snapshot backup
Fastest method for creating backups and running restores
SQL Server database files on Azure Blob Storage
Managed backup

Support for system databases

Support for databases in simple recovery mode

Leveraging backup to block blobs: more granular control

Allows customized backup schedules: full backup and log backup
Customized scheduling

Step1: Run the Scheduling SP to configure custom scheduling

EXEC Managed_Backup.sp_backup_config_schedule
@database_name = 'testDB',
@scheduling_option = 'Custom',
@full_backup_freq_type = 'weekly',
@days_of_week = 'Saturday',
@backup_begin_time = '11:00',
@backup_duration = '02:00',
@log_backup_freq = '00:05'

Step2: Run the Basic SP to configure Managed Backup

EXEC msdb.managed_backup.sp_backup_config_basic
@database_name = 'testDB',
@enable_backup = 1,
@container_url = 'https://storage_account_name.blob.core.windows.net/container name',
@retention_days = 30
Backup to Azure block blobs

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

```
CREATE CREDENTIAL [https://<account>.blob.core.windows.net/<container>]
    WITH IDENTITY = 'Shared Access Signature',
    SECRET = 'sig=mw3K6dpwV%2BWUPj8L4Dq3cyNxCI'

BACKUP DATABASE database TO
    URL = N'https://<account>.blob.core.windows.net/<container>/<blob1>',
    URL = N'https://<account>.blob.core.windows.net/<container>/<blob2>'
```

Hybrid solutions
Backup to Azure with file snapshots

```
BACKUP DATABASE database TO URL = N'https://<account>.blob.core.windows.net/<container>/<backupfileblob1>'
WITH FILE_SNAPSHOT
```

Hybrid solutions
Backup to Azure with file snapshots

Available to users whose database files are located in Azure Storage

Copies database using a virtual snapshot within Azure Storage
Database data does not move between storage system and server instance, removing IO bottleneck

Uses only a fraction of the space that a traditional backup would consume

Very fast
Point-in-time restore with file snapshots

Traditional backup
Multiple backup types
Complex point-in-time restore process

Backup to Azure with file snapshots
Full backup only once
Point-in-time only needs two adjacent backups
Summary: Enhanced backup

Capability

Major backup enhancements in SQL Server 2016:

- Backup to Azure block blob
- Backup to Azure with file snapshots
- Managed backup

Benefits

- Cost savings on storage
- More granular control
- Simple and significant recovery process
- Minimize use of SQL Server resources to accomplish backup
# Hyperscale cloud

## Hyperscale features

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## Hyperscale cloud

- **Simplicity**
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  - Simple point-and-click migration to Azure
  - Suite of advisors for upgrading to SQL Server 2016
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- **Consistency**
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Migrate databases to Azure
Easily migrate to Microsoft Azure
Simple single-click migration experience

**User DB**
- Schema
- Data

**System objects**
- Logins
- Jobs
- Certificates

**SQL settings**
- Max. server memory
- Max. worker threads
- Default language
- Trace flags

**Capability**
- Along with schema and data, migrate other system objects (logins, jobs, and certificates)
- Migrate SQL Server settings (trace flags, default language, and memory settings)

**Benefits**
- Provide recommendations for image size and virtual machine size
- Literally as simple as point and click
Migration methodologies

Method 1
- Migrate a compatible database using SSMS

Method 2
- Migrate a near-compatible database using SAMW

Method 3
- Update database schema offline using Visual Studio and SAMW, and then deploy it with SSMS
Migrate an on-premises SQL Server database to SQL Database (v12)

The Migration Cookbook describes various approaches to migrate an on-premises SQL Server database to the latest SQL Database update (v12)

Download: [http://aka.ms/azuresqlmigration](http://aka.ms/azuresqlmigration)
Suite of advisors for upgrading
Upgrade workflow today

Upgrade is a complicated process with many considerations.

Most upgrades are actually “migration projects”.

Wave of SQL 2005 upgrades coming.

Upgrade Advisor focused on the “assess” phase: find functional blockers.
Suite of advisors

- Modern, scenario-driven user experience
- Suite of advisors
- Rules built on DACFx
- Modern telemetry and feedback pipeline
- Designed to move to a community project
- Upgrade Advisor and Stretch Database initial scenarios
- Independent install via WebPI or download center
- Auto-update notifications

Upgrade compatibility
Best practices
New features

Simplicity
Built on DACFx as a standard runtime
Cataloged and ported rules from all known tools
Designed to have community-written rules
Support for SQL Server 2005 (compat level 80)
HTML and CSV reports
Advisor for upgrade issues and recommendations

Analyzes instance for potential upgrade issues:
- Pre-upgrade issues
- Pre-upgrade recommendations
- Post-upgrade considerations

Delivers feature advisors

First scenario is Stretch Database Advisor

Guidance and customer feedback

New engine for defining guidance rules
Self-contained HTML results as well as CSV
Smaller, more frequent releases
New delivery methods
Built-in auto-update notifications
Customer feedback
Modern telemetry pipeline
Built-in feedback feature
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### Consistent experience from SQL Server on-premises to Microsoft Azure IaaS and PaaS
Consistent platform
Consistent and integrated platform

Virtualization
Complete data platform
Unified management and DevOps
Flexible development paradigm
Common identity
Consistent tools

Consistency across:

- On-premises, private cloud, public cloud
- SQL Server local, VM, SQL Database
- Scalability, availability, security, identity, backup and restore, and replication
- Plethora of data sources
- Reporting, integration, processing, and analytics

All supports hybrid cloud