PaaS

Azure SQL Database

Considerations before beginning

A bad query is always worth tuning

Differences between on-prem and Azure product

Partially supported

- CREATE/ALTER DATABASE
- CREATE/ALTER USER
- CREATE/ALTER LOGIN
- CREATE/ALTER PROCEDURE
- CREATE/ALTER FUNCTION
- CREATE/ALTER TABLE
- CREATE/ALTER VIEW
- CREATE TYPE
- KILL

Not supported

- Cross-database queries
- Linked servers, OPENQUERY, OPENROWSET, etc
- Data Collector
- Database Mail
- Replication
- Change Data Capture
- CLR
- Agent
- FILESTREAM
- Resource Governor
- Service Broker
- Profiler/trace
- ..and more

SLAs

- Uptime and connectivity are very different things!
- "We guarantee at least 99.99% of the time customers will have connectivity between their Basic, Standard, or Premium Microsoft Azure SQL Database and our Internet gateway."
- The longer connectivity is out, the bigger credit you get.
- SLA for SQL Database: https://azure.microsoft.com/en-us/support/legal/sla/sql-database/v1_0/

Pricing & Performance

Tiers

- Based on DTUs - Database Throughput Units
  - "How many transactions could be completed per second under fully loaded conditions"
- Combo of CPU, memory, reads, writes
- Benchmark: https://azure.microsoft.com/en-us/documentation/articles/sql-database-benchmark-overview/
- DTU calculator: http://dtucalculator.azurewebsites.net/ (Reviews are mixed.)

One database or many?

- Elastic pools
- Up to *X* number of databases can share *Y* DTUs
- Regular databases - DTUs
  - 5 – 4,000 DTUs
- Elastic database pools - eDTUs
  - 100 - 1,500 DTUs per pool

Do I want a single database or an elastic pool?

Characteristic	Single DB	Elastic Pool
Number of databases	One	Many, with same schema
Performance	Predictable	Each DB is varied
Cross-DB queries	Few to none	Many
Jobs	Use another tool	Use Elastic Jobs

Creating the DB

You will have to select

- Database name
- Server (existing or new) (No, this is *not* the same as a VM)
  - Name
  - Admin account
  - Location
  - Version
- Source
  - Blank
  - Backup - from your other Azure SQL Databases. Last full daily. Data up to 24 hours old. No, can't use a .bak.
  - Sample - you can run from AdventureWorks but it will find you.
- Tier
- Collation
- Resource group (Tied to that logical "server" you selected or created)

Demo

PowerShell

- Create Azure SQL Database.ps1

Creating a pool

- Go to your SQL server
- + New pool
- Name
- Pricing tier
- Configure - add database

Demo

PowerShell

- Create Azure elastic database pool.ps1

HA & DR

How HA works

- All writes are replicated to two or more nodes
- There is a high possibility of the database moving to another node in the middle of the day. All clients need to implement transient connection handling!
- Reference: Azure Business Continuity Technical Guidance https://msdn.microsoft.com/library/azure/hh873027.aspx
- Reference: Using the Transient Fault Handling Application Block with SQL Azure https://msdn.microsoft.com/library/hh680899(v=pandp.50).aspx

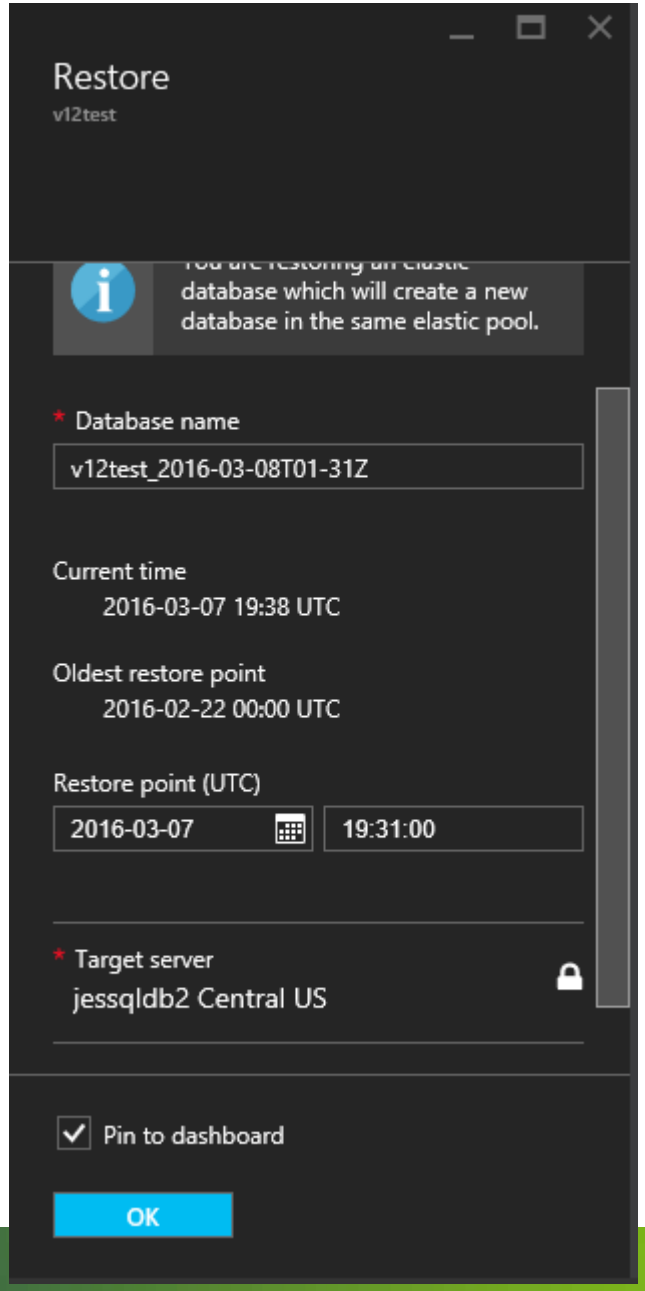
DR choices

- DR is based on your service tier
- Reference: Cloud business continuity and database disaster recovery with SQL Database https://azure.microsoft.com/en-us/documentation/articles/sql-database-business-continuity/

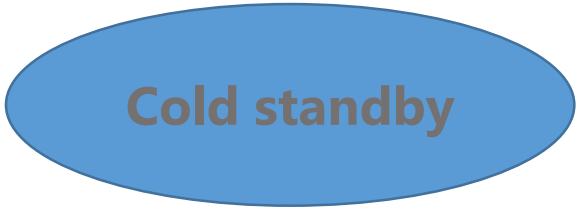
	Point in time restore	Geo-restore	Active Geo-replication
Basic	Any restore point in last 7 days	Yes	Yes
Standard	Any restore point in last 35 days	Yes	Yes
Premium	Any restore point in last 35 days	Yes	Yes

Point in time restore

- Always restores a new database with a different name
- How far back you can go depends on the tier



Geo-Restore



- Your backups are geo-replicated
  - Can have up to 1 hour data loss
- Used when there is an outage in a region
- Restore database to a new name
- Update connection strings
- Verify firewall rules
- Verify logins and users
- Reference: Azure SQL Database Geo-Restore https://azure.microsoft.com/en-us/blog/azure-sql-database-geo-restore/

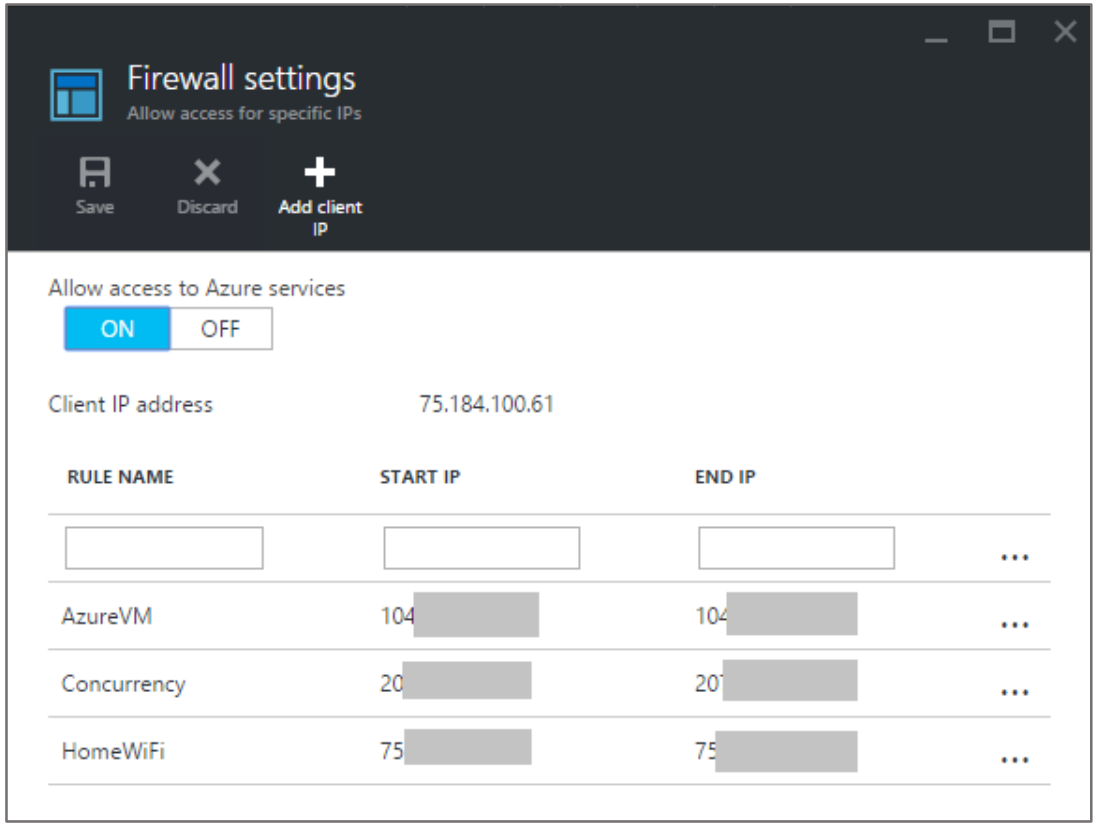
Active Geo-replication

- Data is asynchronously written to a secondary region
- Can have up to four secondaries
- Secondaries are online, readable
- In case of primary region outage, terminate the relationship with a secondary and make that secondary the primary
- Update connection strings
- Verify firewall rules
- Verify logins and users
- Reference: Spotlight on SQL Database Active Geo-Replication https://azure.microsoft.com/en-us/blog/spotlight-on-sql-database-active-geo-replication/

Configuring the DB

Firewall

- The SQL **server** is where you set your firewall rules
  - To make it easy, "Add client IP"
  - To all range of address, set up rule
- Can also use PowerShell, T-SQL
- I forget this frequently!
- Reference: Configure firewall settings on SQL Database using the Azure Portal https://azure.microsoft.com/en-us/documentation/articles/sql-database-configure-firewall-settings/



Connecting from SSMS/VS

- Portal > Database > Tools -> Open in Visual Studio
- Connect to the Server name in Visual Studio
  - View > SQL Server Object Explorer
  - Right-click > Add SQL Server
  - Download Visual Studio Community Free https://www.visualstudio.com/post-download-vs?sku=community&clcid=0x409
- Connect to the server name in SSMS
  - Download the latest release: https://msdn.microsoft.com/en-us/library/mt238290.aspx

Users

- You're going to add these with T-SQL – no GUI
- Reference: Manage database access and login security https://azure.microsoft.com/en-us/documentation/articles/sql-database-manage-logins/
- Reference: Connecting to SQL Database by Using Azure AD Authentication https://azure.microsoft.com/en-us/documentation/articles/sql-database-aad-authentication/
  - Requires Azure Active Directory
  - You really want Azure AD. Really.

Demo

Connecting the app

- Portal -> Database connection strings
  - ADO.NET
  - ODBC
  - PHP
  - JDBC
- Remember what I said earlier about "transient fault handling"

Moving data into the database

First things first - can it be migrated?

- Review the list of unsupported features

Methods for migrating

- Deploy Database to Microsoft Azure Database Wizard
- BACPAC export & import
- Transactional replication
- Reference: SQL Server database migration to SQL Database in the cloud https://azure.microsoft.com/en-us/documentation/articles/sql-database-cloud-migrate/

Deploy Database to Microsoft Azure Database Wizard

- Located in SSMS
- Doesn't give you any options or help to fix incompatibilities
- Reference: Use Deploy Database to Microsoft Azure Database Wizard (Demo) https://azure.microsoft.com/en-us/documentation/articles/sql-database-cloud-migrate-compatible-using-ssms-migration-wizard/

BACPACs

- Export data and schema to BACPAC, import data and schema from BACPAC
- Export schema to BACPAC, import schema from BACPAC; export data with BCP, import data with BCP (can do parallel loading)

Transactional replication

- SQL Database can only be subscriber
- Can replicate an entire database, or only a subset
- Best for migrations that require the least downtime

Maintenance

Maintenance

- Backups
  - Full backup weekly
  - Differential backup hourly
  - Transaction log backup every 5 minutes
- Restore
  - You can restore, but it's always to a different name
- CHECKDB
  - Should be done, but how will you schedule it?
- Indexes
  - You can REORGANIZE and REBUILD
  - How will you schedule it?

No SQL Server Agent! Oh noes!

Executing jobs

- Use SQL Server Agent
  - ...from an earthed or cloud VM.
  - Yep, you're paying for licensing.
- Azure Automation
  - Requires .NET and PowerShell - and you thought you weren't a developer!
  - You pay for it if jobs run for more than 500 minutes in a month
  - Reference: Azure Automation: Your SQL Agent in the Cloud https://azure.microsoft.com/en-us/blog/azure-automation-your-sql-agent-in-the-cloud/
- Elastic Database Jobs
  - Jobs are T-SQL
  - Scheduled with PowerShell
  - Logged
  - Reference: Elastic Database Jobs Overview https://azure.microsoft.com/en-us/documentation/articles/sql-database-elastic-jobs-overview/

Azure Automation

- Set up an Automation Account
  - Can have multiple – one for Web Apps and one for SQL Database; one for dev and one for prod
- Add a Runbook
  - Test it!
- Publish Runbook
- Schedule Runbook
  - Run once, daily, or hourly

Elastic Database Jobs

- Download & install Elastic Database Jobs PowerShell package - https://azure.microsoft.com/en-us/documentation/articles/sql-database-elastic-jobs-service-installation/
- Install services (Portal or PowerShell)
  - A resource group is created that contains a SQL Server and control SQL Database
- Create & schedule jobs with PowerShell
- Demo: Azure elastic database jobs https://www.pythian.com/blog/sql-edge-3-azure-elastic-database-jobs/

Monitoring & alerting

What

- Usage - DTUs, processor, memory, read/writes
- Connectivity - what connectivity % did you have?
- Performance - top queries, worst queries

How

- DMVs
  - Commands with *os* or *server* in the name now have *database* in the name
  - Examples: https://azure.microsoft.com/en-us/documentation/articles/sql-database-monitoring-with-dmvs/
- Portal
  - Add Tiles
    - Resource Utilization, Database Connections, Storage
- Alert Rules
  - Not very fine-grained
- SCOM
  - Windows Azure SQL Database Management Pack for System Center 2012
- 3rd party tools
  - SQL Sentry Performance Advisor
  - Dell Software Spotlight on SQL Server Enterprise

Add Alerts with PowerShell

- There are Azure RM cmdlets that let you add Alerts
- Thanks to Mike Fal for figuring this out and blogging it!
- http://www.mikefal.net/2016/08/23/creating-alerts-for-azure-sql-database-with-powershell/

Demo

Tools for troubleshooting and tuning

Tools for tuning

- Wait statistics
- Extended Events
- Plan cache
- Query Store
- Query Performance Insight
- SQL Database Advisor

Wait statistics

- "What resource(s) is my database waiting on?"
- sys.dm_os_wait_stats is valid, but won't return helpful information
- Use sys.dm_db_wait_stats instead
- Current since database was created, moved, or taken offline
- Capture on a regular basis and store in a table for later querying

Extended Events

- Capture detailed information about events in real-time
  - 125 events exposed
  - Database-level only, not server-level
- Memory- and disk-basked targets to view and store data
- View the sessions using SSMS (not VS)

Plan cache and Query Store

- Use the same DMVs to access plan cache data as you would in SQL Server instances
- View and save the execution plan XML
- Enable Query Store to save historical information about query execution
- Use Query Performance Insight to view the information and make decisions about it

Query Performance Insight

- Requires Query Store be enabled
- Review top resource-consuming queries
  - CPU
  - Duration
  - Number of executions
- Select a query to view its details
- Check recommendations in SQL Database Advisor (on the Portal)

SQL Database Advisor

- Create Index recommendations
  - Non-clustered only
- Drop Index recommendations
  - Detects duplicates
- Schema issues
  - Invalid column name, invalid object name, couldn't find stored procedure, etc
- When queries can benefit from parameterization
  - Enables forced parameterization

Changing tiers

FAQ

- Can I upgrade or downgrade?
  - Yes!
- Is it an online operation?
  - Yes!
- How long does it take?
  - It depends
- How?
  - Portal
  - PowerShell

PowerShell

- Change Azure SQL Database service tier.ps1

Stopping the Database

When do you get charged?

- "You are billed for each hour a database **exists** using the highest service tier + performance level that applied during that hour, *regardless of usage* or whether the database was active for less than an hour. For example, if you create a single database and delete it 5 minutes later your bill will reflect a charge for 1 database hour."

- Want to get rid of the database? Delete from Portal or with PowerShell.
- Backups still exist and can be restored.
  - Retained according to service tier the database was in.