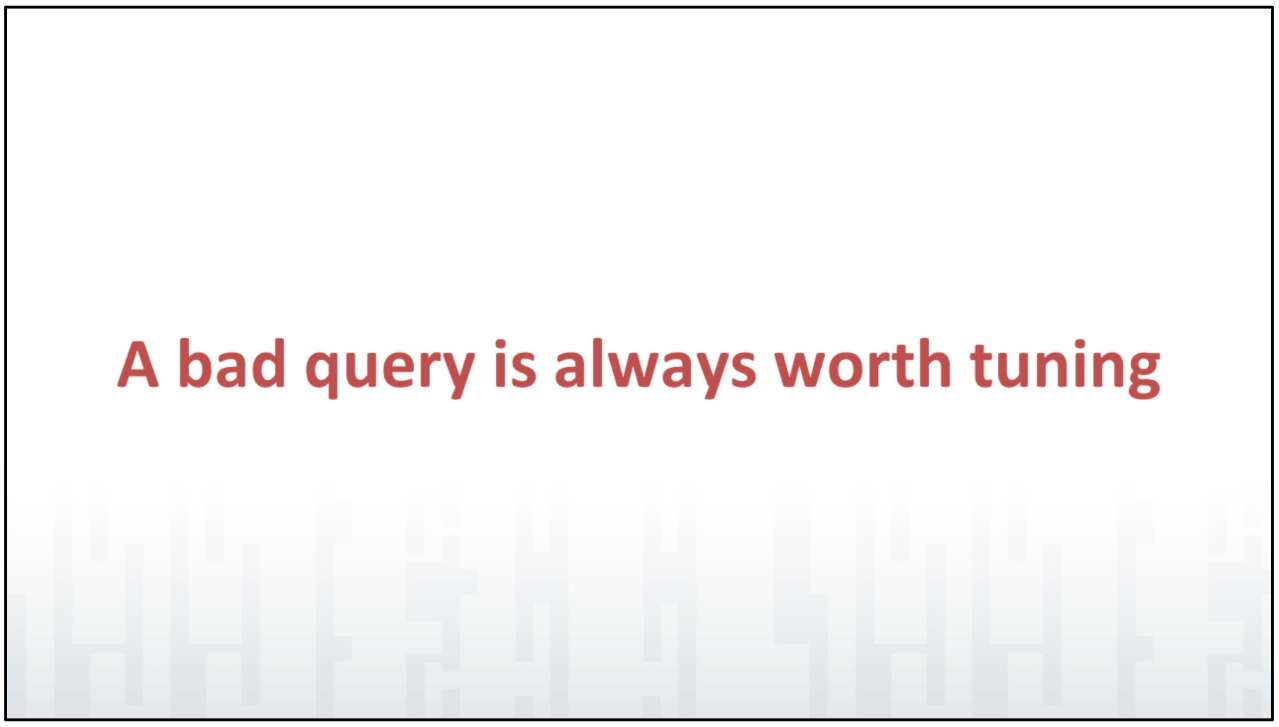
PaaS

Azure SQL Database

SQL *intersection*

Section 4 - 2.5 hours

Considerations before beginning



Microsoft even says so! https://azure.microsoft.com/en-us/documentation/articles/sql-database-performance-guidance/#tuning-your-application

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

SQL intersection

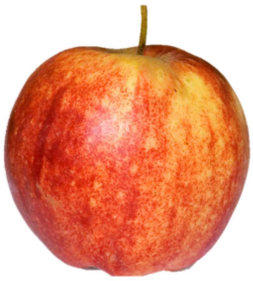
Check https://azure.microsoft.com/en-us/documentation/articles/sql-database-transact-sql-information/ for latest

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/

SQL intersection

Pricing & Performance



SQL intersection

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.)**

SQL intersection

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

SQL intersection

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

SQL intersection

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)**

SQL intersection

Portal > New > Data + Storage > SQL Database.
Name sqldbdemo
Resource group Azure20160408
Server jessqldb2
Source Blank database
Tier Basic
Collation default

PowerShell

- **Create Azure SQL Database.ps1**

SQL intersection

Creating a pool

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

Portal > SQL servers > jessqldb2 > + New pool
Name: RunningPool
Pricing Tier: Standard Pool
Configure pool:
Click OK

Show how to find it with “All resources”. Delete so we can do it with POSH.

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

SQL intersection

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/

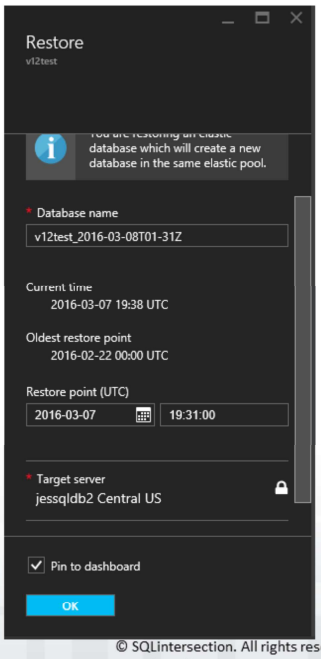
	Point in time restore	Geo-restore	Active Geo-replication
Basic	Any restore point in last 7 days	Yes	Yes
Standard	Any restore point in last 35 days	Yes	Yes
Premium	Any restore point in last 35 days	Yes	Yes

SQL intersection

Set AFTER you create the database. Show them v12test.
Active geo-repl: you pay for each replica.

Point in time restore

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



SQL intersection

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/

SQL intersection

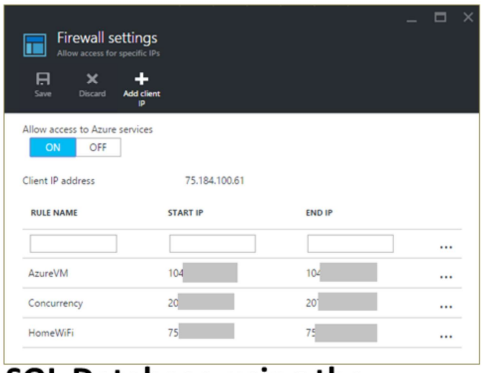
Active Geo-replication

- 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/

SQL intersection

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/**

SQL intersection

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

SQL intersection

Demo – connect with latest SSMS
Demo – connect with VS

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.

SQL intersection

Demo

Azure SQL DB Logins.sql

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/

SQL intersection

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/

Demo with Migration

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)

SQL intersection

Demo with Migration

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?

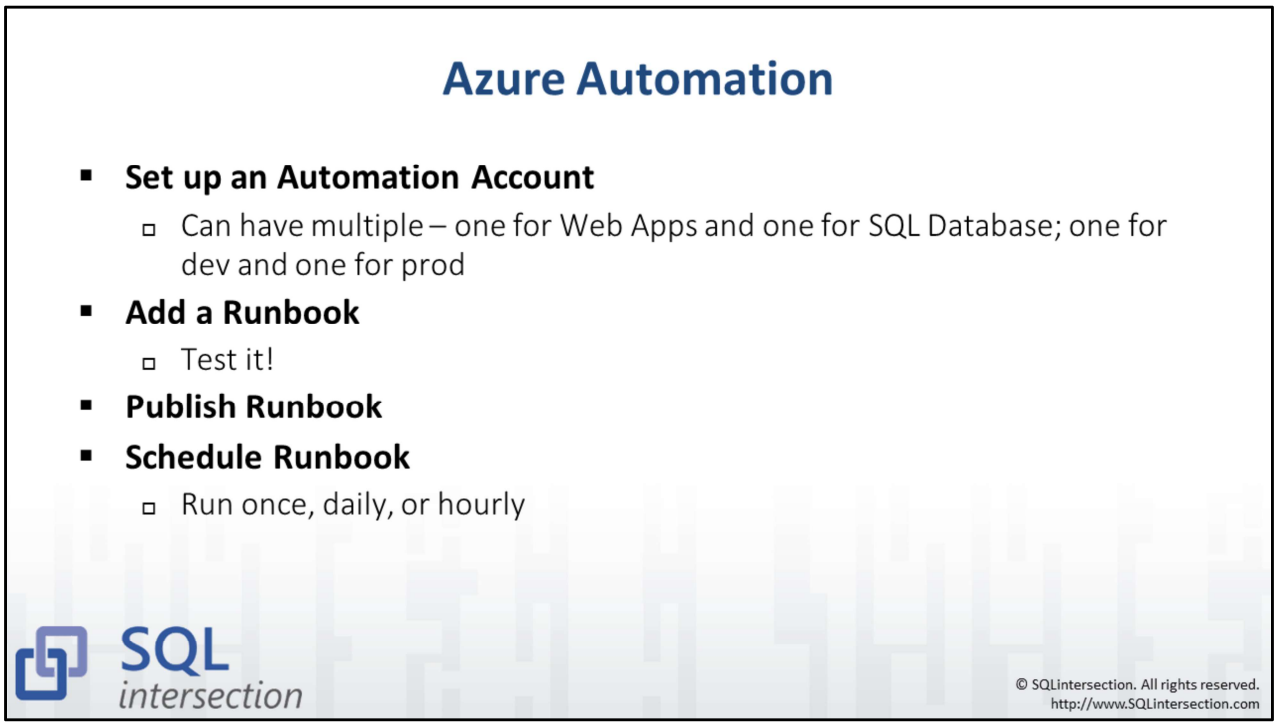
SQL *intersection*

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/

SQL intersection



I got a test script from https://gallery.technet.microsoft.com/scriptcenter/How-to-use-a-SQL-Command-be77f9d2

More can be found at https://gallery.technet.microsoft.com/

Open the script from C:\Users\jborland\OneDrive for Business\Documents\WindowsPowerShell\scripts

Go to Portal > Browse > Automation Accounts. Show +Add is how you create a new account.

Click on SQLDatabase

Click on Runbooks

Click + Add a Runbook

Import – find file

Type: PowerShell Workflow

Click Create

Click on Use-SQLCommandSample

Click Edit

Click Test pane

Fill in data

Publish

Schedule – daily 6:00 pm

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/**

SQL intersection

Monitoring & alerting

What

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

SQL intersection

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

SQL intersection

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/

SQL intersection

Demo – DMVs – pull up DMVs for Azure SQL DB.sql
Demo – Portal – show tiles on v12test
Demo – Alert rules – Name DTU Percent Over 80, Metric DTU Percentage, Condition greater than, Threshold 80, Period Over 2 hours.
Also DTU Under 10 for over 4 hours
What else would YOU set?

Tools for troubleshooting and tuning

Tools for tuning

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

SQL intersection

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)**

SQL intersection

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

SQL intersection

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)**

Pull up 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

SQL intersection

View from Portal

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

SQL intersection

PowerShell

- **Change Azure SQL Database service tier.ps1**

Demo: open C:\Users\jborland\OneDrive for Business\Documents\WindowsPowerShell\scripts\
When finished, check it out in portal!

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.

SQL *intersection*