Common SQL Server Mistakes and How to Avoid Them

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Key technology areas:

- Azure SQL Virtual Machine and storage
- SQL Server performance, tuning and optimization
- Azure Data Services Security
- Disaster Recovery
- Azure SQL DB / Managed Instance

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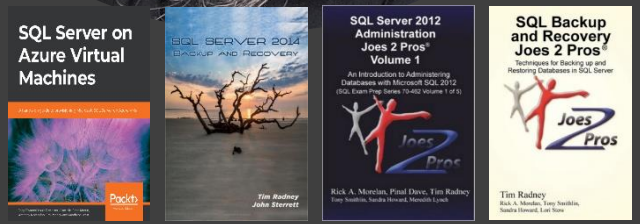
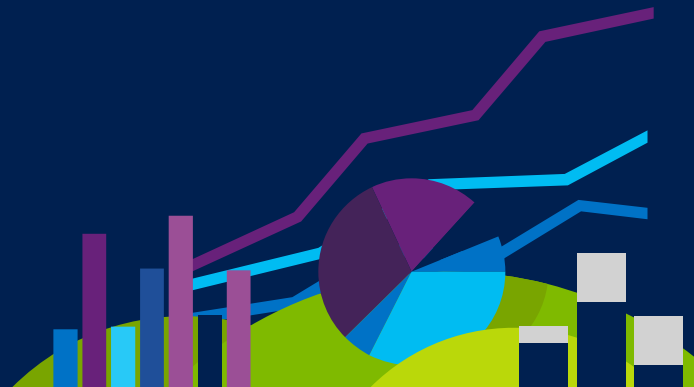


SQL in Azure PaaS, IaaS, and Private Cloud

Best Practices for the Hybrid DBA



Overview

- Backups and Consistency checks
- Log cleanup
- Statistics
- Index maintenance
- Memory settings
- MAXDOP and cost threshold for parallelism
- tempdb
- SQL Server alerts
- Power savings

Applies to: SQL DB | SQL DBMI | SQL IaaS | SQL On-Prem

Not Having Proper Backups

SQL IaaS | SQL On-Prem

- **Do you have recent backups?**
  - The backups need to be adequate
    - Plan your restore strategy to meet your service level agreements
    - Your RPO (recovery point objective) and RTO (recovery time objective) will determine your backup strategy
    - You will need the correct recovery model
- **Do you validate your backups?**
    - The absolute best method to validate backups are good is by restoring them
    - A dedicated environment, close to production specs will give you a good sense of how long a production restore may take
    - Regulators, auditors, and examiners love to see restore validations
- **Script to check for frequency of backups - http://www.timradney.com/backups**

No Consistency Checks

SQL DB | SQL DBMI | SQL IaaS | SQL On-Prem

- **Corruption happens**
  - I/O subsystem 99.98%
  - Local hardware 0.01%
  - SQL Server bug 0.01%
- **Finding corruption**
  - DBCC CHECKDB
  - DBCC CHECKALLOC
  - DBCC CHECKCATALOG
  - DBCC CHECKFILEGROUP
- **Have a scheduled job to run DBCC CHECKDB**
  - When DBCC CHECKDB fails, take immediate action
  - Many times the fix is a restore operation, so take action before backups are deleted and data is lost

Not Purging Logs

SQL IaaS

SQL On-Prem

- **msdb stores all backup and restore history**
  - History is not automatically purged
    - sp_delete_backuphistory
      - Clears backup and restore history older than date given
    - This will delete all backup and restore history prior to '01/01/2018'
- **SQL Server log maintenance**
  - By default the log only rolls over at service restart
  - EXEC sp_cycle_errorlog – starts a new error log, execute daily or weekly
  - Increase default value from 6 to some other number up to 99
  - Recommend keeping at least 30 days of logs for troubleshooting

Deleting Backup History

```
USE msdb;
GO
EXEC sp_delete_backuphistory ‘06/01/2025';
GO
```

Having Out of Date Statistics

SQL DB | SQL DBMI | SQL IaaS | SQL On-Prem

- **Are your statistics up to date?**
  - You need a process to manually update statistics
  - Ola Hallengren – excellent process for updating statistics
  - sp_updatestats
  - "Auto Update Statistics"
    - Updates after approximately 20% + 500 rows change
- **Impacts of statistics to the Query Optimizer**
  - The Query Optimizer uses statistics to build the execution plan
  - Out of date statistics can negatively impact the Query Optimizer from determining a "good enough" execution plan

Not Having Index Maintenance

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- **Fragmentation**
  - Data modifications (Insert, Update, Deletes)
- **Impact of fragmentation on query performance**
  - A whitepaper from Microsoft stated fragmentation can slow down systems from 13% to 460% based on the size of the environment and fragmentation level
  - https://technet.microsoft.com/en-us/library/cc966523.aspx
- **Controlling fragmentation**
  - Rebuild, reorganize or disable-and-rebuild (in a transaction) the index
  - Schedule rebuilds or reorganizations in a maintenance plan < 2016
  - Use a custom script in a SQL Agent job such as Ola Hallengren's Index Optimize script
  - Use third-party tools
- **Fragmentation with SSDs**
  - https://www.sqlskills.com/blogs/jonathan/does-index-fragmentation-matter-with-ssds/

Default Memory Settings In Use

SQL IaaS

SQL On-Prem

- **Max and Min values for SQL Server 2008R2 and below**
  - Maximum default is 2147483647 MB or 2 PB
  - Minimum default is set to 0
  - Potential for SQL Server to starve the OS and OS to starve SQL Server
  - Max memory applies to the buffer pool only
- **SQL Server 2012 +**
  - Maximum default is 2147483647 MB or 2 PB
  - Minimum default is set to 0
  - Memory Manager redesign
  - Max memory applies to all memory manager allocations
  - Can consider letting SQL Server dynamically manage memory

  - How much memory does SQL Server need? https://learn.microsoft.com/en-us/sql/database-engine/configure-windows/server-memory-server-configuration-options?view=sql-server-ver17

MAXDOP

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- **It is recommended to specify a value other than 0**
  - Some applications may recommend a value of 1 (e.g. SharePoint)
  - SQL Server 2008 – 2014
    - NUMA node(s) with less than 8 logical processors
      - Keep MAXDOP at or below number of logical processors
    - NUMA node(s) with more than 8 logical processors
      - Set MAXDOP to 8
  - http://support.microsoft.com/kb/2806535
  - https://sqlperformance.com/2019/06/sql-performance/common-sql-server-mishaps

MAXDOP

SQL IaaS | SQL On-Prem | SQL DBMI

- **SQL Server 2016+ utilizes soft-NUMA**
  - During startup, Database Engine detects number of logical processors
    - If more than 8 physical cores per NUMA node or socket, soft-NUMA nodes are created automatically.
    - The engine handles placement of logical processors from the same physical core into different soft-NUMA nodes
  - NUMA node(s) with less than 16 logical processors
    - Keep MAXDOP at or below number of logical processors
  - Single NUMA node with more than 16 logical processors
    - Set MAXDOP to16
  - Multiple NUMA nodes with more than 16 logical processors
    - Set MAXDOP to half the number of logical processors per NUMA node with a MAX of 16

Cost Threshold For Parallelism

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- **Cost threshold for parallelism**
  - Query cost/subtree cost
  - Default value is 5
  - This should be adjusted up to 25 – 50 based on your environment - http://bit.ly/1rTs9UX

Improperly Sized tempdb

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- **Special characteristics for tempdb**
  - Recreated at startup
  - Only one tempdb database per instance
  - Modeled after the model database
  - Cannot be backed up
- **Considerations**
  - With 8 cores or less, create equal-size data files per the number of cores
  - With more than 8 cores, start with 8 equal size data files and increase by 4 files based on contention
  - http://support.microsoft.com/kb/2154845
  - Enable trace flag 1118 always – on by default in 2016+
  - Place data files on separate disk with fast I/O, if needed
  - Enable Instant File Initialization `

Using SQL Server Agent Alerts

SQL IaaS | SQL On-Prem | SQL DBMI

- **Provides proactive monitoring**
  - Requires database mail
    - Configure a mail operator to send alerts to a distribution group
  - Agent alerts
    - Severity 19 – 25 errors which are fatal errors
    - Error 823 and 824 – I/O issues
    - Error 825 which is related to an I/O operation retry
    - Agents can be created using the GUI or a T-SQL script
  - Have this as part of your standard server build
  - Step by step process http://bit.ly/16nABr6

Using Balanced Power Savings

SQL IaaS

SQL On-Prem

- **Power savings has a negative impact for SQL Server**
  - Can under-clock your CPU
  - Not conducive to SQL Server CPU behavior
  - Set power setting to “High Performance” rather than “Balanced Power”
  - Disable power savings in BIOS
  - Free tool CPUz can show clock speed in use
    - www.cpuid.com
  - Other power settings can be bad such as putting a NIC to sleep

Summary

- **SQL Server is great, but a “next, next, next, finish” install is not good**
  - Have proper backups
  - Run regular consistency checks
  - Perform log cleanups
  - Update your statistics
  - Have proper index maintenance
  - Have proper memory settings
  - Configure MAXDOP and cost threshold for parallelism
  - Configure tempdb for your instance
  - Configure SQL Server Agent alerts
  - Turn off any power savings


Thank You!
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Slides and demo code
timradney.com/presentations