PERFORMANCE TUNING
GETTING BIG BANG FOR YOUR BUCK

Monica Rathbun
Consultant
Denny Cherry & Associates Consulting
MONICA RATHBUN

Consultant
Denny Cherry & Associates Consulting

PASS Mid-Atlantic Regional Mentor
User Group Leader: Hampton Roads VA
SQL Saturday VA Beach Organizer

MRathbun@sqlespresso.com sqlespresso.com
@SQLEspresso linkedin.com/in/sqlespresso
PRESENTATION RULES

Always Ask Questions

Interrupt Me

This is a two-way conversation, let’s learn from each other’s experiences
BEST PRACTICES

Start with the basics
POWER PLAN

Windows Control Panel Power Options

Power Options

Choose or customize a power plan
A power plan is a collection of hardware and system settings (like display brightness, sleep, etc.) that manages how your computer uses power. Tell me more about power plans

Preferred plans

- Balanced (recommended)
  Automatically balances performance with energy consumption on capable hardware.

- High performance
  Favors performance, but may use more energy.

See also
- User Accounts
# SERVICES

Why are you running this?

## Services Window

The Services window displays a list of various services, each with its name, description, status, startup type, and log on as information. The highlighted service is `SQL Full-text Filter Daemon Launcher (MSSQLSERVER)`.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Status</th>
<th>Startup Type</th>
<th>Log On As</th>
</tr>
</thead>
<tbody>
<tr>
<td>SQL Full-text Filter Daemon Launcher (MSSQLSERVER)</td>
<td>Service to launch SQL Full-text Filter</td>
<td>Running</td>
<td>Manual</td>
<td>Local System</td>
</tr>
<tr>
<td>SQL Server (MSSQLSERVER)</td>
<td>Provides storage</td>
<td>Running</td>
<td>Manual</td>
<td>Local System</td>
</tr>
<tr>
<td>SQL Server Agent (MSSQLSERVER)</td>
<td>Executes jobs</td>
<td>Running</td>
<td>Automatic</td>
<td>Local Service</td>
</tr>
<tr>
<td>SQL Server Analysis Services (MSSQLSERVER)</td>
<td>Supplies online statistical data</td>
<td>Running</td>
<td>Automatic</td>
<td>Local System</td>
</tr>
<tr>
<td>SQL Server Browser</td>
<td>Provides SQL Server web access</td>
<td>Running</td>
<td>Automatic</td>
<td>Local System</td>
</tr>
<tr>
<td>SQL Server Integration Services 11.0</td>
<td>Provides a unified interface</td>
<td>Running</td>
<td>Automatic</td>
<td>Local System</td>
</tr>
<tr>
<td>SQL Server Reporting Services (MSSQLSERVER)</td>
<td>Manages, executes SQL Server reports</td>
<td>Running</td>
<td>Automatic</td>
<td>Local System</td>
</tr>
<tr>
<td>SQL Server VSS Writer</td>
<td>Provides the interface for snapshot management</td>
<td>Running</td>
<td>Automatic</td>
<td>Local System</td>
</tr>
<tr>
<td>SDDF Discovery</td>
<td>Discovers network configuration</td>
<td>Disabled</td>
<td>Local Service</td>
<td></td>
</tr>
<tr>
<td>Skill Image Acquisition Events</td>
<td>Launches applications</td>
<td>Manual</td>
<td>Local System</td>
<td></td>
</tr>
<tr>
<td>Superfetch</td>
<td>Maintains and updates system state</td>
<td>Manual</td>
<td>Local System</td>
<td></td>
</tr>
<tr>
<td>System Event Notification Service</td>
<td>Monitors system events</td>
<td>Running</td>
<td>Automatic</td>
<td>Local System</td>
</tr>
<tr>
<td>System Events Broker</td>
<td>Coordinates and manages events</td>
<td>Running</td>
<td>Manual (Trigger Start)</td>
<td>Local System</td>
</tr>
</tbody>
</table>

---

*Image: Services window showing various services with a focus on `SQL Full-text Filter Daemon Launcher (MSSQLSERVER)`.*
Build List
https://sqlserverbuilds.blogspot.com/

- Bug Fixes Performance Degradations
- Improvement SQL 2016 SP1 Optimizer
- Drivers on VM and NICs
- Support Microsoft Support
- Windows Patches

PATCHING
MEMORY
Proper configuration is vital

Min and Max Memory
Multiple Instances
Extra Services SSRS, SSIS, SSAS
Lock Pages in Memory *
Set Memory Reservation for Your VM on the Host
Don’t over allocate!
Everything Uses TEMPDB - Make sure you don’t ignore it.

Pin to High Performing Disk

Multiple Files
1 file per CPU core up to 8 files

Trace flag
1118/1117
Pre 2016

Heavy Contention in Metadata fixed
2016 CU 8 and 2017 CU 5

Trace Flag 2453 allows table variables to trigger recompile
MAKE FRIENDS WITH NETWORK & STORAGE ADMINS

Their baby might be ugly
VIRTUAL ENVIRONMENTS

Over Provisioned Hosts

- Too Many VMs on One Host
- What Happens on One VM Now Affects Another
- VM Over/Under CPU Allocation
- Thin Provisioning
COMPRESSION

Row/Page Compression - More Data In MEMORY

Saves Space on Disk

Backup Compression: Less Data in STORAGE

Costs CPU speed, but worth it

More data in memory – It’s the GOLDEN EGG!
ALLOW SNAPSHOT ISOLATION & READ COMMITTED SNAPSHOT ISOLATION (RCSI)

Snapshot Isolation
Is updated row versions for each transaction are maintained in tempdb.

RCSI option
Allows access to versioned rows under the default READ COMMITTED isolation level.
If set to OFF, you must explicitly set the level for each session in order to access versioned rows.

Ta-dah!
READERS CAN'T BLOCK WRITERS AND WRITERS CAN'T BLOCK READERS

Default Isolation Level in Azure SQL DB
Maintain | Keep These Up To Date!
---|---
Updates | Sync vs Async
Large Table | Trace Flag 2371
Missing Stats | Did You Know You Can Make Your Own?

This is the magic sauce that helps the optimizer.

Defaulted in SQL 2016
## PARALLELISM

**CAUTION:** Using too many cores = more overhead to put things back together

### MAX Degree of Parallelism (MaxDop)
- \( \geq 8 \)
- maxdop 8 or lower
- Can specify maxdop for individual statements as query hint
- CAUTION: Changes Flushes Procedure Cache

### Cost Threshold for Parallelism (CTfP)
- “Cost” over this value qualifies for multiple processors to execute
- Good Start is 35-50
- *Keeps small queries single threaded
- Watch for CXPACKET
- Waits too many then adjust CTfP higher *
INSTANT FILE INITIALIZATION (IFI)

- Initialized instantaneously to avoid zeroing operations / Reclaims used disk space

- Fast execution on data files

- Add data/log files
- Create database
- Increase file size & autogrowth

SQL Server service account **Perform Volume Maintenance Tasks** security policy in Windows. Use AD Group Policy to grant this to service accounts in your domain.
WINNING RESULTS

Create 5GB DB IFI Comparison

Milliseconds

Without Instant File Initialization  With Instant File Initialization
Trace Flag 610
SQL Server 2008 – 2014
*2016 Defaulted Bulked Logged

- SELECT INTO
- INSERT SELECT
- CREATE INDEX
- MERGE

- High Volume Data Loads Faster
- Log Files Smaller
- No Point in Time Recovery
- Simple or Bulked Logged

- Data Warehouse or Repeatable Loads
- Logs Extent Allocation & Metadata
VIRTUAL LOG FILES

Performance boost on startup, insert/update/delete & backup/restore operations.

- A large number of VLFs can slow things down.
- VLF counts under 100 ideally
- Shrink files to two VLFs
- Grow in chunks back to the current size
- DBCC LOG INFO or sys.dm_db_log_stats (2016 SP2)
INDEXES

These are not set it and forget it

- Remove Un-Used Indexes
- Find Missing Indexes
- Covering Indexes

Wasted Write Disk IO
Disable then Delete

Wasted Read IO
Avoid Duplicates

Consolidate Indexes
Specific Query Tuning – Key Lookups
## EXECUTION PLANS

**Easy things to look at**

<table>
<thead>
<tr>
<th>Index Needs</th>
<th>More Granular Review</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Missing Includes</td>
</tr>
<tr>
<td></td>
<td>Scans</td>
</tr>
<tr>
<td>Sorts</td>
<td>Does the data need to be sorted?</td>
</tr>
<tr>
<td></td>
<td>Can it be done elsewhere?</td>
</tr>
<tr>
<td>Key Lookups</td>
<td>Extra Reads</td>
</tr>
<tr>
<td></td>
<td>Easily Avoided in Most Cases</td>
</tr>
<tr>
<td>Spills</td>
<td>Spills to TempDB</td>
</tr>
<tr>
<td></td>
<td>Forced to go to Disk</td>
</tr>
</tbody>
</table>

![Diagram](image)