

# 15 Tips to increase the Survivability of your Database

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# About\_me

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IT 25 years

Started with PROGRESS

SQL On/Off (Since 6.5...Mostly 2008+)

# Why this session?

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- It is not a matter of IF corruption happens, but when (and it's never at a good time)
- Knowing about corruption AS SOON AS POSSIBLE is invaluable
- If you know about corruption immediately, you have more options in recovery:
  - Most recent backups won't have the corruption (If you backup the corruption, well...)
  - Restoring the database might be your best option.
  - Your business won't be down as long if you are ready for problems
  - Might just save your job!

# The 15

- 1) Database mail (Operator + Account)
- 2) Create alerts for critical errors
- 3) Setup Alert notifications
- 4) Notifications for EVERY agent job
- 5) SQL Error Logs
- 6) DBCC CHECKDB Daily
- 7) Drive Space
- 8) Database page\_verify\_option = 2 (Page\_verify\_option\_desc = "CHECKSUM")
- 9) CHECKSUM during Backup & Restore
- 10) Backup logs for ALL User Databases in FULL recovery mode
- 11) Routinely restore databases
- 12) Business SLA / RTO / RPO on all databases
- 13) Benchmark / monitor system
- 14) What NOT to do
- 15) Practice your skills

# # 0.5 What to do first

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- During an actual crisis...First: Step away from the keyboard
- How will help you best solve this problem?
  - 1) Accurately assess the situation. Is this really as bad as first glance? Is it worse?
  - 2) Where is my documentation
  - 3) **DO NO HARM** – Don't do anything without making a backup, copy first and work on the backup for testing!
  - 4) Do you have the skills to successfully restore the data?
- **If NOT, THAT IS OK**
- It's better to ask for help, than to ask after the fact!

# # 0.5 What to do first

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If you start immediately without a plan you are effectively saying

“Hold my beer, watch this!”

# #1 Database mail

- Setup an operator (#1.1) and database mail (#1.2)
- Setup operators as group e-mail for DBA's (yes, DBAs do get sick/go on vacation/leave the company)
- **\*\* Note: In the GUI, it falls under the SQL Agent, verify/change the SQL Agent to auto-start on reboot**
- **\*\* Use SQL Server Configuration Manager (Default is Manual start) (#1.3)**
- Test the mail to the group (#1.4)
- NOTE: Anti-Virus can cause blocking of the email to send. You may need to enable sending of email via your anti-virus program.
- Routinely, View Database Mail Log verify any messages sent don't have errors
- NOTE: Azure does NOT support mail

<https://azure.microsoft.com/en-us/documentation/articles/sql-database-transact-sql-information/>

# #1.1 Database mail

- + Jobs
  - Job Activity Monitor
- + Alerts
- + Operators
  - SQLDBAGroup
- + Proxies
- + Error Logs

SQLDBAGroup Properties

Select a page

- General
- Notifications
- History

Script Help

Name:   Enabled

Notification options

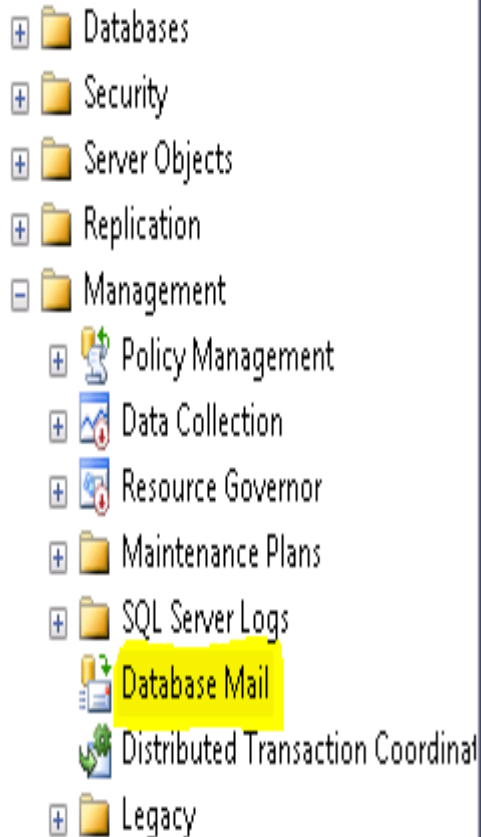
E-mail name:

Net send address:

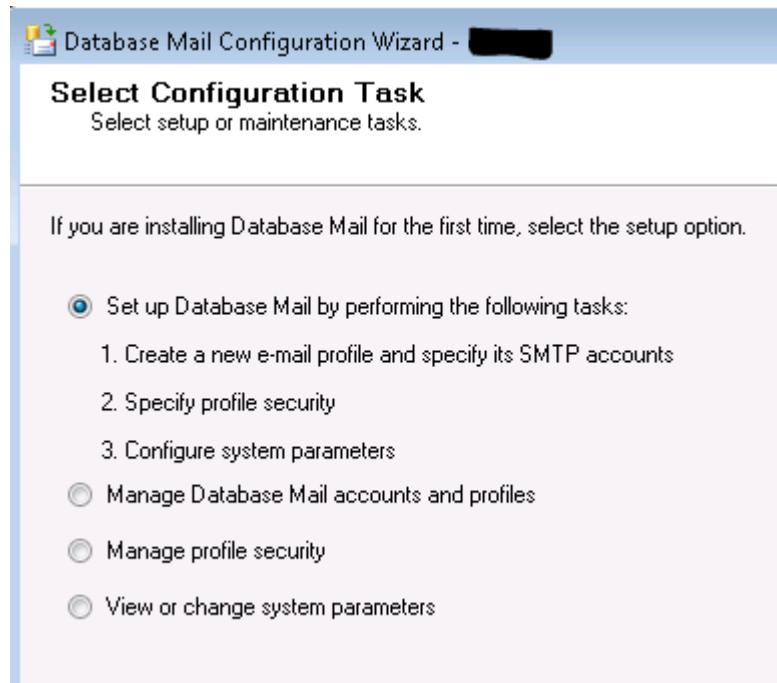
Pager e-mail name:



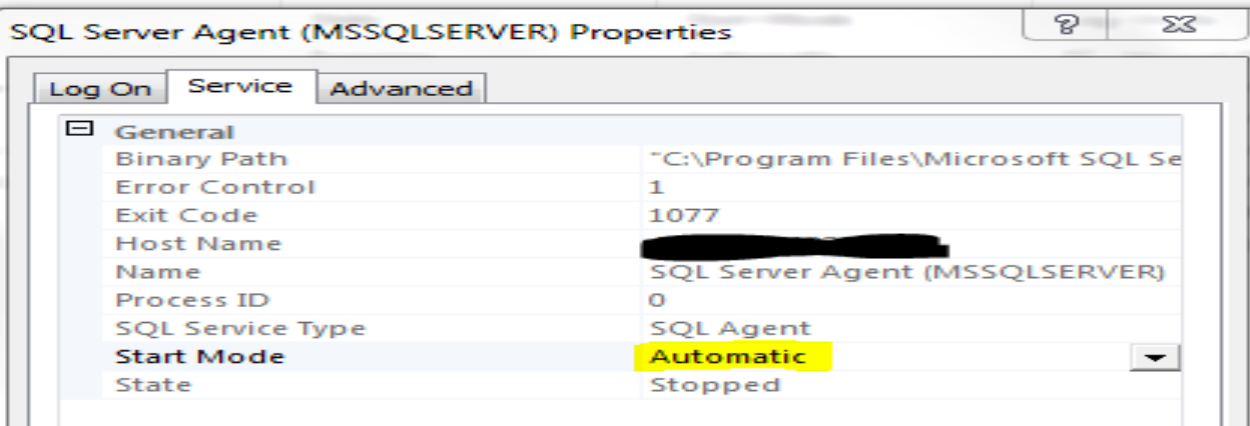
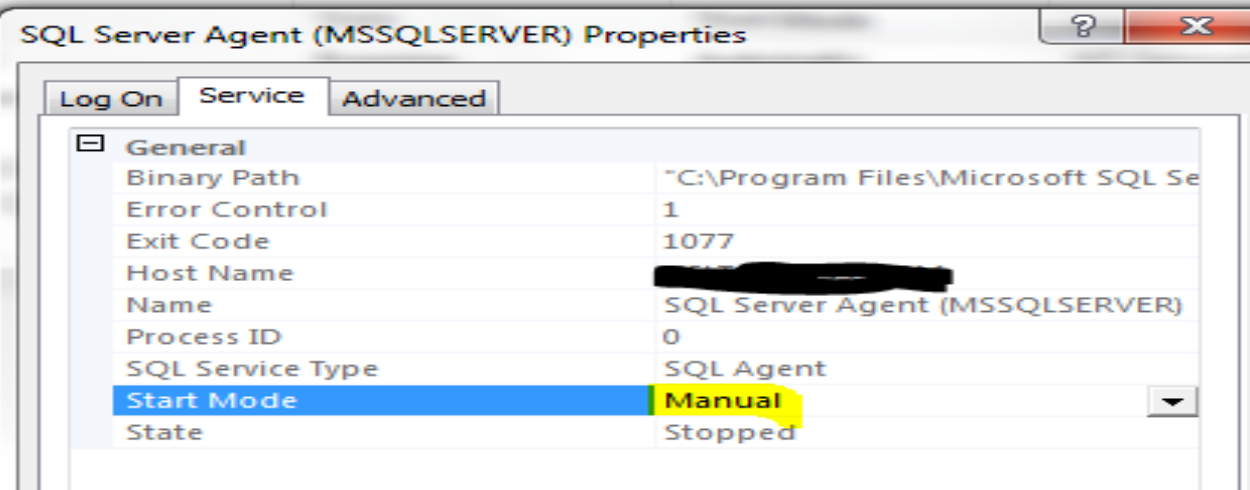
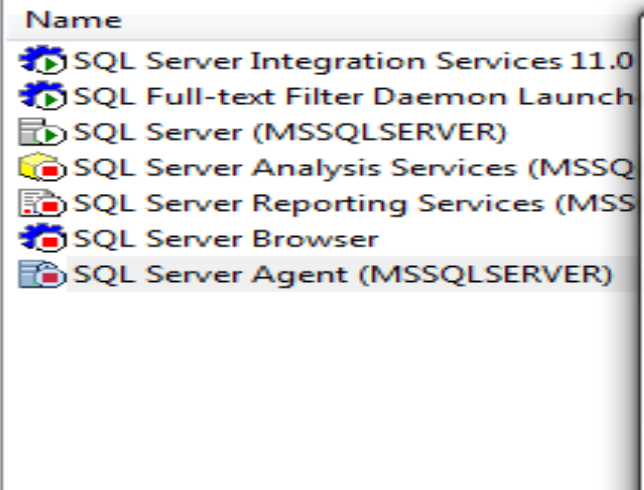
# #1.2 Database mail



Right-Click on Database mail  
Setup your profile



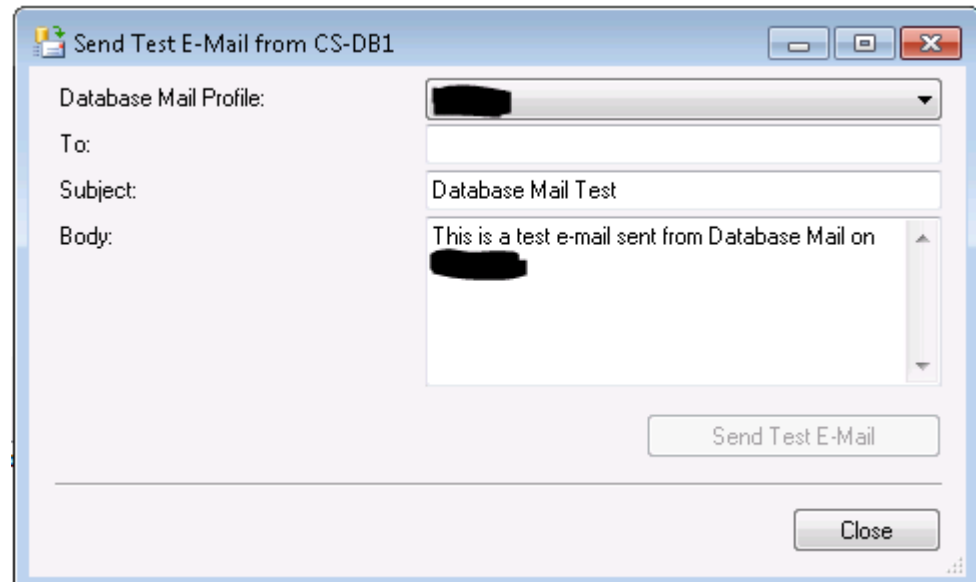
# #1.3 Auto-Start SQL Server Agent



# #1.4 Test Database mail

- + Databases
- + Security
- + Server Objects
- + Replication
- Management
  - + Policy Management
  - + Data Collection
  - + Resource Governor
  - + Maintenance Plans
  - + SQL Server Logs
  - Database Mail**
  - + Distributed Transaction Coordinator
  - + Legacy

Right-Click on Database mail  
Send Test E-Mail



## #2 Create Critical Alerts

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- SQL Server is aware of database corruption as it happens, but if it isn't alerting you, how do you know it's there?
- Setting up alerts lets you know when it happens; receive an email upon SQL Server detecting it
- **T-SQL to create the alerts**: See Reference
- **Reference:**

<http://www.sqlskills.com/blogs/glenn/creating-sql-server-agent-alerts-for-critical-errors/>

# #2.1 Critical Alerts

- [-]  SQL Server Agent
  - [+]  Jobs
  -  Job Activity Monitor
  - [-]  Alerts
    -  CSLTCNU43395RM Alert - Error 823: The operating system returned an error
    -  CSLTCNU43395RM Alert - Error 824: Logical consistency-based I/O error
    -  CSLTCNU43395RM Alert - Error 825: Read-Retry Required
    -  CSLTCNU43395RM Alert - Error 832: Constant page has changed
    -  CSLTCNU43395RM Alert - Error 855: Uncorrectable hardware memory corruption detected
    -  CSLTCNU43395RM Alert - Error 856: SQL Server has detected hardware memory corruption, but has recovered
    -  CSLTCNU43395RM Alert - Sev 19 Error: Fatal Error in Resource
    -  CSLTCNU43395RM Alert - Sev 20 Error: Fatal Error in Current Process
    -  CSLTCNU43395RM Alert - Sev 21 Error: Fatal Error in Database Process
    -  CSLTCNU43395RM Alert - Sev 22 Error: Fatal Error: Table Integrity Suspect
    -  CSLTCNU43395RM Alert - Sev 23 Error: Fatal Error Database Integrity Suspect
    -  CSLTCNU43395RM Alert - Sev 24 Error: Fatal Hardware Error
    -  CSLTCNU43395RM Alert - Sev 25 Error: Fatal Error
  - [-]  Operators
    -  SQLDBAGroup
  - [+]  Proxies
  - [+]  Error Logs

# #3 Setup Alert Notifications

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- Once the alerts are setup, you must tell SQL Server how you want to be notified.
- E-mail and the operator(s) to receive the message
- Pager <- Anyone carry a pager?
- This must be done for each alert

# #3.1 Alert Notifications

The screenshot shows the 'Alert Properties' dialog box in SQL Server Enterprise Manager. The title bar reads: 'CSLTCNU43395RM Alert - Error 823: The operating system returned an error' alert properties. On the left, a 'Select a page' sidebar lists 'General', 'Response' (selected), 'Options', and 'History'. The main area has a 'Script' dropdown and a 'Help' icon. Below this, there is a checkbox for 'Execute job' which is unchecked, followed by an empty dropdown menu and two buttons: 'New Job...' and 'View Job'. A checked checkbox for 'Notify operators' is followed by the text 'Operator list:'. Below this is a table with columns 'Operator', 'E-mail', 'Pager', and 'Net S...'. The table contains one row for 'SQLDBAGroup' with a checked checkbox under 'E-mail' and unchecked checkboxes under 'Pager' and 'Net S...'.

Operator	E-mail	Pager	Net S...
SQLDBAGroup	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

# #4 Agent Jobs Failure

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- Setup the same notifications on ALL Agent Jobs if they fail
  
- Know when:
  - Backup Jobs fail
  - DBCC CHECKDB fails
  - Other housekeeping jobs fail



# #4.1 Agent Jobs Failure

New Job

Select a page

- General
- Steps
- Schedules
- Alerts
- Notifications
- Targets

Script Help

Actions to perform when the job completes:

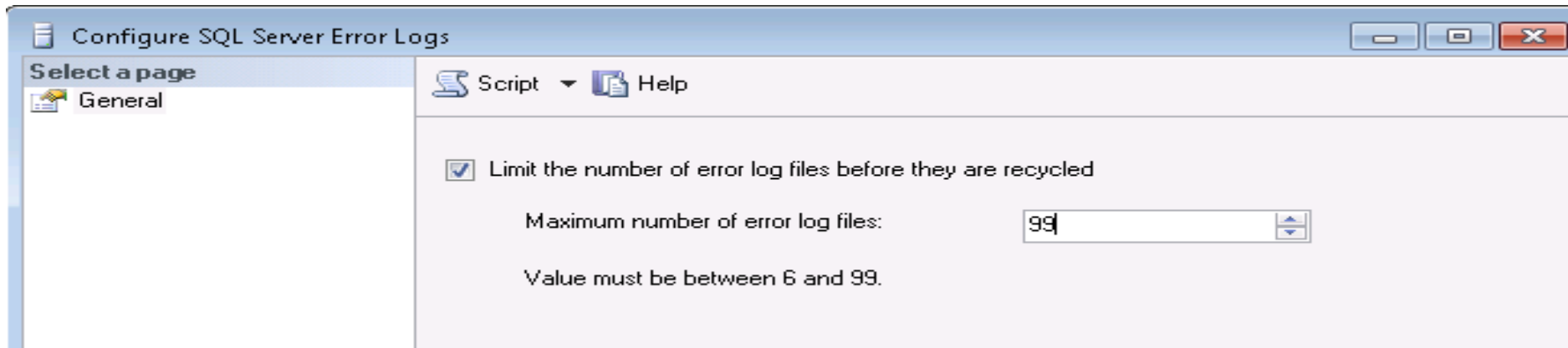
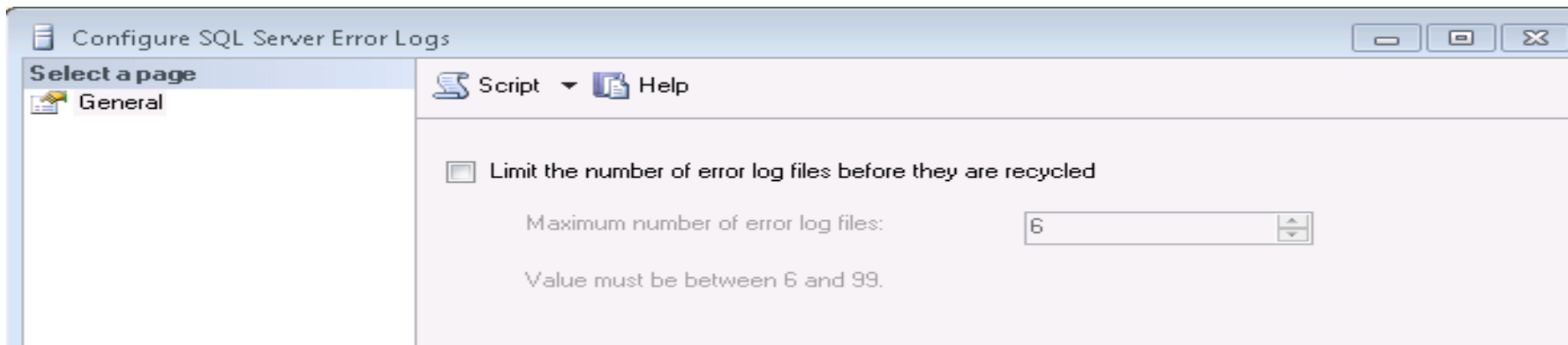
<input checked="" type="checkbox"/> E-mail:	SQLDBAGroup	When the job fails
<input type="checkbox"/> Page:		When the job fails
<input type="checkbox"/> Net send:		When the job fails
<input type="checkbox"/> Write to the Windows Application event log:		When the job fails
<input type="checkbox"/> Automatically delete job:		When the job succeeds

# #5 SQL Error Logs

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- This is an ERROR log, keep it as clean as possible
- Set to max # log files = 99 (#5.1)
- Recycle logs on a daily/weekly basis (#5.2)
- Read logs regularly (daily/weekly)
- If you need to go back further than 99 days to find an issue...you have bigger problems
- Set TF3226 to prevent backup database/log messages to go to logs (#5.3)
- Use SQL Server Configuration Manager to configure TF3226

# #5.1 SQL Error Logs



## #5.2 SQL Error Logs

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### T-SQL:

```
USE master;
```

```
GO
```

```
-- cycle error log
```

```
EXEC sp_cycle_errorlog;
```

```
GO
```

# #5.3 SQL Error Logs

The screenshot displays the SQL Server Configuration Manager interface. The left-hand tree view shows the 'SQL Server Services' folder expanded, with 'SQL Server (MSSQLSERVER)' selected. The main pane shows a list of services, including 'SQL Server (MSSQLSERVER)'. A dialog box titled 'SQL Server (MSSQLSERVER) Properties' is open, with the 'Startup Parameters' tab selected. The dialog box contains a text input field for specifying a startup parameter, an 'Add' button, and a list of existing parameters. The existing parameters are:

- dC:\Program Files\Microsoft SQL Server\MSSQL11.MSS
- eC:\Program Files\Microsoft SQL Server\MSSQL11.MSS
- IC:\Program Files\Microsoft SQL Server\MSSQL11.MSS
- T3226

The '-T3226' parameter is highlighted in yellow. Below the list of existing parameters is a 'Remove' button.

# #6 DBCC CHECKDB

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- Run daily when possible
- Exception is when it doesn't run in your maintenance window

# #7 Drive Space

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Don't put databases on C:\

Don't place backups on same drive as database!

Routinely Check Disk space on whatever drive you have Databases & Logs

# #8 page\_verify\_option

```
SELECT database_id, name, page_verify_option, page_verify_option_desc FROM sys.databases
```

SQLQuery1.sql - C...(CMC\adubois (51))\* X

1 SELECT database\_id, name, page\_verify\_option, page\_verify\_option\_desc FROM sys.databases

100 %

Results Messages

	database_id	name	page_verify_option	page_verify_option_desc
1	1	master	2	CHECKSUM
2	2	tempdb	2	CHECKSUM
3	3	model	2	CHECKSUM
4	4	msdb	2	CHECKSUM
5	5	ReportServer	2	CHECKSUM
6	6	ReportServerTempDB	2	CHECKSUM
7	7	guidville	1	TORN_PAGE_DETECTION
8	8	TSQL2012	0	NONE
9	9	mytables	2	CHECKSUM



# #8.1 page\_verify\_option

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```
SELECT database_id, name, page_verify_option, page_verify_option_desc  
FROM sys.databases  
WHERE page_verify_option_desc <> 'CHECKSUM'
```

```
USE [master];  
GO
```

```
ALTER DATABASE [database-name]  
SET PAGE_VERIFY CHECKSUM  
WITH NO_WAIT;
```

```
GO
```

## #8.2 page\_verify\_option

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Setting the Page\_verify\_option is good.

However, you don't have a checksum on any pages until they are written to disk.

Select doesn't work (Reads Only)

Best way to get checksum? Re-index

# #9 CHECKSUM

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- CHECKSUM IS NOT ONLY FOR `page_verify_option`
- Use when backing up your databases

**Reference:**

<http://www.sqlskills.com/blogs/paul/a-sql-server-dba-myth-a-day-2730-use-backup-with-checksum-to-replace-dbcc-checkdb/>

<http://sqlmag.com/blog/does-using-checksum-ensure-successful-backup>



# #10 T-Logs

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- Make sure T-logs of databases in FULL recovery are being backed up
- Pre-size databases and Logs

## Reference:

<https://www.simple-talk.com/books/sql-books/sql-server-transaction-log-management-by-tony-davis-and-gail-shaw/>

# #10.1 T-Logs

```
1 use master; -- Change to Database you want to check
2 go
3
4 DBCC LOGININFO
5
6 -- OR you can do it this way
7 DBCC LOGININFO ('ZDBA_Utility')
```

100 %

Results Messages

	RecoveryUnitId	FileId	FileSize	StartOffset	FSeqNo	Status	Parity	CreateLSN
1	0	2	253952	8192	37	0	128	0
2	0	2	253952	262144	38	2	128	0
3	0	2	286720	516096	36	0	64	0

# #11 Routinely Test Restores

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- Know where scripts to restore are
- Don't have any hesitation with verifying scripts moving db and log to correct drive.
- Know what the script does
- Monitor how long it takes to restore a database...might you need to update SLA?

# #11.1 Routinely Test Restores

Results Messages

	DatabaseName	SLA Type	IsCompressed	StartTime	EndTime	Total Time (Seconds)
1	WSS_UsageApplication	CHECKDB	0	2015-09-08 14:13:37	2015-09-08 14:19:42	365
2	WSS_UsageApplication	Restore	1	2015-09-08 14:06:08	2015-09-08 14:10:53	285
3	Word Automation	CHECKDB	0	2015-09-08 14:03:15	2015-09-08 14:03:15	0
4	Word Automation	Restore	1	2015-09-08 14:03:04	2015-09-08 14:03:05	1
5	WFResourceManagementDB	CHECKDB	0	2015-09-08 14:00:27	2015-09-08 14:00:28	1
6	WFResourceManagementDB	Restore	1	2015-09-08 14:00:06	2015-09-08 14:00:06	0
7	WFManagementDB	CHECKDB	0	2015-09-08 13:58:42	2015-09-08 13:58:43	1
8	WFManagementDB	Restore	1	2015-09-08 13:58:31	2015-09-08 13:58:31	0
9	WFInstanceManagementDB	CHECKDB	0	2015-09-08 13:57:22	2015-09-08 13:57:23	1
10	WFInstanceManagementDB	Restore	1	2015-09-08 13:57:13	2015-09-08 13:57:13	0
11	Sync	CHECKDB	0	2015-09-08 13:55:43	2015-09-08 13:55:56	13
12	Sync	Restore	1	2015-09-08 13:55:02	2015-09-08 13:55:13	11

# #12 SLA

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- Meeting with managers and end-users
- Determine SLA which consists of
  - RTO – Recovery Time Objective
  - RPO – Recovery Point Objective
- Know when to try and repair vs when to restore from backup.



# #13 Monitor

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- Benchmark your system
- Continue to monitor
- Might be possible to see a problem before it strikes

# #14 NEVER EVER

## ■ When you are having problems

- NEVER EVER Just Start during emergency! Grab a cup of coffee first!
- NEVER EVER Detach a Database
- NEVER EVER Reboot SQL or machine
- NEVER EVER Remove (Delete) the Log File
  - <http://www.sqlskills.com/blogs/paul/a-sad-tale-of-mis-steps-and-corruption-from-today/>
- NEVER EVER Make modifications to a database without an up to the minute backup (If backup is possible)
  
- <http://www.sqlskills.com/blogs/paul/corruption-last-resorts-that-people-try-first/>
- <http://www.sqlskills.com/blogs/paul/technet-magazine-february-2009-sql-qa-column/>
  
- NEVER EVER DO ANYTHING IF YOU AREN'T 100% SURE YOU KNOW WHAT THE COMMAND DOES

# #15 Practice

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Introducing the Database corruption challenge

Steve Stedman

Stevededman.com

@SQLEMT

<http://stevededman.com/2015/04/introducing-the-database-corruption-challenge-dbcc-week-1-challenge/>

Russ Thomas Challenge

<https://sqljudo.wordpress.com/monthly-dba-challenge/>

# BONUS

- This is a performance tip, but recovering your database log as fast as possible is important
- What are VLF's and why should I care?
- Set your default auto-grow to fixed length not default %
- Pre-size your database and logs – Capacity Planning.
- Logs:
  - Adding < 64 MB = 4 VLFs
  - Adding < 1GB = 8 VLFs
  - Adding > 1GB = 15 VLFs
- NO Magic # of VLFs that you should try to achieve? For example: Any logs > 50 VLFs (Not a hard number) should be looked at and determine if you have log file growth set up correctly
- References:
  - <http://www.sqlskills.com/blogs/kimberly/transaction-log-vlfs-too-many-or-too-few/>
  - <http://www.sqlskills.com/blogs/kimberly/8-steps-to-better-transaction-log-throughput/>

# Double BONUS

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- Before you have a problem, know where to find additional help
- #SQLHelp
- Find a consultant you trust

# Resources

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Pond's Twelfth Law: In Your Pursuit of Five Nines, Don't Practice in Front of the CIO

<http://blogs.technet.com/b/wardpond/archive/2009/09/09/pond-s-twelfth-law-in-your-pursuit-of-five-nines-don-t-practice-in-front-of-the-cio.aspx>

Glenn Berry on Pluralsight

Glenn Berry on Simple Talk

<https://www.simple-talk.com/sql/database-administration/provisioning-a-new-sql-server-instance---part-one>

<https://www.simple-talk.com/sql/database-administration/provisioning-a-new-sql-server-instance-%e2%80%93-part-two/>

<https://www.simple-talk.com/sql/database-administration/provisioning-a-new-sql-server-instance-%e2%80%93-part-three/>

Paul Randal on Pluralsight

SQLSkills.com



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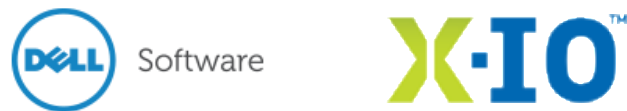
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