When Database Corruption Strikes

Presented by Steve Stedman

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About Steve

- **SQL Data Partners – Weekly Podcast** Co-Host http://SqlDataPartners/Podcast
- Blog regularly at http://SteveStedman.com
- Founder of the **Database Corruption Challenge**
- Creator of **Database Health Monitor** **http://DatabaseHealth.com**
- 26 years of SQL Server experience
- Freelance Database Consultant (SQL Server) with Stedman Solutions, and SQL Data Partners.
- Bellingham SQL Server Users Group – Chapter Leader

Agenda

- Causes of Corruption
- Detecting Corruption
- Tracking Corruption (what has gone bad?)
- Before fixing or removing corruption
- Removing Corruption
- Examples (2)

Database Corruption Challenge

- Was an about weekly event that ran for 10 weeks.
- I created a corrupt database and confirm that it can be recovered.
- The corrupt database is posted.
- Participants send me their solutions.

- 10 Corrupt databases available for download from http://SteveStedman.com/corruption

Training for Database Corruption and Training for CPR

- Too late to learn when you need them.
- Outcomes can be very bad if not trained.
- Regular practice required to keep your skills sharp.

Confusion With Database Corruption

- Backup and restore of a corrupt database may help fix the corruption.
  - **FALSE**. When you back up a database, the corruption is backed up.
- Rebooting the SQL Server may help with the corruption.
  - **FALSE**. Once the file is corrupt a reboot will not help.
- If I just ignore the corruption it may go away or fix itself.
  - **UNLIKELY**. If your regular process truncates the table with the corruption, then it will go away… Otherwise, very unlikely.

Detecting Corruption

- DBCC CheckDB

```
DBCC CheckDB();
```

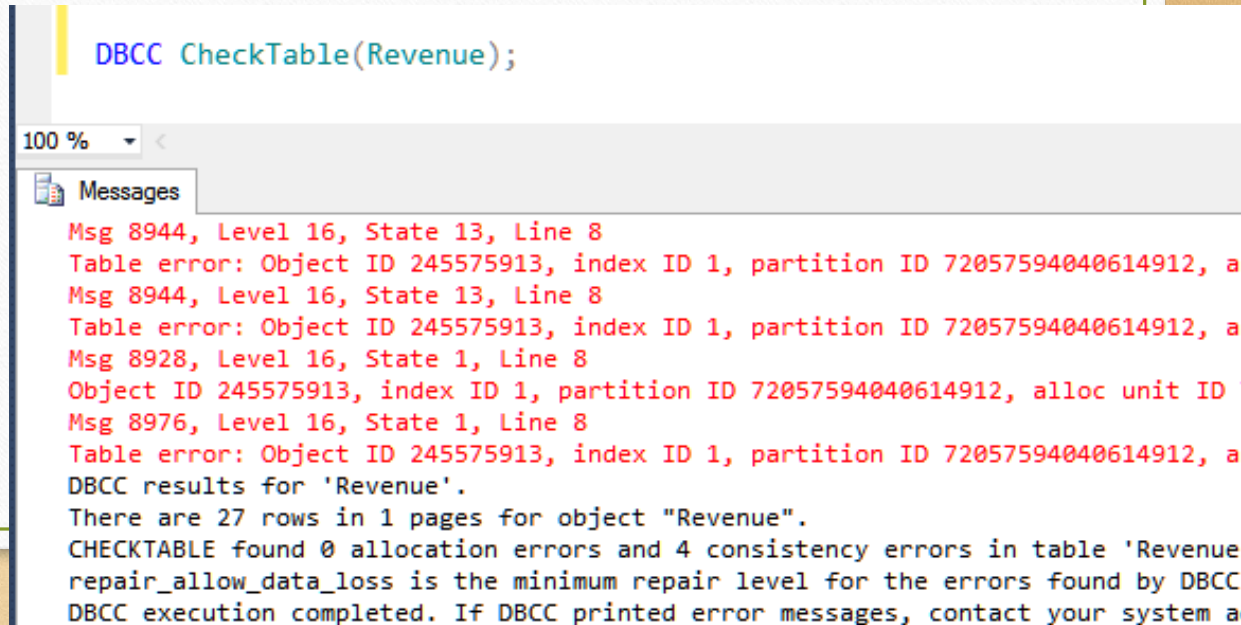
100 %

Messages

```
There are 0 rows in 0 pages for object "sys.sqlagent_jobs".
DBCC results for 'sys.sqlagent_jobsteps'.
There are 0 rows in 0 pages for object "sys.sqlagent_jobsteps".
DBCC results for 'sys.sqlagent_job_history'.
There are 0 rows in 0 pages for object "sys.sqlagent_job_history".
DBCC results for 'sys.sqlagent_jobsteps_logs'.
There are 0 rows in 0 pages for object "sys.sqlagent_jobsteps_logs".
Msg 8944, Level 16, State 13, Line 1
Table error: Object ID 245575913, index ID 1, partition ID 72057594040614912, alloc un
Msg 8944, Level 16, State 13, Line 1
Table error: Object ID 245575913, index ID 1, partition ID 72057594040614912, alloc un
Msg 8928, Level 16, State 1, Line 1
Object ID 245575913, index ID 1, partition ID 72057594040614912, alloc unit ID 7205759
Msg 8976, Level 16, State 1, Line 1
Table error: Object ID 245575913, index ID 1, partition ID 72057594040614912, alloc un
DBCC results for 'Revenue'.
There are 27 rows in 1 pages for object "Revenue".
CHECKDB found 0 allocation errors and 4 consistency errors in table 'Revenue' (object
DBCC results for 'sys.queue_messages_1977058079'.
```

Detecting Corruption

- DBCC CheckDB
- DBCC CheckTable



Detecting Corruption

- DBCC CheckDB
- DBCC CheckTable
- DBCC Check_____
  - Constraints, Catalog, Alloc, FileGroup, Ident

Detecting Corruption

- DBCC CheckDB
- DBCC CheckTable
- DBCC Check_____
  - Constraints, Catalog, Alloc, FileGroup, Ident
- msdb..suspect_pages

```
SELECT * FROM msdb..suspect_pages;
```

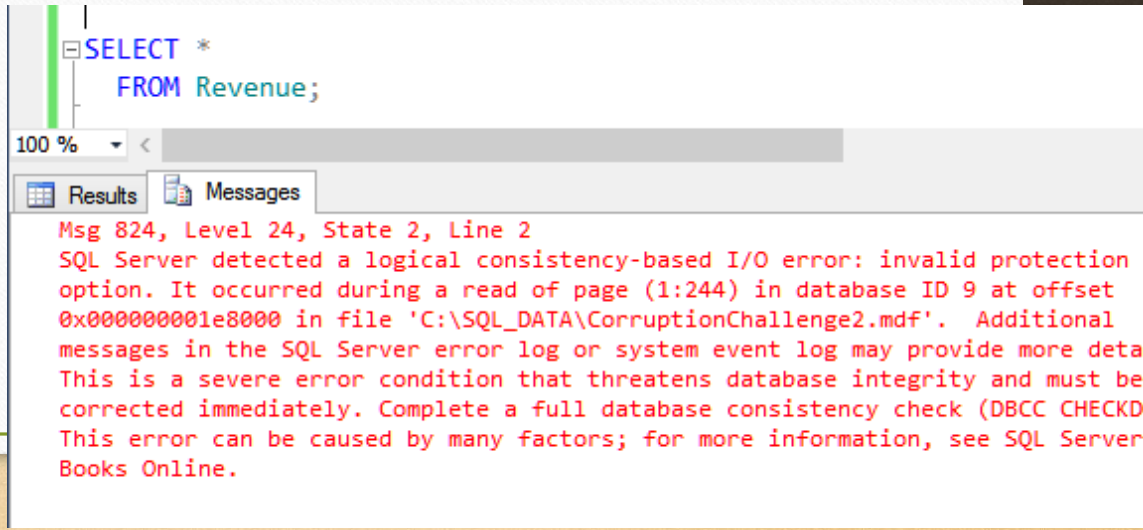
.00 %

Results | Messages

	database...	file_id	page...	event_ty...	error
1	11	1	244	4	8
2	11	1	244	1	4

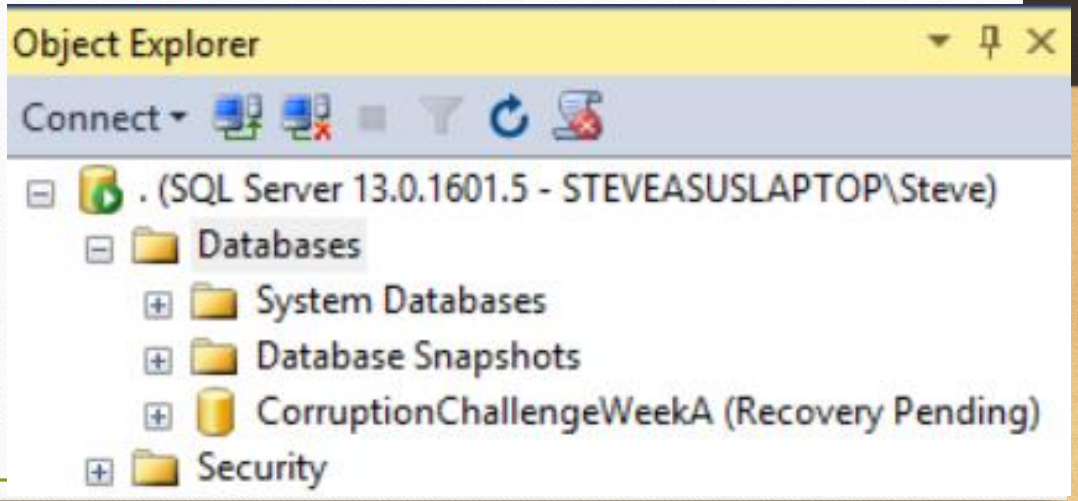
Detecting Corruption

- DBCC CheckDB
- DBCC CheckTable
- DBCC Check_____
  - Constraints, Catalog, Alloc, FileGroup, Ident
- msdb..suspect_pages
- Just running a query may show corruption.



Detecting Corruption

- DBCC CheckDB
- DBCC CheckTable
- DBCC Check_____
  - Constraints, Catalog, Alloc, FileGroup, Ident
- msdb..suspect_pages
- Just running a query may show corruption.
- Recovery Pending



Tracking Corruption (what has gone bad?)

- Error messages and the error log

```
Msg 8944, Level 16, State 13, Line 1
Table error: Object ID 2105058535, index ID 1, partition ID 72057594038845440, alloc
      unit ID 72057594039762944 (type In-row data), page (1:158), row 3. Test
      (ColumnOffsets <= (nextRec - pRec)) failed. Values are 3139 and 288.
Msg 8944, Level 16, State 13, Line 1
Table error: Object ID 2105058535, index ID 1, partition ID 72057594038845440, alloc
      unit ID 72057594039762944 (type In-row data), page (1:158), row 3. Test
      (ColumnOffsets <= (nextRec - pRec)) failed. Values are 3139 and 288.
CHECKDB found 0 allocation errors and 4 consistency errors in table 'Revenue' (object ID
CHECKDB found 0 allocation errors and 4 consistency errors in database 'CorruptionChalle
repair_allow_data_loss is the minimum repair level for the errors found by DBCC CHECKDB
```

Tracking Corruption (what has gone bad?)

Selected row details:

Date 5/10/2015 4:20:36 PM
Log SQL Server (Archive #1 - 5/10/2015 8:53:00 PM)

Source spid52

Message
SQL Server detected a logical consistency-based I/O error: incorrect pageid (expected 1:9; actual 0:0). It occurred during a read of page (1:9) in database ID 8 at offset 0x0000000012000 in file 'C:\SQL_DATA\CorruptionChallenge5.mdf'. Additional messages in the SQL Server error log or system event log may provide more detail. This is a severe error condition that threatens database integrity and must be corrected immediately. Complete a full database consistency check (DBCC CHECKDB). This error can be caused by many factors; for more information, see SQL Server Books Online.

Tracking Corruption (what has gone bad?)

11/8/2015 2:44:01 ...	spid57	External dump process return code 0x20000001. External dump process returned no errors.
11/8/2015 2:43:58 ...	spid57	[INFO] Identity Begin End | State Result Error Speculate Prepared LazyCommit ReadOnly |
11/8/2015 2:43:58 ...	spid57	Stack Signature for the dump is 0x0000000000000074
11/8/2015 2:43:58 ...	spid57	* Short Stack Dump
11/8/2015 2:43:58 ...	spid57	* --
11/8/2015 2:43:58 ...	spid57	* **
11/8/2015 2:43:58 ...	spid57	*
11/8/2015 2:43:58 ...	spid57	* DBCC CheckDB(CorruptionChallenge1) WITH NO_INFOMSGS;
11/8/2015 2:43:58 ...	spid57	* Input Buffer 132 bytes -
11/8/2015 2:43:58 ...	spid57	*
11/8/2015 2:43:58 ...	spid57	* DBCC database corruption
11/8/2015 2:43:58 ...	spid57	*
11/8/2015 2:43:58 ...	spid57	* Private server build.
11/8/2015 2:43:58 ...	spid57	* 11/08/15 14:43:58 spid 57
11/8/2015 2:43:58 ...	spid57	* BEGIN STACK DUMP:
11/8/2015 2:43:58 ...	spid57	*
11/8/2015 2:43:58 ...	spid57	* **
11/8/2015 2:43:58 ...	spid57	***Stack Dump being sent to D:\SQL2014\MSSQL12.SQL2014\MSSQL\LOG\SQLDump0022.txt

Tracking Corruption (what has gone bad?)

- Error messages and the error log
- See what you can query

```
-- lets see what we have in the corrupt table
SELECT *
  FROM Revenue;
-- 54 rows
```

Tracking Corruption (what has gone bad?)

- Error Messages and the Error Log
- See what you can query
- Check your non-clustered indexes

```
-- pull from the non-clustered index without
--   touching the clustered index
SELECT [id], [DepartmentID], [Revenue]
  FROM Revenue
  WITH (INDEX (ncDeptIdYear) );
```

Before Fixing or Removing Corruption

- Do you have a way to start over if something goes wrong?
- Do you have a backup of the current state?
- If your solution is going to cause data loss, can you save anything before causing that data loss?
- Do you have someone to review your ideas before proceeding?

Can I Get a "Do Over"?

What if you go through the whole process, but determine that part of your cleanup lost that could have been saved in the beginning?

Removing Corruption

- Restore from backup, prior to when the corruption was encountered.
  - Common solution. Lose data back to the point in time that corruption was encountered
  - Not always feasible.
    - Missing Backups.
    - Corruption has been there longer than your backup retention period.

Removing Corruption

- Drop/Recreate Index – if corruption is in a non-clustered index
- Truncate table – if you have a way to get the contents back
- `DBCC CheckTable(Revenue, REPAIR_REBUILD);`
- `DBCC CheckTable(Revenue, REPAIR_ALLOW_DATA_LOSS);`
- `DBCC CheckDB(database1, REPAIR_ALLOW_DATA_LOSS);`

Example 1

- You are given a .bak file with a corrupt database.
- That's it… That is all you have access to.
- The original database was already destroyed by a network admin attempting to solve the problem.
- Earlier non-corrupt backups were overwritten with the corrupt backup.

Example 1 – DBCC CheckDB

```
DBCC CheckDB(CorruptionChallenge1) WITH NO_INFOMSGS;
```

100 %

Messages

```
Msg 8944, Level 16, State 13, Line 2
Table error: Object ID 245575913, index ID 1, partition ID 72057594040614912, alloc unit ID
  72057594045857792 (type In-row data), page (1:280), row 3. Test (ColumnOffsets <= (nextRec - pRec))
  failed. Values are 3139 and 288.
Msg 8944, Level 16, State 13, Line 2
Table error: Object ID 245575913, index ID 1, partition ID 72057594040614912, alloc unit ID
  72057594045857792 (type In-row data), page (1:280), row 3. Test (ColumnOffsets <= (nextRec - pRec))
  failed. Values are 3139 and 288.
Msg 8928, Level 16, State 1, Line 2
Object ID 245575913, index ID 1, partition ID 72057594040614912, alloc unit ID 72057594045857792
  (type In-row data): Page (1:280) could not be processed.  See other errors for details.
Msg 8976, Level 16, State 1, Line 2
Table error: Object ID 245575913, index ID 1, partition ID 72057594040614912, alloc unit ID
72057594045857792 (type In-row data). Page (1:280) was not seen in the scan although its parent (1:281)
```

Stop - Think

- What would I do first?
- If my work makes something worse, how can I undo what I try?
- What can I do to determine what is corrupt?
- What can I do to recover missing data caused by the corruption?

Example 1

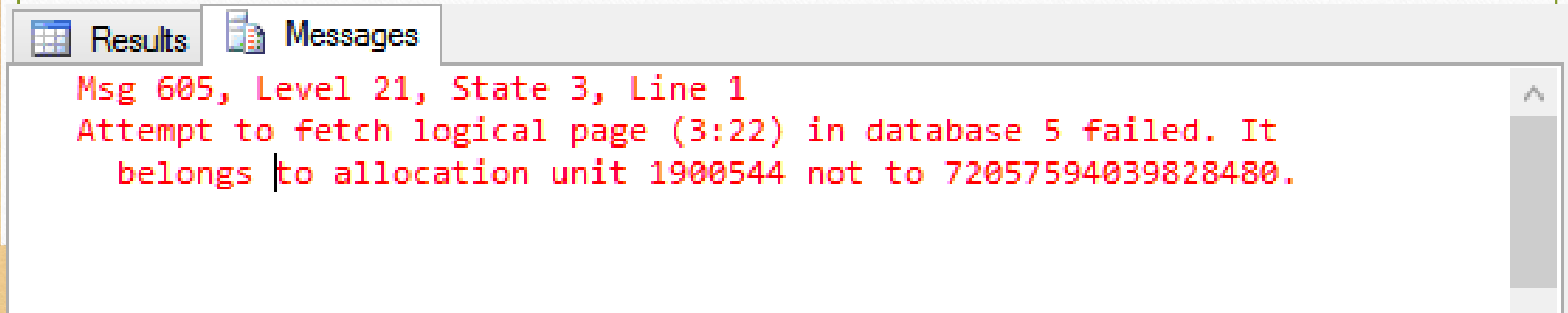
- Demo

Example 1

- Any Questions…

Example 2

- This was week 4 in the Database Corruption Challenge.
- Here is what we know. Everything was just fine, and all of a sudden users started reporting the following error when selecting from the database:



Example 2 – Errors from CheckDB

Msg 2534, Level 16, State 2, Line 1
Table error: page (3:22), whose header indicates that it is allocated to object ID 29, index ID 1, partition ID 281474978611200, alloc unit ID 1900544 (type In-row data), is allocated by another object.
Msg 2534, Level 16, State 2, Line 1
Table error: page (3:25), whose header indicates that it is allocated to object ID 29, index ID 1, partition ID 281474978611200, alloc unit ID 1900544 (type In-row data), is allocated by another object.
Msg 2511, Level 16, State 2, Line 1
… and many more

Example 2 – Additional Details

- The full backup file after the corruption occurred.
- Let's just say this database didn't have the best backup and restore schedule in place.
- There are no earlier backups to use.

Stop - Think

- What would I do first?
- If my work makes something worse, how can I undo what I try?
- What can I do to determine what is corrupt?
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Example 2

- Demo

Example 2

- Any Questions?

Summary

- Detecting Corruption
- Tracking Corruption (what has gone bad?)
- Before fixing or removing corruption
- Removing Corruption
- Examples

Don’t forget to ask for help…

- If you are stuck with a corrupt database don’t be afraid to ask for help.

More Examples

- More Corruption Challenges available on my website.
- My website: http://SteveStedman.com/Corruption
- Connect
  - Twitter @SqlEmt
  - LinkedIn http://linkedin.com/in/stevestedman
  - Email Steve@StedmanSolutions.com
- Find me at PASS Summit 2016

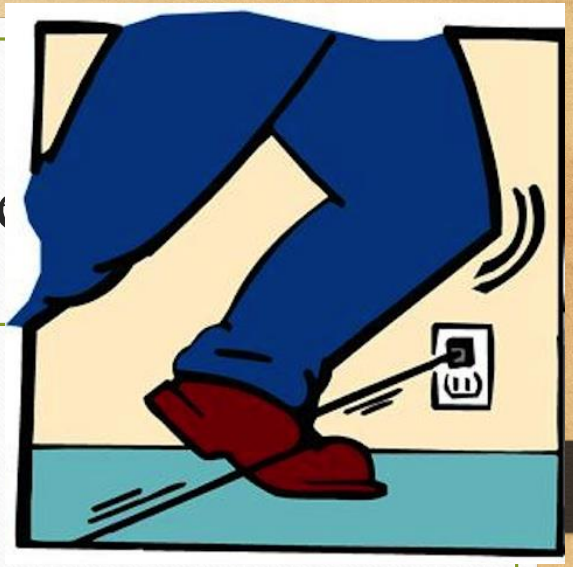
Thank You

- Questions?

Example - On Your Own

- This was week 3 in the Database Corruption Challenge
- http://stevestedman.com/fFQvC
- Download the challenge and try it on your own.

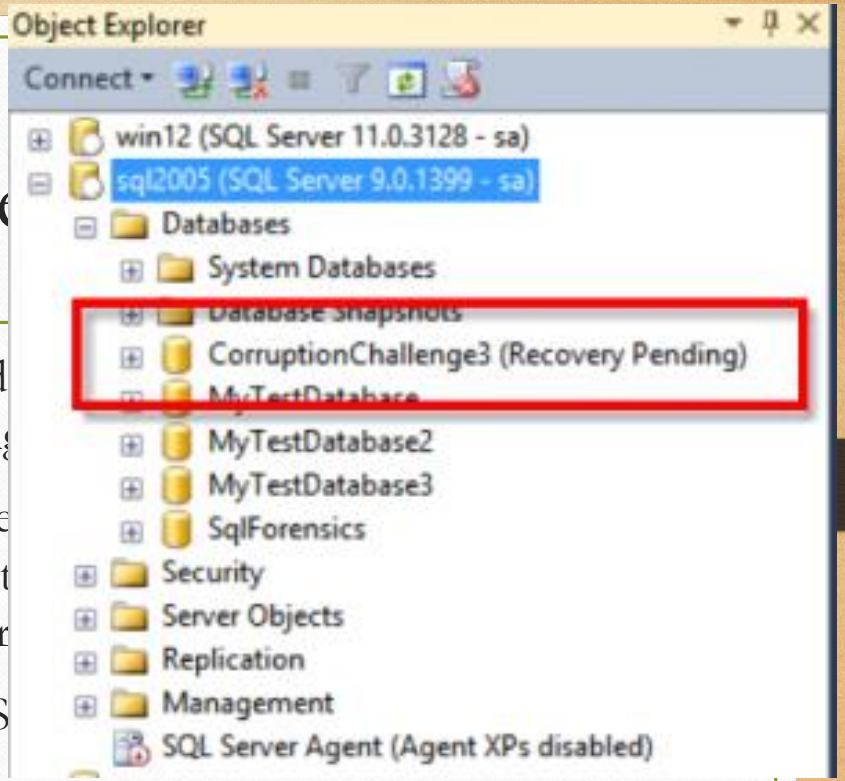
Example 4 – Timelin



- 2:53pm - full backup
- 2:54pm - transaction log backup
- 3:01pm - transaction log backup
- 3:12pm - transaction log backup
- 3:19 a catastrophic failure occurred causing the operating system running SQL Server to reboot.
  - Let's blame it on a power surge, or maybe it was just someone who accidently bumped the power cord. I like the power surge idea, so that I don't get blamed for kicking the power cord.

Example

- After the server rebooted, several other d
  just fine, however the CorruptionChalleng
- After examining the SQL Server data dire
  file for this database was gone. The only t
  was the .ldf file and previous backups for
- This was caused by some issue between S
- The database is in the Recovery Pending state.



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