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When Database Corruption Strikes

Will you be ready?

Steve Stedman, Founder, Stedman Solutions, LLC.

Please silence cell phones

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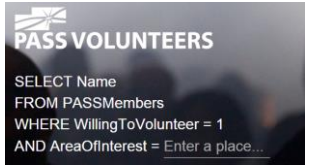

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Steve Stedman

Founder, Stedman Solutions, LLC.

Lead Technology Partner – SQL Data Partners

26 years of SQL Server experience

Bellingham SQL Server Users Group – Chapter Leader

Blog regularly at http://SteveStedman.com

Founder of the Database Corruption Challenge

Podcast Co-Host SQL Data Partners

Creator of Database Health Monitor (http://DatabaseHealth.com)

Freelance Database Consultant (SQL Server).

/stevestedman @SqlEmt

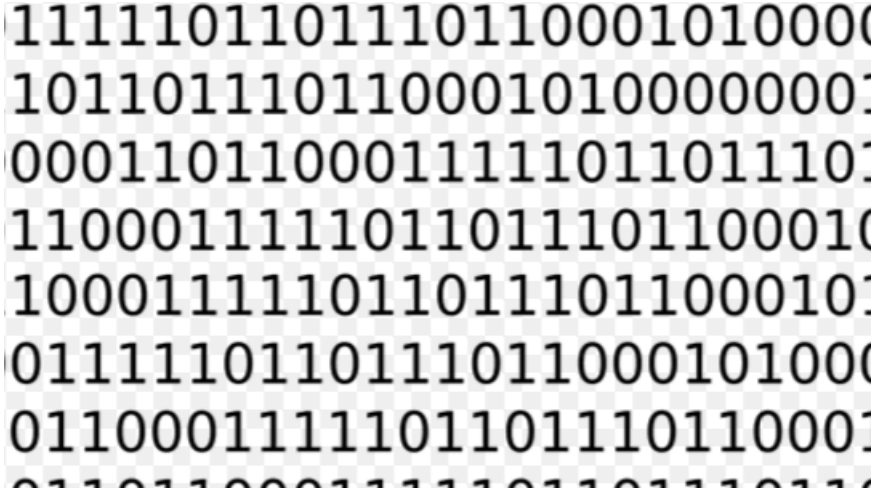
Agenda

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

Training for Database Corruption is like Training for CPR

What is Database Corruption?

- Pages in the database that are incorrectly formatted.
  - This could be as simple as a single bit, or as huge as the entire file.
- Sometimes prevents the database from starting.
- Sometimes prevents queries from running.
- Sometimes presents as missing or incorrect data.



Causes of Database Corruption

- Drive / Storage Failure – example drive replacement in RAID array.
- Power Outage – While database pages are being written.
- Network issues for network attached storage.

- Most of the time it is problems with I/O.

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();
```

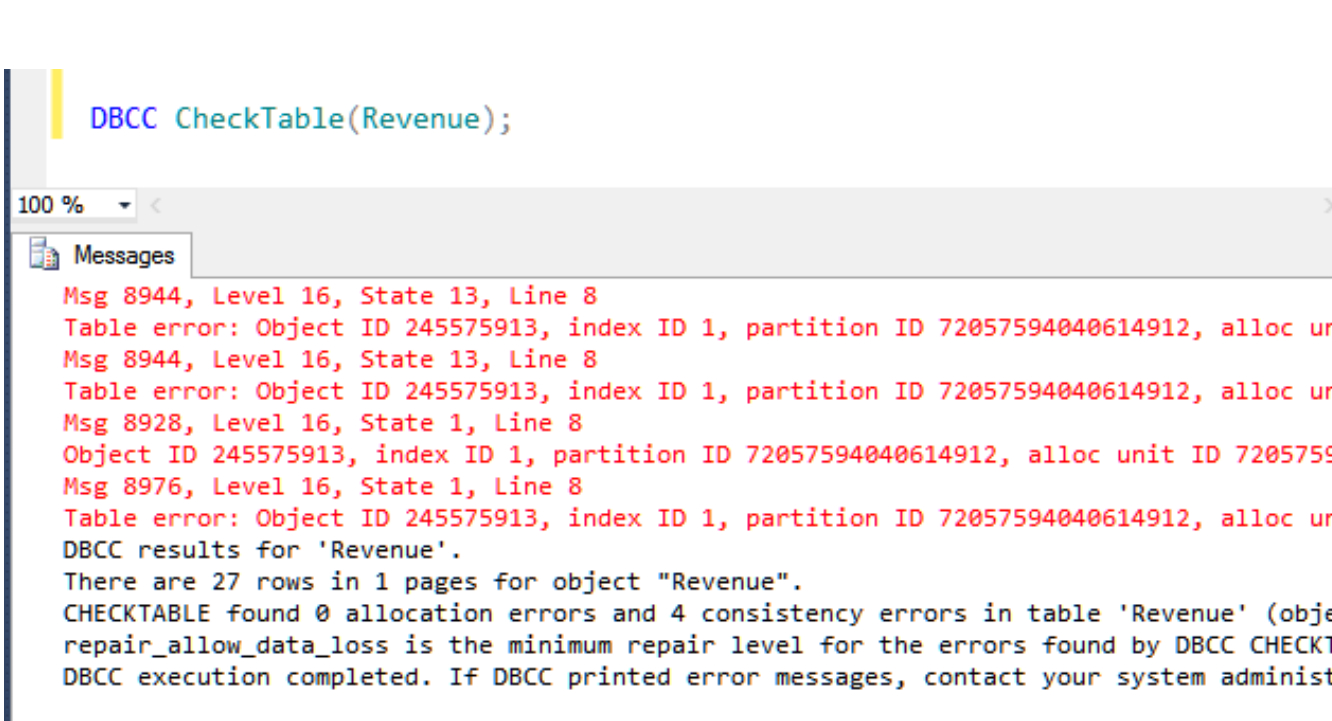
100 %

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____
- msdb..suspect_pages

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

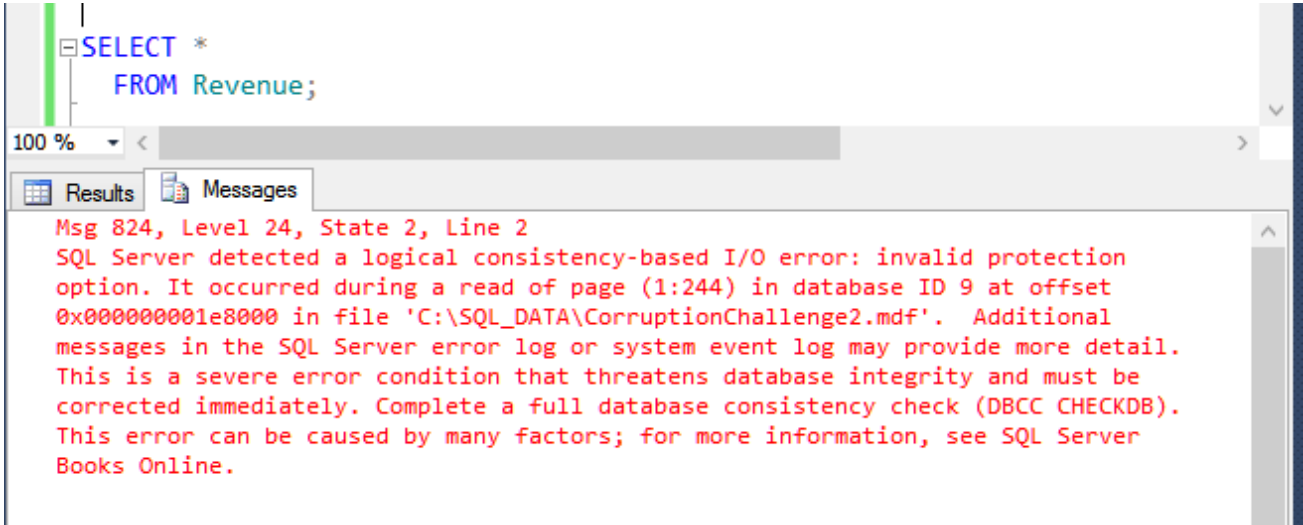
00 %

Results | Messages

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

Detecting Corruption

- DBCC CheckDB
- DBCC CheckTable
- DBCC Check_____
- msdb..suspect_pages
- Just running a query may show corruption.



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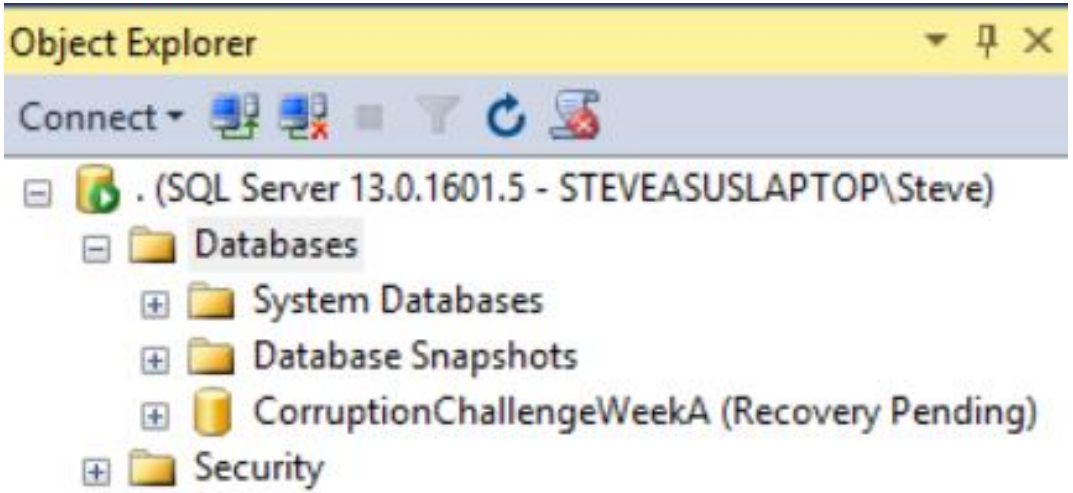
Detecting Corruption

- DBCC CheckDB
- DBCC CheckTable
- DBCC Check_____
- msdb..suspect_pages
- Just running a query may show corruption.
- Recovery Pending or Suspect



Tracking Corruption (what has gone bad?)

Check error messages - focus on the red.

```
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 21050
CHECKDB found 0 allocation errors and 4 consistency errors in database 'CorruptionChallenge1'.
repair_allow_data_loss is the minimum repair level for the errors found by DBCC CHECKDB (Corrup
```

Tracking Corruption (what has gone bad?)

Check the Error Log

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 0x00000000012000 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?)

Check the Error Log

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	*

Tracking Corruption (what has gone bad?)

See what you can query

```
-- lets see what we have in the corrupt table
SELECT *
  FROM Revenue;
-- 54 rows  Is that the expected number of rows?
```

Tracking Corruption (what has gone bad?)

Check your non-clustered indexes

Do you have the same number of rows, and same data that the clustered index has?

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

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 what could have been saved in the beginning?

Removing Corruption

Restore from backup, prior to when the corruption was encountered

Common solution. You will 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 Options

```
DBCC CheckTable(Revenue, REPAIR_REBUILD);
DBCC CheckTable(Revenue, REPAIR_ALLOW_DATA_LOSS);    (DANGER)
DBCC CheckDB(database1, REPAIR_ALLOW_DATA_LOSS);     (DANGER)
```

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.

```
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) and
CHECKDB found 0 allocation errors and 4 consistency errors in table 'Revenue' (object ID 245575913).
CHECKDB found 0 allocation errors and 4 consistency errors in database 'CorruptionChallenge1'.
repair_allow_data_loss is the minimum repair level for the errors found by DBCC CHECKDB
(CorruptionChallenge1).
```

100 %

Stop – Think

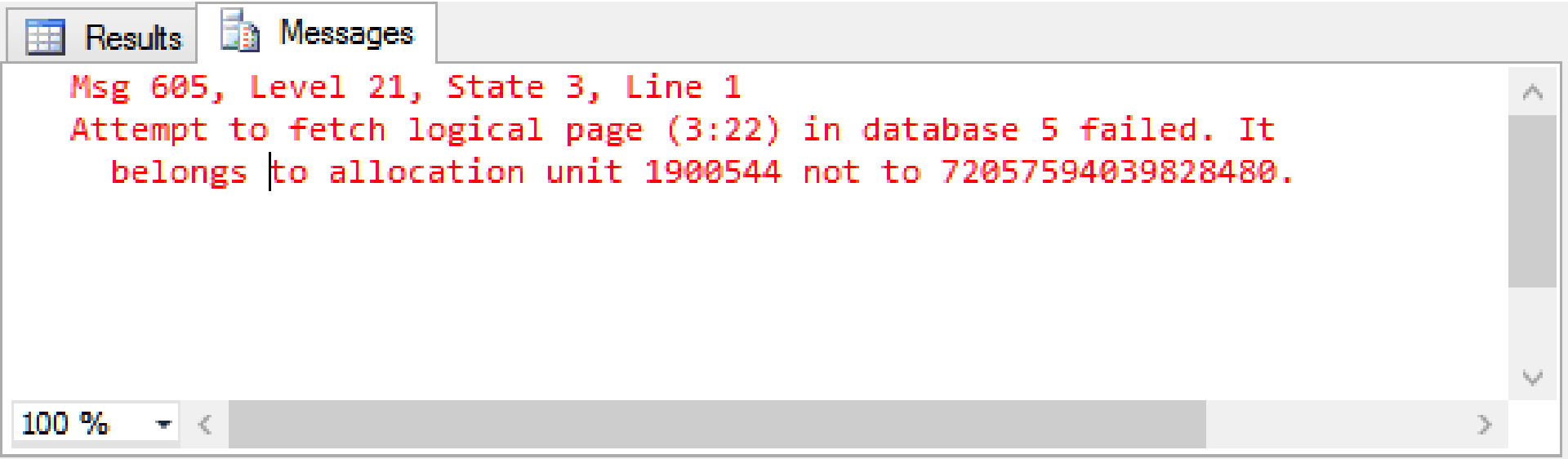
- What would I do first?
- If my work makes something worse, how can I undo what I try?
- What can I do to determine what is corrupt?
- What can I do to recover missing data caused by the corruption?

Example 1

Demo

Example 2

Here is what we know. Everything was just fine, and all of a sudden users started reporting the following error when running a select statement against the database:



This was week 4 in the Database Corruption Challenge.

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

You have access to the full backup file of the database 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?
- What can I do to recover missing data caused by the corruption?

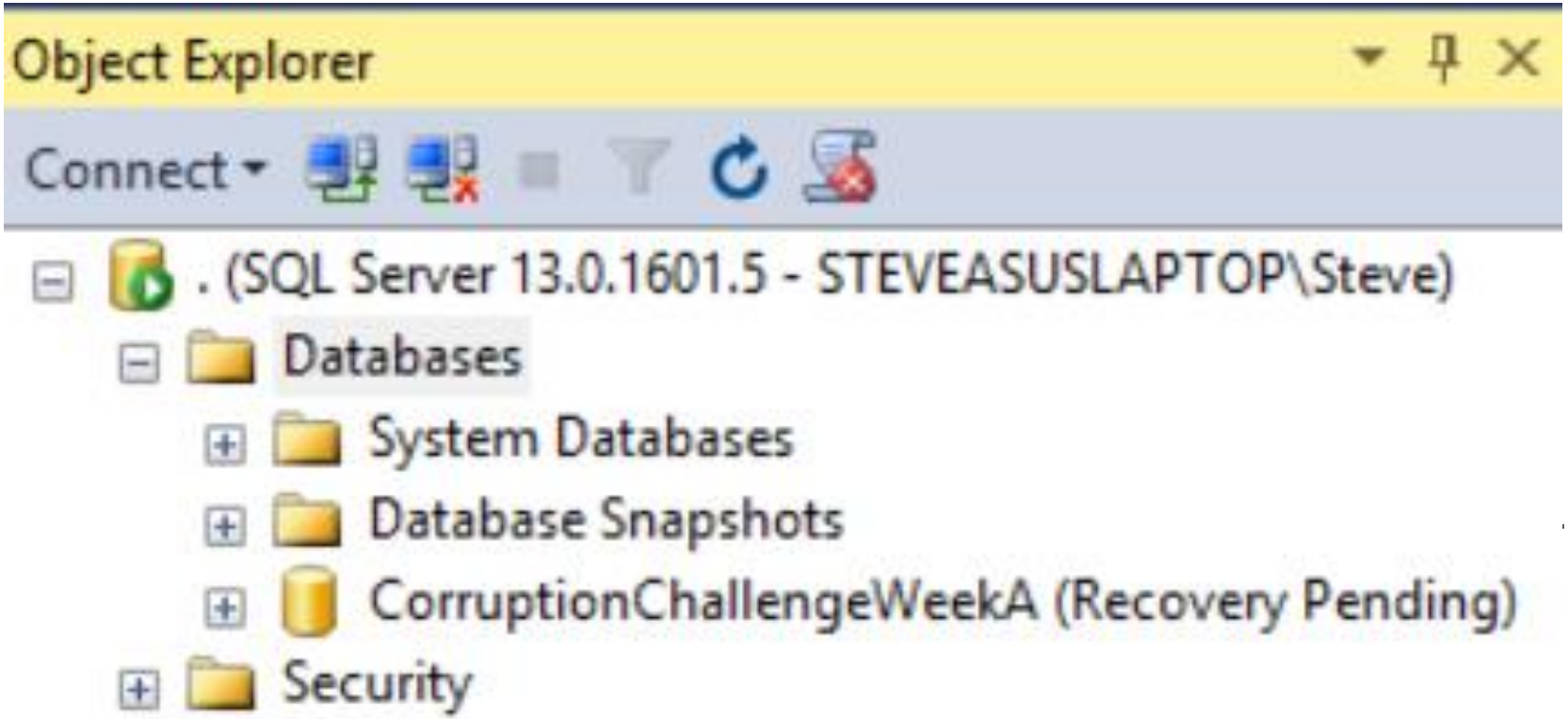
Example 2

Demo

Example 3

- This is a real world example from a client that I worked with this year.
- Names have been changed and databases have been recreated to simulate the actual event.
- Here is the scenario:
  - A new client calls you with a corrupt database.
  - There were able to provide the corrupt database mdf and ldf files.

Example 3 - Details



Example 3

There is an old joke

- "You either need to have a good backup and recovery plan or a good resume, **pick one**"
- Is there a third option?

In this case there are no backups, so all you have is your skills…

- Your skills to fix the database, not your skills to write a resume.

Example 3

Demo

Summary

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

More Examples

More Corruption Challenges available on my website.

http://SteveStedman.com/Corruption

Session Evaluations

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Thank You

Learn more from

Steve Stedman

Steve@StedmanSolutions.com or follow @SqlEmt