SQL Server: Advanced Corruption Recovery Techniques

Module 6: Advanced Repair Techniques

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Introduction

- **The most advanced techniques involve editing system tables and manually changing page structures directly**
- **Although very challenging, success could save a business or your job**

- **In this module we'll cover:**
  - System table corruption
  - When not to run repair
  - Reconstructing deleted data
  - Manually editing data files

Is Repair Guaranteed to Work?

- **The simple answer is no**
- **There are an infinite number of combinations of possible corruptions and it's not possible to test them all**
  - Some areas are not tested well at all, like system table corruption
  - Some repairs cannot be done, like rebuilding the boot page or a PFS page
- **Story: testing the repair code while at Microsoft**
- **If you absolutely need to have zero data loss, you must have backups or a synchronously replicated copy of the database**
  - Use database mirroring, availability groups, or SAN replication
- **Usually you're going to use restore, if backups are available**
  - Remember the Restore vs. Repair debate from the more basic course

Metadata Corruption

- **Someone manually changed system tables in SQL Server 2000…**
- **Hidden system tables are accessible only when the Dedicated Admin Connection (DAC) is used**
  - sqlcmd –A or prefix the SSMS connection string with "admin:"
  - 2012: Error message in SSMS can be ignored
  - 2012: TF7806 at startup plus running SQL Browser allows DAC connections under all circumstances, including named instances
    - SQL Performance blog post on this at http://bit.ly/RKxGQV
- **These tables cannot be changed unless the server is booted with –m**
- **From SQL Server 2008 onward, if a system table is directly modified, it is noted in the database metadata**
  - **This modification makes your database technically unsupported**
  - Check DBCC DBINFO
    - If you update a system catalog using 3-part naming, the dbi_updSysCatalog of the database you're in is erroneously updated

Rebuilding System Table Indexes

- **Structurally corrupt system table clustered indexes cannot be repaired successfully**
- **Structurally corrupt system table nonclustered indexes sometimes can be rebuilt by repair**
  - You may have to play around with DBCC CHECKTABLE to find which table is corrupt as DBCC CHECKDB may fail
  - This is not guaranteed to work…be careful as it may make things worse
- **I would try to avoid running repair on system tables completely**
  - Or at least test it on a copy of the database

Using Older Backups and Repair

- **If you don't have valid, recent backups to recover with, you may be able to use older backups along with repair**
- **Steps to use:**
  - Perform the repair operation
  - Determine what data is missing or damaged
  - Restore the old backup as a different database name
  - Determine if any of the missing data can be salvaged from the old database
- **Of course, no guarantee that the salvaged data is up-to-date, but it may be better than nothing**

Reconstructing Data From Nonclustered Indexes

- **If repair is the only option and heap or clustered index structures are damaged, you may be able to recover data from nonclustered indexes**
  - This may also be the case if repair is impossible because of corrupt metadata
- **Create SELECT statements to figure out which table rows will be lost from running repair**
- **Create SELECT statements to force selection from non-damaged nonclustered indexes to salvage some of the column data**
- **Success rates will vary depending on the amount of column coverage in the nonclustered indexes**
  - May need to use DBCC PAGE, as discussed later
- **Do this BEFORE running repair, as the repair will rebuild nonclustered indexes based on the repaired heap or clustered index**

Using DBCC PAGE To Walk Tables

- **If repair is the only option and heap or clustered index structures are damaged, you may be able to recover data using DBCC PAGE**
  - This may also be the case if repair is impossible because of corrupt metadata
- **Method 1: to assist in figuring out what key ranges will be lost, and will need to be reconstructed from nonclustered indexes**
  - Write code to programmatically walk through table structures using DBCC PAGE … WITH TABLERESULTS
- **Method 2: manually examine corrupt pages to try to get data values from them**
  - After first determining what the corrupt pages are, from repair or using Method 1 above

The Ultimate Advanced Recovery

- **Manually editing data files using a hex editor or DBCC WRITEPAGE is the most advanced method of corruption recovery**
  - Usually requires very detailed knowledge of database structures
- **Always take a backup before manually editing a database**
  - If something goes wrong, you can still get back to the starting point
- **I usually do this once or twice a year for clients**
  - Some examples:
    - Fixing up broken off-row LOB links in SQL Server 2000 sysindexes
    - Recreating a file header page by copying from an older backup
    - Deallocating a broken page to allow data export when other metadata problems prevent DBCC CHECKDB repair from running
- **Always run DBCC CHECKDB to make sure you haven't made things worse and have fixed the original problem**
- **Always do it on a copy of the corrupt database**
  - If a backup/restore won't work, use a file system copy and hack attach

Any Other Ways to Salvage Data?

- **Possible other places to get data:**
  - Data warehouse
  - Test/dev systems
  - 3rd-parties that host/consume some of your data
  - Replication subscribers
  - Hard-copy printouts
- **I've heard some incredible stories of tenacity in the face of corruption**
  - "Unbelievable tale of disaster recovery" at http://bit.ly/185Z2bI

Course Summary

- **Now you know:**
  - A lot more about how DBCC CHECKDB works and it can be tuned
  - Undocumented DBCC commands that can help with corruption recovery
  - Methods for dealing with transaction log problems
  - Advanced restore techniques
  - Advanced repair techniques
- **The most important takeaways from this course:**
  - Basics will only get you so far, often more unconventional techniques are needed to recover from corruption
  - The more you practice, the easier corruption recovery will be
  - DBCC WRITEPAGE is a powerful, but dangerous command…use it carefully
- **Email me interesting corruption stories: Paul@SQLskills.com**
- **Thanks for watching!**