SQL Server: Detecting and Correcting Database Corruption

Module 6: Interpreting DBCC CHECKDB Output

Paul S. Randal
http://www.SQLskills.com/blogs/paul/
Paul@SQLskills.com

pluralsight
hardcore developer training

Introduction

- **It's important to be able to recognize when corruption is present and whether the type of corruptions places limitations on what you can do to fix it**
- **DBCC CHECKDB output can be hard to understand but there are some tips and tricks you can use**

- **In this module we'll cover:**
  - Interpreting DBCC CHECKDB output
  - Simple examples of corruptions
  - Restore vs. repair

First Signs of Corruption…

- **Users report connections being broken, possibly 823 or 824 errors**
- **Backup jobs start failing**
  - Error 3043 – backup detected checksum errors
- **SQL Agent alerts start firing**
- **Maintenance jobs start failing**
- **Errors in the SQL Server error log**
- **All these are signs that you've got corruption somewhere**

Running DBCC CHECKDB

- **Use the following command with only these options:**
  - DBCC CHECKDB (yourdb) WITH NO_INFOMSGS
    - Add ALL_ERRORMSGS when using SQL Server 2008 RTM or before
- **Good idea to know how long it usually takes to run for a database**
  - Allows you to report to management how long before results are known when a disaster occurs
  - Longer run time usually indicates some corruption has been found
- **Wait for the command to complete**
  - It's the only way to know what corruptions you have
  - Don't jump the gun and assume you need to restore
- **Look through the output for anything significant**

Where Does DBCC CHECKDB Output Go?

- **As long as the command is not interrupted:**
  - Completion message is written to the SQL Server error log
  - Completion message is written to the Windows Application event log
- **Regular output only goes to the connection running the command**
- **If corruptions are found:**
  - Severity 16 messages are printed as part of the output but do not cause TRY/CATCH blocks to go into the CATCH block
  - SSMS (SQL Server Management Studio) will report that the query failed, even though the command completed successfully
- **SSMS will only report the first 1,000 error messages**

Interpreting DBCC CHECKDB Output (1)

- **There are over 100 errors that DBCC CHECKDB can output, some with over 200 message states**
  - Effectively there are roughly a thousand different corruption conditions that can be reported
- **Figuring out what one corruption means isn't too bad**
  - MSDN has some of them published
- **Figuring out multiple corruptions can become very hard and usually isn't worth the time**
- **There are some tips and tricks you can use to determine the course of action to take**

Interpreting DBCC CHECKDB Output (2)

- **Did DBCC CHECKDB fail?**
  - If it stops before completing successfully, something bad has happened that is preventing it from running correctly
  - This means there is no choice but to restore from a backup or try exporting the data, as DBCC CHECKDB cannot be forced to run (and hence repair)
- **Examples of fatal (to DBCC CHECKDB) errors:**
  - 7984 – 7988: corruption in critical system tables
  - 8967: invalid states within DBCC CHECKDB itself
  - 8930: corrupt metadata such that DBCC CHECKDB could not run
- **The SQL Server error log message will list an error state**
  - See the "Understanding DBCC Error Messages" portion of the Books Online for DBCC CHECKDB for details at http://bit.ly/179p6At

Interpreting DBCC CHECKDB Output (3)

- **Are the corruptions only in nonclustered indexes?**
  - If recommended repair level is REPAIR_REBUILD, then yes
  - Otherwise, check all the index IDs in the errors and if they're all greater than 1, then yes
  - If yes, you don't need to restore or run repair, as we'll see in Module 8
- **Was there an un-repairable error found?**
  - Examples:
    - 2570 error: invalid data for the column type (data purity error)
    - 8992 error: CHECKCATALOG (metadata mismatch) error
    - 8909, 8938, 8939 (page header corruption) errors where type is 'PFS'
  - None of these can be automatically repaired so your options are to restore or to attempt manual repairs
    - We'll fix 2570 errors in Module 8, and some others in the advanced course

Interpreting DBCC CHECKDB Output (4)

- **Everything else I haven't mentioned I classify as "general corruptions"**
  - Your options are to restore or repair or export to a new database
- **The more corruptions there are, the harder it is to figure out what's actually broken**
  - It also depends on what kind of page is corrupt
- **For example, for a data page in the leaf level of a clustered index:**
  - There may just be one error about one row on the page
    - And there may also be a matching error about each nonclustered index
    - And there may also be a matching error about each off-row LOB value in the row
    - Etc…
  - There may be an error that the entire page cannot be processed
    - And there will also be errors about broken links to other pages
    - And there may also be errors about nonclustered indexes
    - Etc…
  - Etc…

Restore vs. Repair (1)

- **Although many people say that repair is a last resort, it could be that restoring from a backup would take much longer than a repair**
  - If downtime is more important than data loss, repair may be better
  - There is always the option to try exporting data from the damaged database
- **Multiple decision points that can short-circuit the decision process**
- **Do you still have a database?**
  - No – you must restore from a backup
- **Do you have working backups?**
  - No – you must use repair, or restore a damaged backup (advanced), or export data to a new database
- **Is the transaction log damaged?**
  - Yes – you must restore, or run emergency mode repair (advanced), or export data to a new database
  - We'll cover transaction log scenarios in the advanced course

Restore vs. Repair (2)

- **Did DBCC CHECKDB fail?**
  - Yes – you must restore or export, as you cannot run repair
- **Is it just nonclustered indexes that are damaged?**
  - Yes – neither restore or repair, manually rebuild them (Module 8)
- **Are there any un-repairable errors?**
  - Yes – you must restore or export, or potentially manually repair them
  - Some manual repairs are trivial, but most are (usually very) advanced

- **If you're still able to make a repair vs. restore choice:**
  - Consider your down time and data loss Service Level Agreements
  - Use whichever option you can which allows you to limit down time and data loss while still staying within the SLAs
- **There is a comprehensive flow chart of the decision making process available at http://bit.ly/VGFQH5**

Exporting Data to a New Database

- **If repair or restore are not possible, you must export as much data as possible into a new database**
- **Steps to take:**
  - Create the new database with the same tables and indexes
    - And stored procedures, functions, etc.
  - SELECT as much data as possible from all tables into the new database
- **Corruptions may complicate this and call for advanced methods**
  - These are discussed and demonstrated in Module 6 of the advanced course

Summary

- **Always let DBCC CHECKDB complete before beginning to recover**
- **Analyzing the output from DBCC CHECKDB will help you determine your possible courses of action to recover**
- **The more you expose yourself to corruptions, the more comfortable you'll become with analyzing the output and figuring out what to do**

- **In the next module, we'll discuss:**
  - Simple techniques to recover using RESTORE