Database corruption

How to detect and avoid common problems

Michał Sadowski
michal.sadowski@hotmail.com
@SadowskiMichal

Sponsors


PASS


Microsoft
DELL
Software


DB-BEST
TECHNOLOGIES


<epam>


eleks®


BAKOTECH®


devart
Database Interaction Solutions


softserve experience matters

Few words about me

- Michał Sadowski
- Located in Kraków, Poland
- Taking active technical role in upgrade (to SQL Server 2014) project
- MCP since 2005
- MCITP: SQL Server DBA 2005/2008
- Interests:
  - Disaster Recovery
  - Performance tuning
- Leader of **PLSSUG** Kraków group
- Principal IT Specialist in ABB, responsible for Treasury Management System

Agenda

- Introduction
- Basics of data file
- Database Recovery options
- Basics of heap and (non)clustered index
- How to approach corruption?
- Examples with demos
- Features available in Enterprise Edition
- Summary

THERE ARE TWO TYPES OF PEOPLE: THOSE WHO HAVE LOST DATA AND THOSE WHO WILL...

Introduction

- Database corruption happens very frequently – however not always DBA is aware of that
- Corruption doesn’t mean that database is useless
- SQL Server has built-in mechanisms to detect corruption
- Right steps just after you detect corruption can minimize system unavailability
- You can detect and fix most of the corruption in short time

Basics of data file

- There is at least one data file (*.mdf, *.ndf)
- There is at least one transaction log file (*.ldf)
- SQL Server is using Write Ahead Logging (WAL) mechanism
- SQL Server reads/writes data in pages (8 kb), which are grouped in extents (8*8kb)
- Each data file contains data and metadata
- Data file can be in Read-Only mode

Possible database states

- ONLINE
- OFFLINE
- RESTORING
- RECOVERING
- RECOVERY_PENDING
- SUSPECT
- EMERGENCY

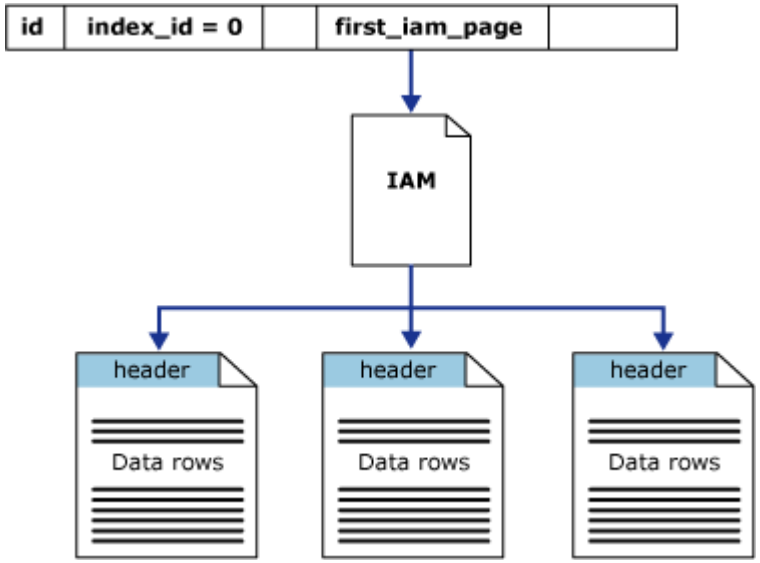
Database Recovery Option

- NONE
  - Default option after installation
- TORN_PAGE_DETECTION
  - Bit to be flipped for each 512-byte sector on data page
- CHECKSUM
  - Availble in SQL Server 2005+
  - From SQL Server 2008+ also in tempdb

Basics of heap and (non)clustered index

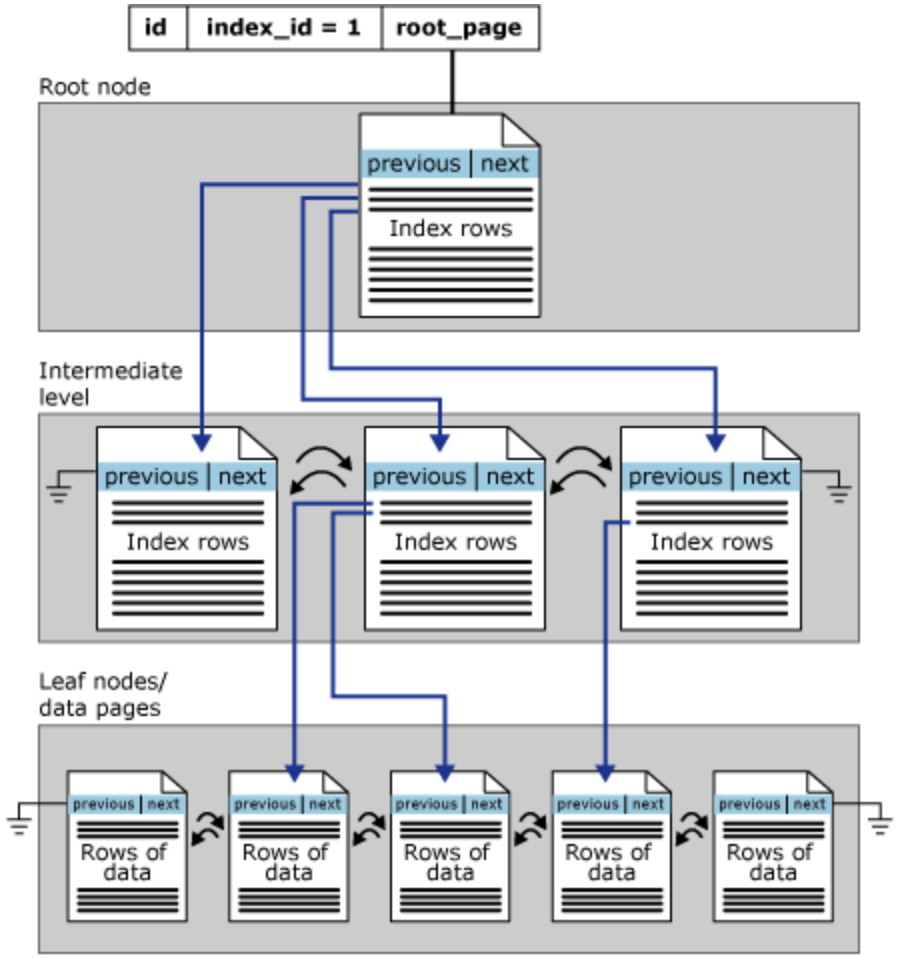
- Data rows are stored in structures called heap or clustered index
- There can be only one clustered index
- There can be up to 999 (2008+) nonclustered indexes
- Index are organized as B-tree and can have many levels
- Nonclustered index doesn’t contain any data, only data pointers
- The only exception is index with INCLUDE

Heap



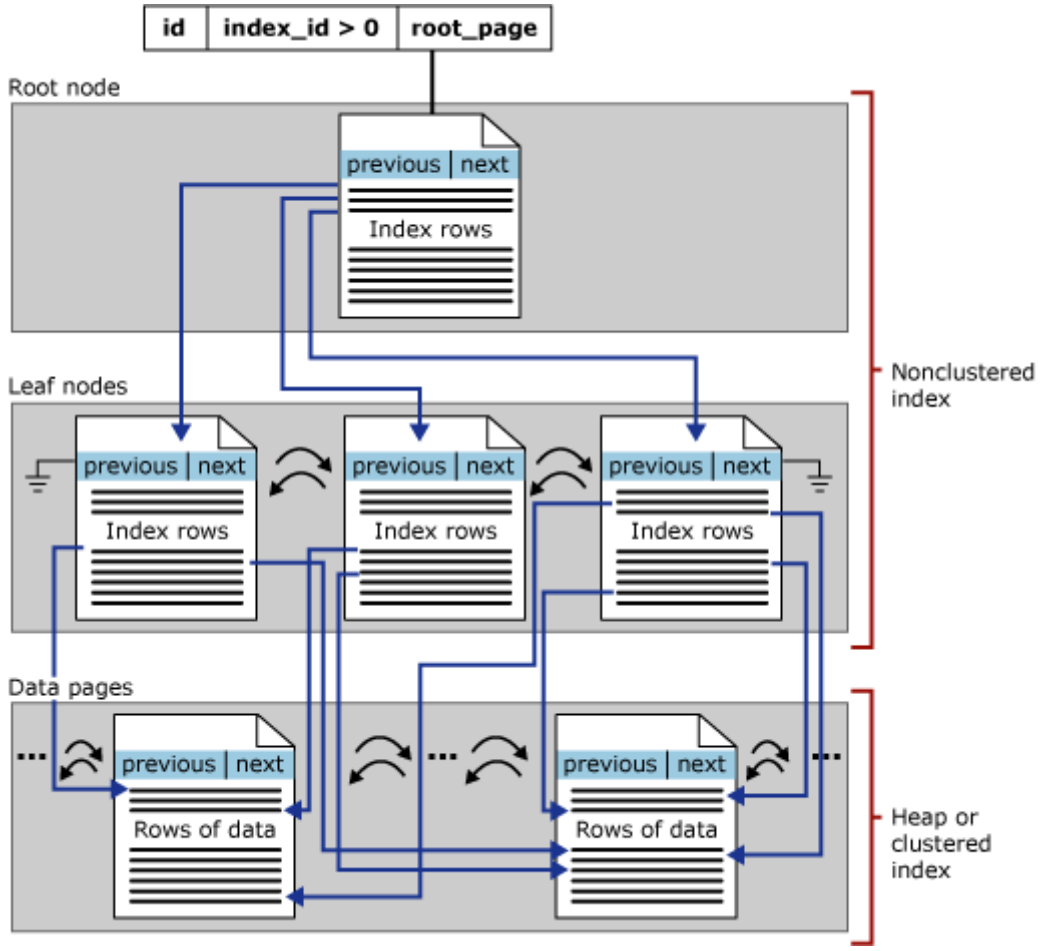
https://technet.microsoft.com/en-us/library/ms188270(v=sql.105).aspx

Clustered index



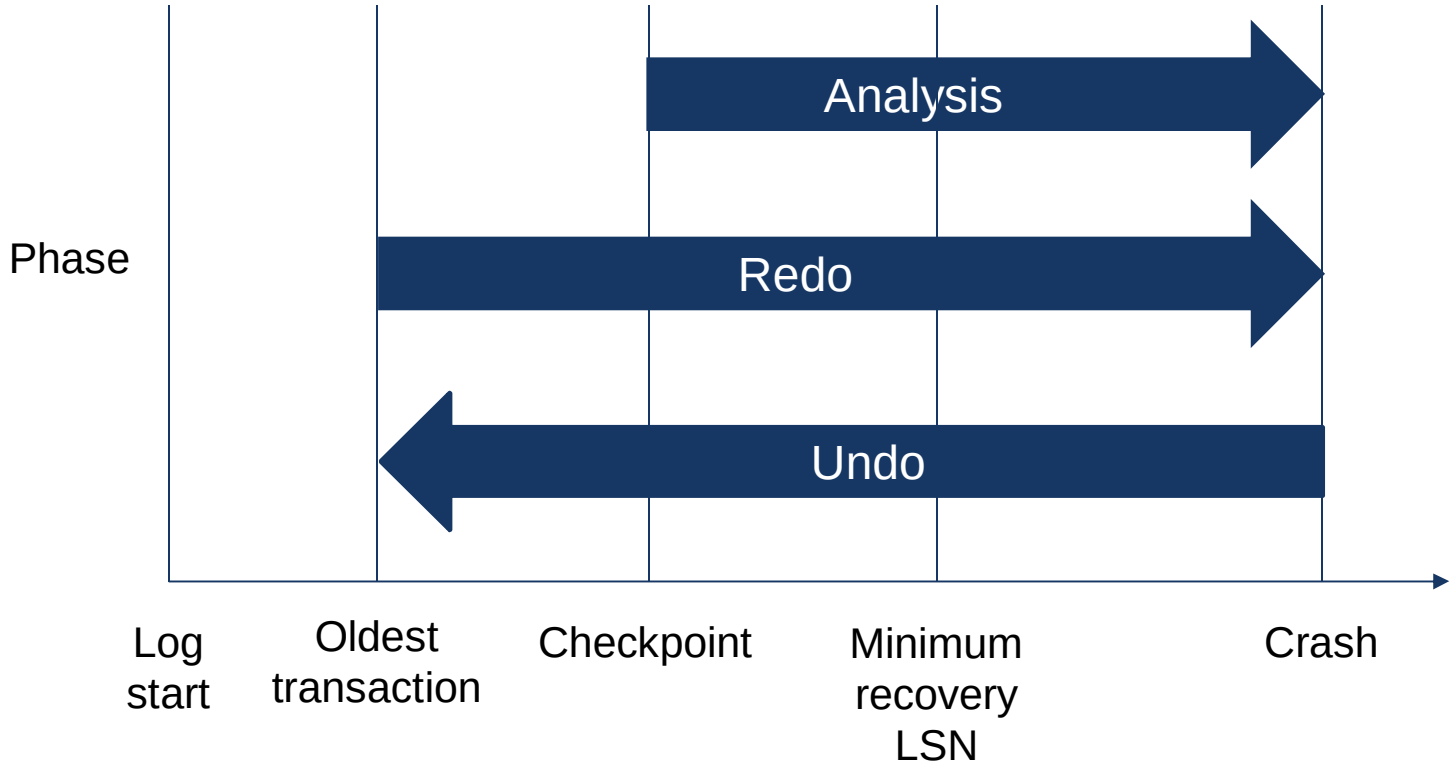
https://technet.microsoft.com/en-us/library/ms177443(v=sql.105).aspx

Nonclustered index



https://technet.microsoft.com/en-us/library/ms177484(v=sql.105).aspx

Phases of Recovery



Why use multiple files?

- For most DBs single data and transaction log file should be enough
- Easier management and restore of DB – 5 x 200GB vs. 1TB disks
- Use filegroups to enable placement of objects on specific physical disks – better performance
- Primary file will contain only system tables and objects – faster DB in ONLINE state
- Put heavily accessed tables and the nonclustered indexes that belong to those tables on different filegroups – better performance and availability
- Transaction log file on different disk
- Piecemeal restore

DBCC CHECKDB

- Transactionally consistent static view of DB
- Low-level consistency checks of the critical system catalogs
- Allocation consistency checks
- Consistency checks of every table
- Cross-table consistency checks:
  - Service Broker metadata
  - Various system catalogs
  - Indexed views
  - XML, spatial indexes

How to approach corruption?

- Check if you can connect to database
- Check what is corrupted
- Check result of DBCC CHECKDB
- Check if you have latest valid backup / if AlwaysOn / mirroring / log-shipping / snapshot / other backup solution is in place
- In case you don’t have any valid backups ALWAYS make backup before any modification of suspected database

DEMO

EXAMPLES OF CORRUPTED DATABASES

Features available in Enterprise Edition

- Table and index partitioning
- Single page restore
- Fast recovery
- Online indexing
- Online schema changes
- Database snapshot
- Parallel index operations

Summary

- If you found out that database is corrupted –
  DON'T PANIC
- Prepare restore (not backup) strategy based on business requirements
- Always use DBCC CHECKDB
- Always use CHECKSUM option
- Check average execution time of
  DBCC CHECKDB
- Restore backups frequently (e.g. every month) and check how long it took
- Remember about msdb.dbo.suspect_pages table

To learn more, go here:

- Paul's Randal blog, categories:
  - Corruption
  - DBCC
  - CHECKDB From Every Angle
- Pluralsight: SQL Server: Detecting and Correcting Database Corruption
- MSDN: Piecemeal Restore of Database

FOR HELP, CONTACT ME:

michal.sadowski@hotmail.com

Questions?

THANK YOU!

Sponsors


PASS


Microsoft
DELL
Software


DB-BEST
TECHNOLOGIES


<epam>


eleks®


BAKOTECH®


devart
Database Interaction Solutions


softserve experience matters