

Backup and Restore Tips and Tricks

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Objectives

- Backup Types
- Recovery Models
- Backup/Restore Methods
- Transaction Log Management
- Backup Options for each type

Introduction

What structures need to be backed up?

- Data Files
- Log Files
- Filegroups

What databases should be backed up?

- User Databases
- Master
- Model
- MSDB
- TempDB

What do you lose without system DB backups?

- Logins
- Linked Servers
- Endpoints
- Roles
- Everything Server Level
- What's in MSDB?

Backup Types

- Full
- Differential
- Log
- Copy_Only
- File
- Filegroup
- Partial
- Tail Log

Recovery Models

Simple

- Log backups not supported
- Point-in-time restore not supported
- Page restore not supported
- File restore – Only secondary files marked READONLY

Full

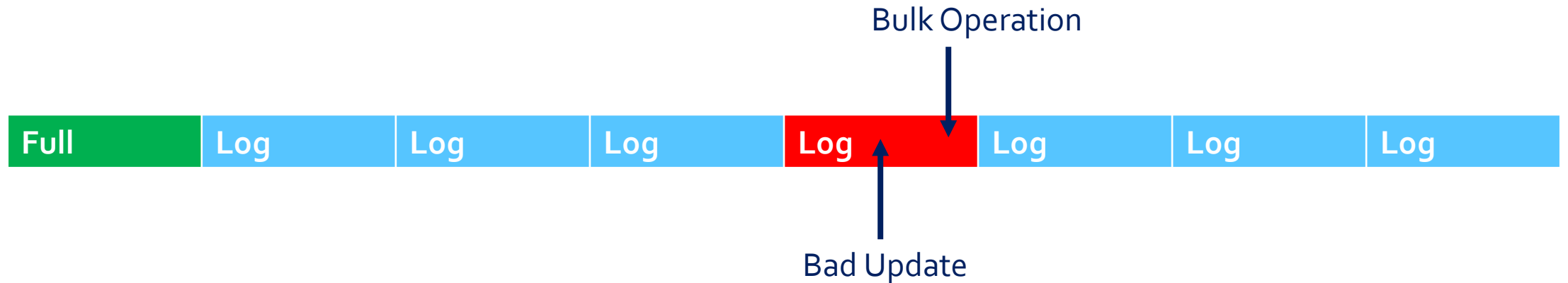
- Default as inherited from Model
- All operations fully logged
- Log Backups supported
- Point-in-time restore supported
- Page restore supported
- File restore supported

Bulk-Logged

- Bulk logged operations are minimally logged
 - Includes the extents modified by a minimally logged operation
 - Size is about the same
- Log backups supported
- Page restore supported
- File restore supported

Bulk-logged

- Point in time restore
 - Log cannot contain a bulk-logged operation
 - All or none



Bulk-logged Operations

- BULK INSERT
- Bcp.exe
- SELECT INTO
- CREATE INDEX
- ALTER INDEX REBUILD
- DROP INDEX

Backing Up

Storage

- Not on the same drive as your DBs
- Local storage
- SAN
- Network storage
- Tape Library
- Local and then copy to network

Backup to Azure

- Introduced in SQL 2012 SP1 CU2
- GUI introduced in SQL 2014
- Backup to URL
- SQL Server backup to Microsoft Windows Azure Tool
- Does not support multi-file, MAXTRANSFERSIZE, BLOCKSIZE

Backup Methods

- GUI
- Maintenance Plans
- T-SQL
- Powershell
- Third Party



Backup & Restore Options

Full Backups

- Backs up everything to the end of the data reading portion (not the DB state at initiation)
- COPY_ONLY
- FORMAT/NOFORMAT
- INIT/NOINIT
- CHECKSUM
- SKIP/NOSKIP
- NOREWIND
- NOUNLOAD
- COMPRESSION
- STATS=XX

Full Backup Restores

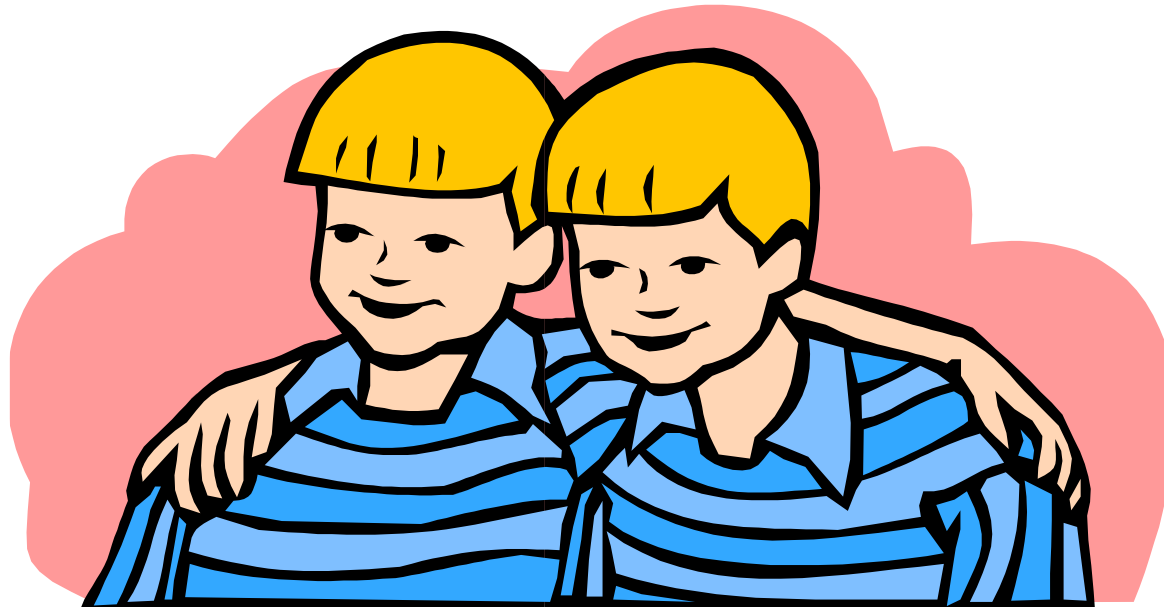
- RECOVERY/NORECOVERY
- STANDBY
- MOVE LogicalName TO PhysicalName
- REPLACE **
- FILE
- CHECKSUM
- STATS=XX
- NOREWIND
- NOUNLOAD

Differential Backups

- Backs up everything since the last FULL backup
- It's cumulative and not incremental
- Syntax identical to a full backup and add WITH DIFFERENTIAL

Differential Backup Restore

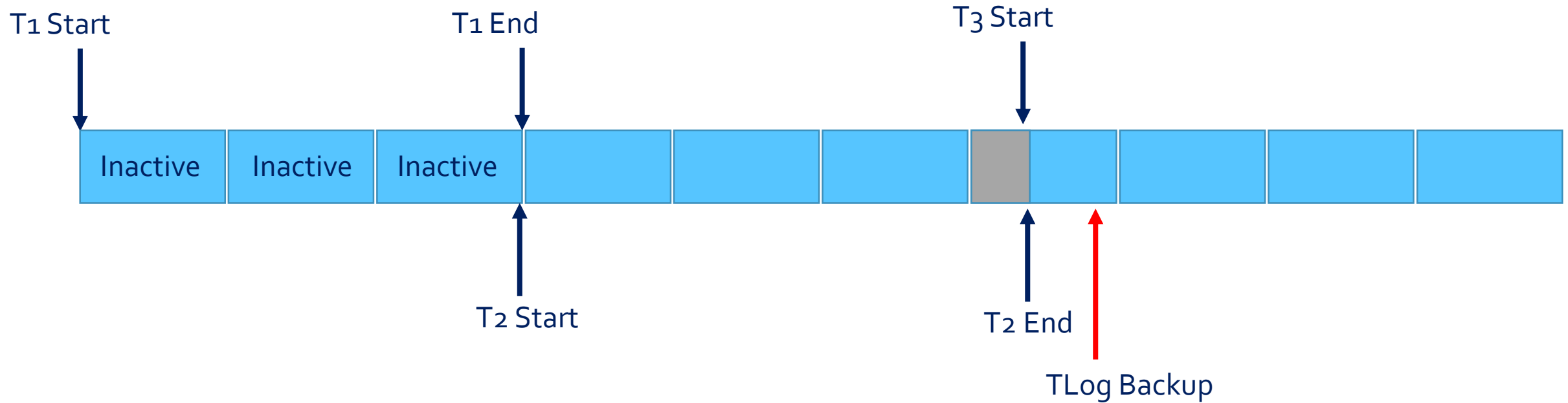
- Identical to restoring a full database backup



How the SQL Server Log works

- Sequential
- Each transaction marked with an LSN
- Internally comprised of virtual log files (VLFs)
- VLFs marked inactive by a checkpoint for Simple recovery model
- VLFs marked inactive by a log backup for Full and Bulk Logged
- DBCC LOGINFO

Log Flow



Log Backups

- Backs up everything since the last LOG backup
- COPY_ONLY
- NORECOVERY
- STANDBY

Log Backup Restore

- RECOVERY/NORECOVERY
- STANDBY

File & Filegroup Backups

- Shrink VLDB Backup window
- Increase I/O
- Separate Read-only/archive data
- Piecemeal Restore

File & Filegroup Syntax

- BACKUP DATABASE [MyDB] FILE= 'Logical File Name'
- BACKUP DATABASE [MyDB] FILEGROUP= 'Filegroup Name'
- WITH DIFFERENTIAL

Speed Options

- BUFFERCOUNT
- MAXTRANSFERSIZE
- BLOCKSIZE
- COMPRESSION
- Multiple Files

Speed Impact – Real Case Studies

Database	Size before	Size after	Time before	Time after
DB1	43.4GB	11.2GB	23:36	9:13
DB2	50MB	1.02MB	0:08	0:01
DB3	9.16GB	1.77GB	5:54	2:48
Db4	20GB	4.24GB	11:04	4:42

Demo

Trivia

You take a full backup every day at 2am, differentials every 4 hours from 3am to 11pm, and log backups every hour from 4am to 1am.

The database is in Simple Recovery. You have an outage at 9am, what should you restore?

- A. The Full backup
- B. The Full backup, 3am Diff backup, and 7am Diff backup
- C. The Full backup, 7am Diff backup, and 8am Log backup
- D. The Full backup and 7am Diff backup

You take a full backup every day at 2am, differentials every 4 hours from 3am to 11pm, and log backups every hour from 4am to 1am.

The database is in Full Recovery. You have an outage at 9:30am, what should you restore?

- A. The latest Full backup
- B. The latest Differential backup
- C. The latest Log backup
- D. Every Log backup since the last Differential backup
- E. Every Log backup since the last Full backup

You take full backups every day at 2am and 2pm, differentials every day at 8am and 8pm, and log backups every hour between.

The database is in Full Recovery. You have an outage at 10pm and also notice that the 2pm Full backup is corrupt, what should you restore?

- A. The 2am Full backup
- B. The 8am Differential backup
- C. The 8pm Differential backup
- D. Every Log backup since the 8am Differential backup
- E. Every Log backup since the 8pm Differential backup
- F. Every Log backup since the last Full backup

Will there be an error and what is it?

```
1  USE master
2  GO
3  RESTORE DATABASE [MyDB1]
4  FROM DISK = 'D:\Backups\MyDB1_1.bak'
5  WITH RECOVERY, REPLACE,
6  MOVE 'MyDB1_1' TO 'D:\Data\MyDB1_1.mdf',
7  MOVE 'MyDB1_1_log' TO 'D:\Data\MyDB1_1_log.ldf'
8  GO
```

Will there be an error and what is it?

```
1  ALTER DATABASE [Production1] SET RECOVERY SIMPLE|
2  GO
3
4  [-] BACKUP DATABASE [Production1]
5  |   TO DISK = 'C:\Backups\Production1_Full.bak'
6  |   GO
7
8  [-] BACKUP LOG [Production1]
9  |   TO DISK = 'C:\Backups\Production1_Log.trn'
10 |   GO
11
```

Msg 4208, Level 16, State 1, Line 11

The statement BACKUP LOG is not allowed while the recovery model is SIMPLE. Use BACKUP DATABASE or change the recovery model using ALTER DATABASE.

Msg 3013, Level 16, State 1, Line 11

BACKUP LOG is terminating abnormally.

```

1  USE [Master]
2  GO
3
4  RESTORE DATABASE [Production1]
5  FROM DISK = 'C:\Backups\Production1_Full.bak'
6  WITH NORECOVERY, REPLACE
7  GO
8
9  RESTORE DATABASE [Production1]
10 FROM DISK = 'C:\Backups\Production1_Diff.bak'
11 GO
12
13 RESTORE LOG [Production1]
14 FROM DISK = 'C:\Backups\Production1_Log1.trn'
15 WITH NORECOVERY
16 GO
17
18 RESTORE LOG [Production1]
19 FROM DISK = 'C:\Backups\Production1_Log2.trn'
20 WITH RECOVERY
21 GO

```

Will there be an error
and what is it?

```

Processed 280 pages for database 'Production1', file 'Production1' on file 1.
Processed 3 pages for database 'Production1', file 'Production1_log' on file 1.
RESTORE DATABASE successfully processed 283 pages in 0.037 seconds (59.715 MB/sec).
Processed 48 pages for database 'Production1', file 'Production1' on file 1.
Processed 1 pages for database 'Production1', file 'Production1_log' on file 1.
RESTORE DATABASE successfully processed 49 pages in 0.020 seconds (19.140 MB/sec).
Msg 3117, Level 16, State 1, Line 13
The log or differential backup cannot be restored because no files are ready to rollforward.
Msg 3013, Level 16, State 1, Line 13
RESTORE LOG is terminating abnormally.
Msg 3117, Level 16, State 1, Line 18
The log or differential backup cannot be restored because no files are ready to rollforward.
Msg 3013, Level 16, State 1, Line 18
RESTORE LOG is terminating abnormally.

```

Summary

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