



Eternal Story on Temporary Objects

Dmitri V. Korotkevitch

<http://aboutsqlserver.com>

About Me

14+ years of experience working with Microsoft SQL Server

Microsoft SQL Server MVP

Microsoft Certified Master – SQL Server 2008

Email: dmitri@aboutsqlserver.com

Blog: <http://aboutsqlserver.com>



Agenda

```
create table #Temp( )
```

```
declare @Temp table ( )
```

```
create type tvpType as table ( )
```



Table Spool

Stores the data from the input into a temporary table in order to optimize rewinds.



```
alter database MyDB set read_committed_snapshot on
```

```
alter database tempdb add file ( )
```

What is TempDB?



Mid-level DBA



Senior DBAs...



Temporary Tables

Temporary Tables == Regular Tables

- No Views
- No Triggers
- New Statistics Recompilation Threshold of 6 rows
 - KEEP PLAN hint removes threshold

Temporary Tables

Temp Table Creation:
System Objects and
Allocation Maps changes
(Database and Log Files)

Writing Log Records to
tempdb log file

```
create table #StageTbl(..);  
  
insert into #StageTbl(..)  
    select ..  
    from UserTbl  
    where ..
```

Logical or Physical Reads
from UserTbl

Writing Data Pages to
tempdb data file(s)

Extents and Pages
allocations for #StageTbl
data

Temp Table Deletion:
System Objects and
Allocation Maps changes
(Database and Log Files)

Temporary Tables

Staging large amount of data is expensive

Good use-cases:

- Query Simplification
- Improving Cardinality Estimations (especially in case of UDF)
- Reducing Locking Time

Demo: Using Temporary Tables

Temporary Objects Caching

SQL Server keeps IAM and one data page per index

Requirements:

- Objects in SP and Triggers
- <8MB
- No Named Constraints
- No DDL changes after creation (DROP is OK)



Demo: Temporary Objects Caching

Table Variables

Lightweight Temporary Tables

- Stored in TempDB
- No Indexes; however, Primary Key and Unique Constraints are supported
- No Statistics
- Statement-level rollback only

Demo: Using Table Variables

Table Variables vs. Temporary Tables

Temporary Tables



Table Variables



Table Variables vs. Temporary Tables

Use Table Variables when missing statistics does not affect execution plans

- Small amount of data
- No joins with other tables
- Plans are: PK/UQ Singleton Lookup OR Full Scan

Generally, Temporary Tables are the safer choice

Table Types and Table-Valued Parameters



Table Types and Table-Valued Parameters

Scope / Visibility

- Temporary Tables: Call Stack
- Table Variables: Current Batch only
- Table Types: Passing Table Variable as parameter to T-SQL routine

Table-Valued Parameters is one of the fastest ways to pass batch of rows from client to T-SQL module

- Performance is on-par with SqlBatchCopy
- Schema should strictly match .Net DataTable
- No Sql_variant support (Bug in .Net)

Demo: Table Types and TVP

Spools

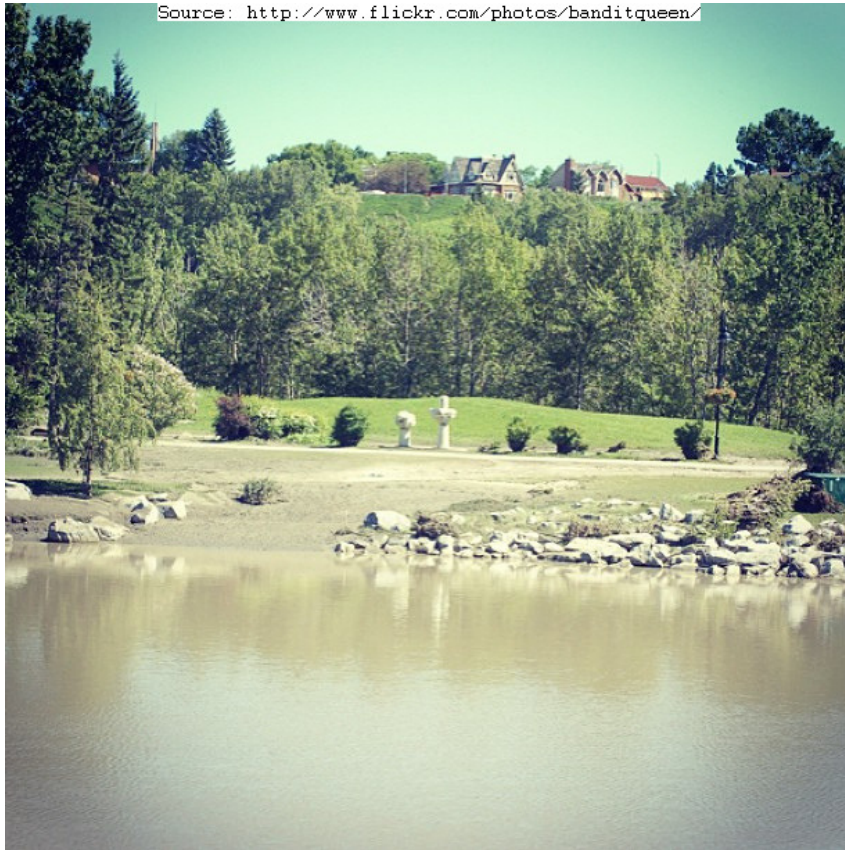
Internal Temporary Tables / Caches

Used for Optimization and Consistency



Demo: Spools

TempDB Spills



TempDB Spills

Sort or Hash operators do not have enough memory

Often incorrect memory grant estimations

- Outdated Statistics
- Incorrect row-size estimation

Monitor Hash and Sort warnings

- Extended Events (SQL Server 2012+)
- SQL Trace

Demo: Tempdb Spills

Row Versioning / Version Store



READ COMMITTED
SNAPSHOT / SNAPSHOT

AFTER UPDATE/DELETE
triggers

ONLINE INDEX REBUILD

MARS



Demo: Version Store

TempDB Best Practices

Reduce TEMPDB load

Put tempdb to fastest drive array

- Use redundant array if downtime is unacceptable

Use –T1118

- Disabling Mixed Extents Allocation

Create multiple files

- < 8 logical CPU: 1 file per CPU
- >= 8 logical CPU: 8 files and add files in groups of 4 if needed (PAGELATCH waits on tempdb)
- All files should be the same size with auto-growth in MB

Utilize temporary objects caching

TempDB as Staging Area

Good

- Logging is more efficient than with users' databases
 - DB does not need REDO support
 - SIMPLE recovery mode
- Does not write to transaction log in users' databases
 - LOG Backups
 - HA Strategies

Bad

- Data could disappear in case of SQL Server restart or HA failover

We covered

Temporary Objects

- Temporary Tables
- Table Variables
- Table Types and Table-Valued Parameters

Spools

Spills

Version Store

Temporary Objects Caching

Best Practices

Q & A

Thank you very much for attending!

Slide Deck and Code Samples will be posted at:

- <http://aboutsqlserver.com/presentations>

Email: dmitri@aboutsqlserver.com

Blog: <http://aboutsqlserver.com>



Thank You for Attending