SUMMIT2017
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Upgrade to SQL Server 2017

Intelligent Diagnostics Built-in

Parikshit Savjani, Program Manager, Microsoft
Pedro Lopes, Program Manager, Microsoft

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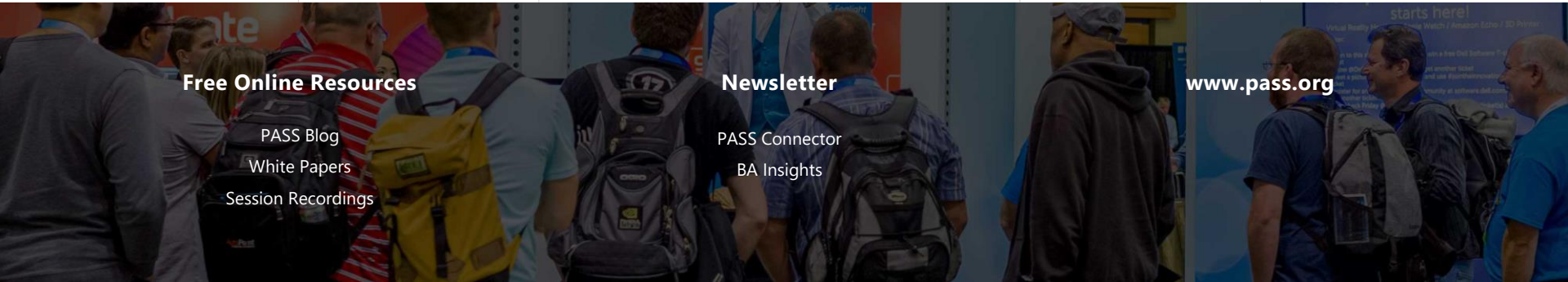

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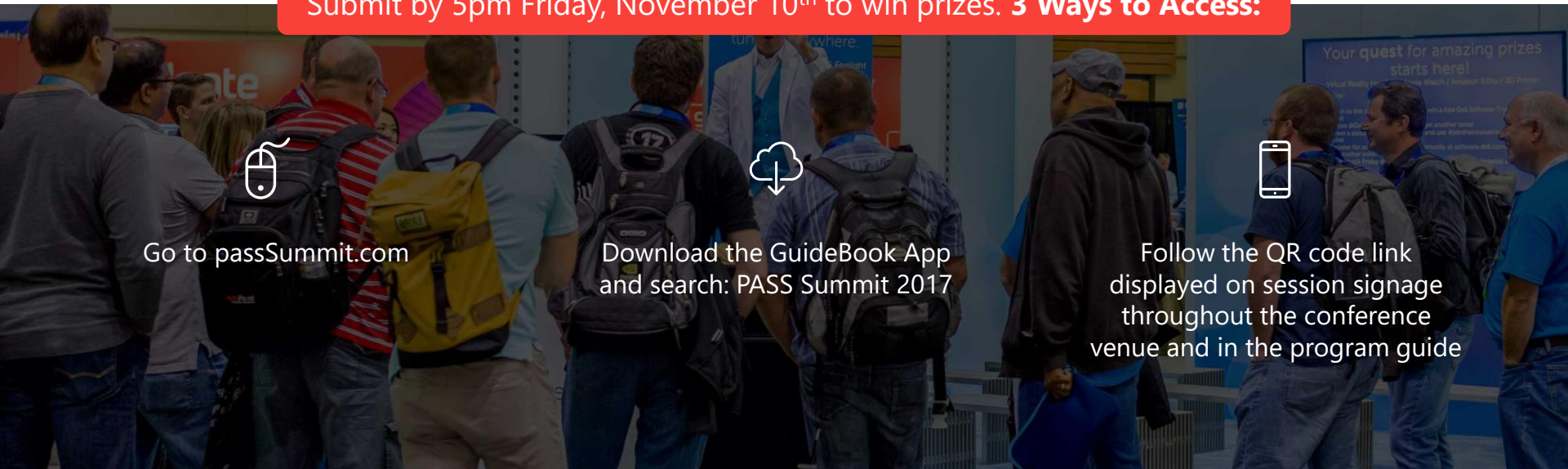

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Pedro Lopes

Program Manager, Microsoft

/pedroazevedolopes @sqlpto

Role

Program manager on the SQL Server Tiger team – owning all in-market versions of SQL Server

Focus areas

Relational Engine – Query processing, performance tuning and optimization.

History

Working with SQL Server since 2002.

Parikshit Savjani

Program Manager, Microsoft

/parikshitsavjani

@talktosavjani

Role

Program manager on the SQL Server Tiger team

Focus Areas

Storage Engine – Backup, SQLOS, Engine, Customer Success.

History

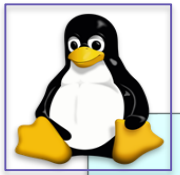
Working with SQL Server since 2008.

Agenda

Today we'll cover:

- New Automatic and Adaptive capability in SQL Server 2016/2017 to improve workload performance.
- Key diagnostic features, tools built into SQL Server 2016 and 2017 for performance and server scenarios.
- How to leverage new diagnostics built into SQL Server 2017 to drive intelligent actions.

SQL Server 2017 Theme and Focus



Choice

- Windows
- Linux
- Docker (MacOS)
- Azure

Intelligent

- Adaptive QP
- Automatic Tuning
- Intelligent Diagnostics
- R
- Python
- Graph

Migration

- DMA
- DMS
- SSMA
- DEA

Customer and Community Driven Investments

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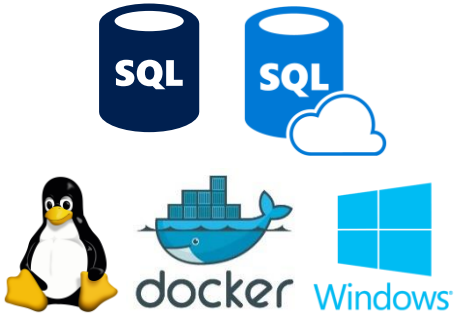
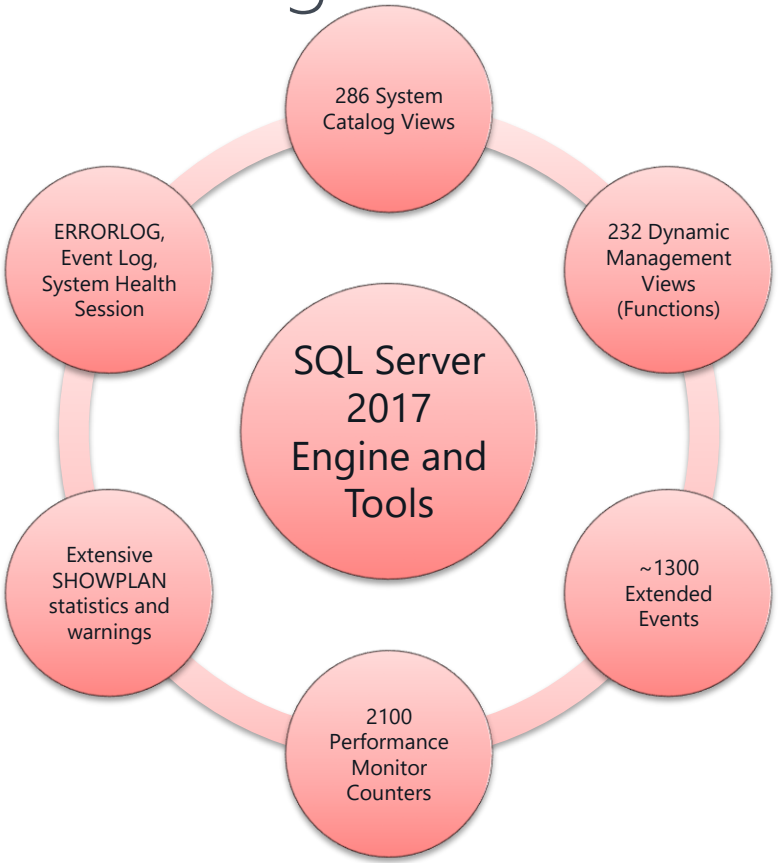
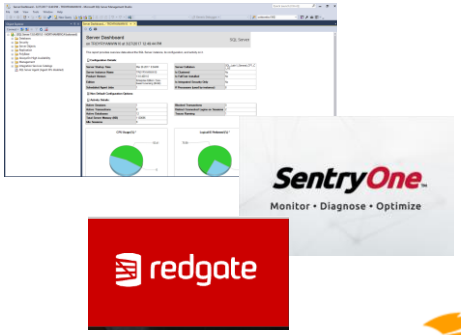
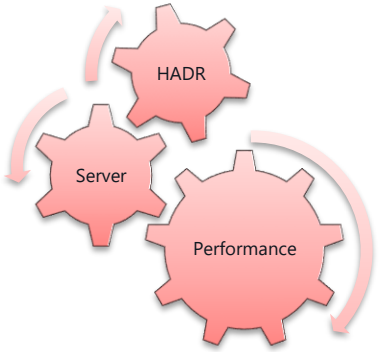
The Best Built-In Diagnostics in the Industry

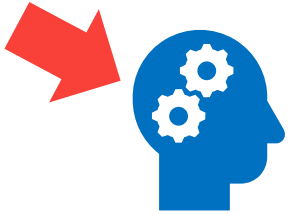








Diagnostics + Intelligence



Automatic
Adaptive
Proactive

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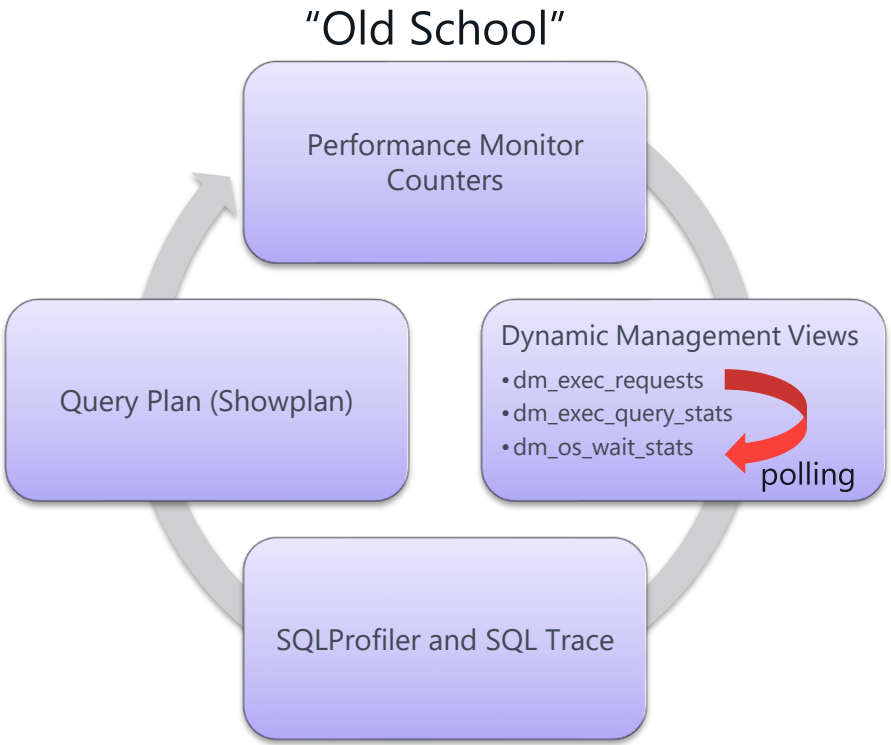
Performance Diagnostics

SQL Server 2016 in full acceleration



Extended Events – xEve

SSMS is your new best friend

Query Store

Performance Dashboard Reports

Performance Baseline Reports

Live Query Statistics

Lightweight Query Profiling

Expanded Query Plan Diagnostics

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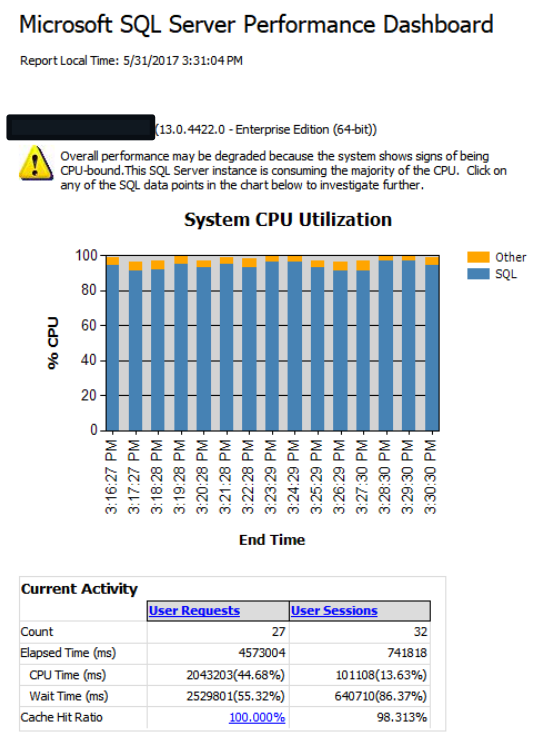
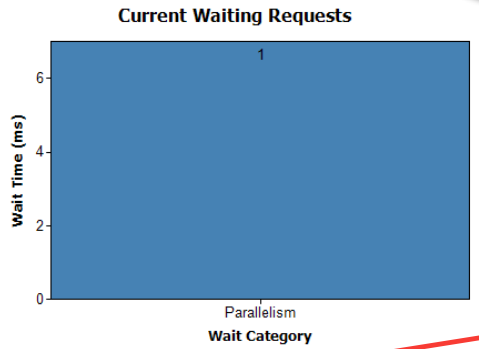
Performance Dashboard in SSMS





No extra downloads!
No new schema to deploy!
Long standing request by CSS and customers

Categorized Wait stats page

New categorized Latches page

Scoring added to Missing Index Report

For demo, see sessions:
- "SQL Server 2017: "Intelligence: Meet Database"
- From Zero to Hero: Troubleshooting SQL Server Performance Made Easier

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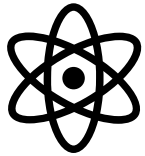
SQL Server 2017 – Modern and Intelligent



Query Store – Wait Stats

Automatic Tuning and Plan Correction

Query Plan Analysis

In SSMS. Read more here

Adaptive Query Processor

For demo on Auto Tuning, see session:
- How Can Intelligent Azure SQL Database Improve the Performance of your Application?

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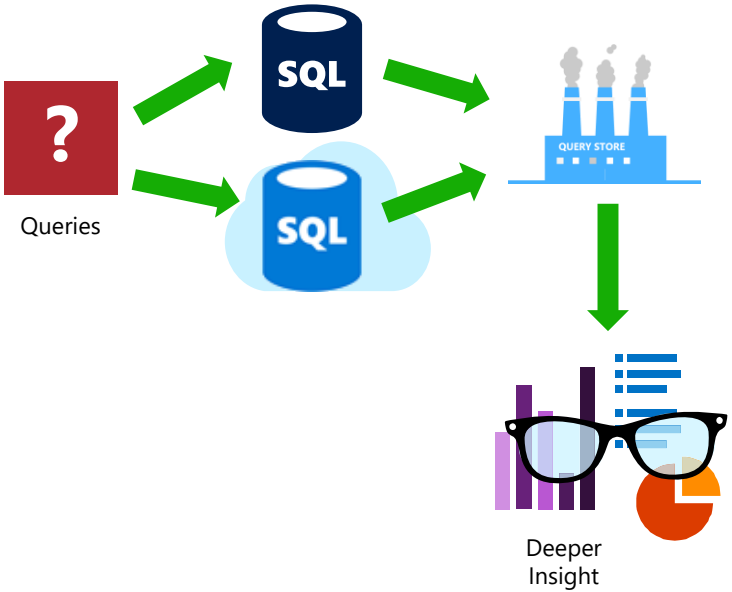
Query Store

Comprehensive query-performance information when you need it most!

'Flight-data recorder' for your database:

- Queries, plans, and compilation and runtime statistics available at your fingertips
- Allows you to easily identify and fix performance regression issues in minutes



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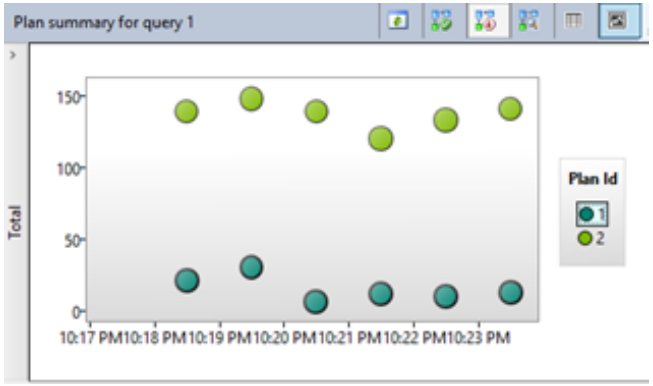
Enables the following scenarios:

- **Finding regressed queries**
- **Ad-hoc workload optimization**



Enable Query Store → Let Query Store collect the data → Pinpoint and fix problem queries

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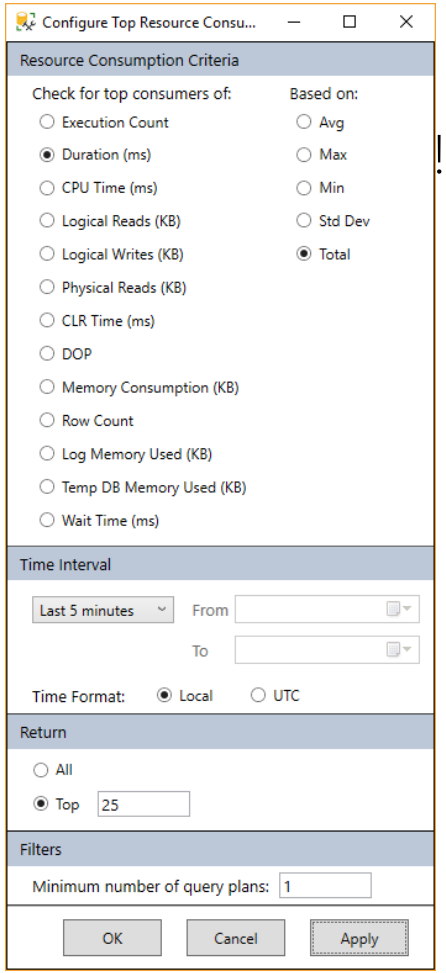
- **Identifying top resource consuming queries**
  - Using **dimensions** like waits, runtime, CPU usage.

Export with DBCC CLONEDATABASE



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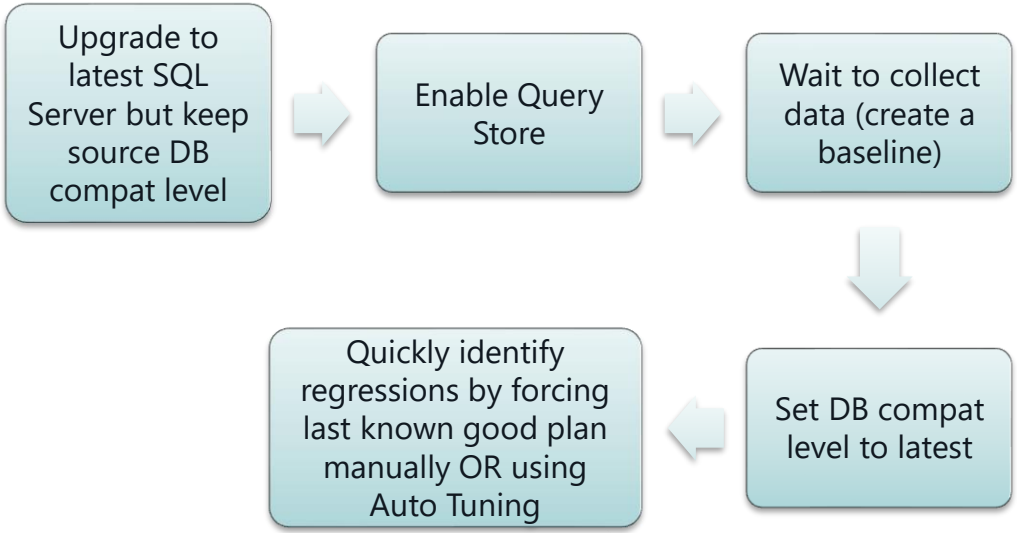
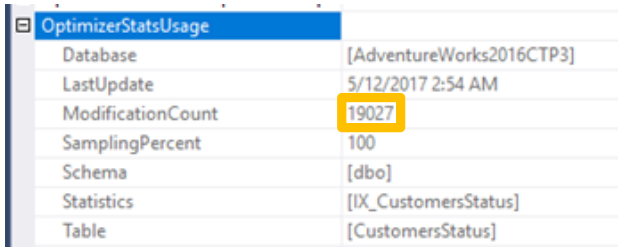
- Finding regressed queries
- Identifying top resource consuming queries
  - Using dimensions like waits, runtime, CPU usage.
- Ad-hoc workload optimization
- **Smooth application upgrades**

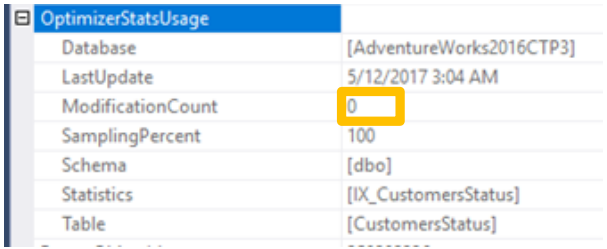


Statistics information in Showplan

Identify which statistics were used by the Query Optimizer for a given compilation.

Gain actionable insight to where estimations came from.





Using statistics info in Showplan

Demo

Server Diagnostics

The Transformation to Intelligent Server Diagnostics

"The way we have always done it"

- Automatic Checkpoint
- ERRORLOG files
- Catalog Views
- Perfmon
- DBCC commands
- Log Autogrow and truncate problems
- PSSDiag
- How many TempDB files and trace flags?
- Debuggers for stack dumps
- CMEMTHREAD waits
- I/O spikes
- Windows Server

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Indirect Checkpoint	Extended Events+	System Health Session
Smart Backup and other Diagnostics	DMVs	Auto TempDB config
Stack dump analysis	Dynamic resource usage	We know Linux

The New World

Extended Events	• Is there anything you can't trace?
Ongoing diagnostic collection	• A true server level black box recorder
DBCC to DMV	• Let's leave DBCC to actual consistency checking
TempDB auto config and insights	• Optimized for most deployments
Dynamic Resource Usage	• Better Memory Response; smoother I/O

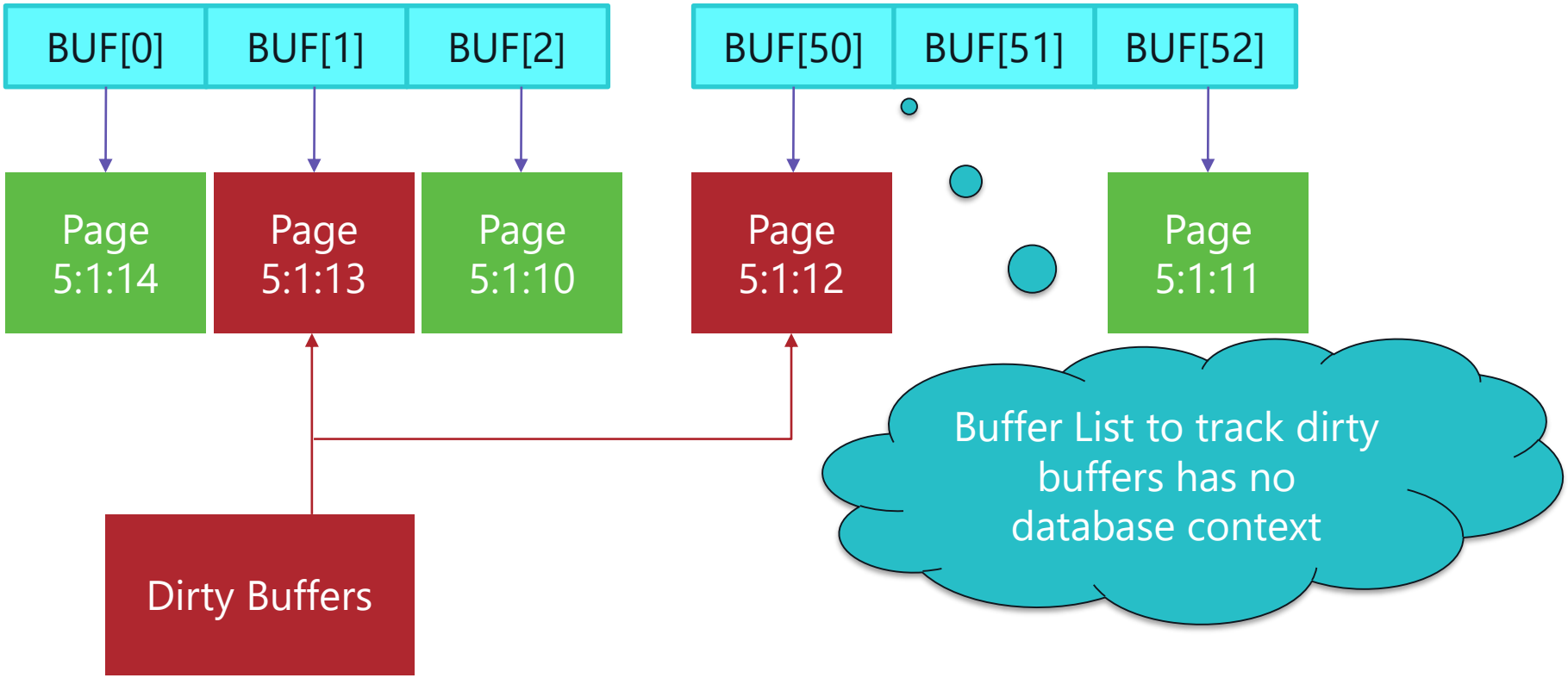
Why Indirect Checkpoint?

- Introduced in SQL Server 2012
- The default behavior starting from SQL Server 2016
- Database-level setting
  (vs. server-level automatic checkpoint)
  - `ALTER DB SET TARGET_RECOVERY_TIME = 60 seconds`

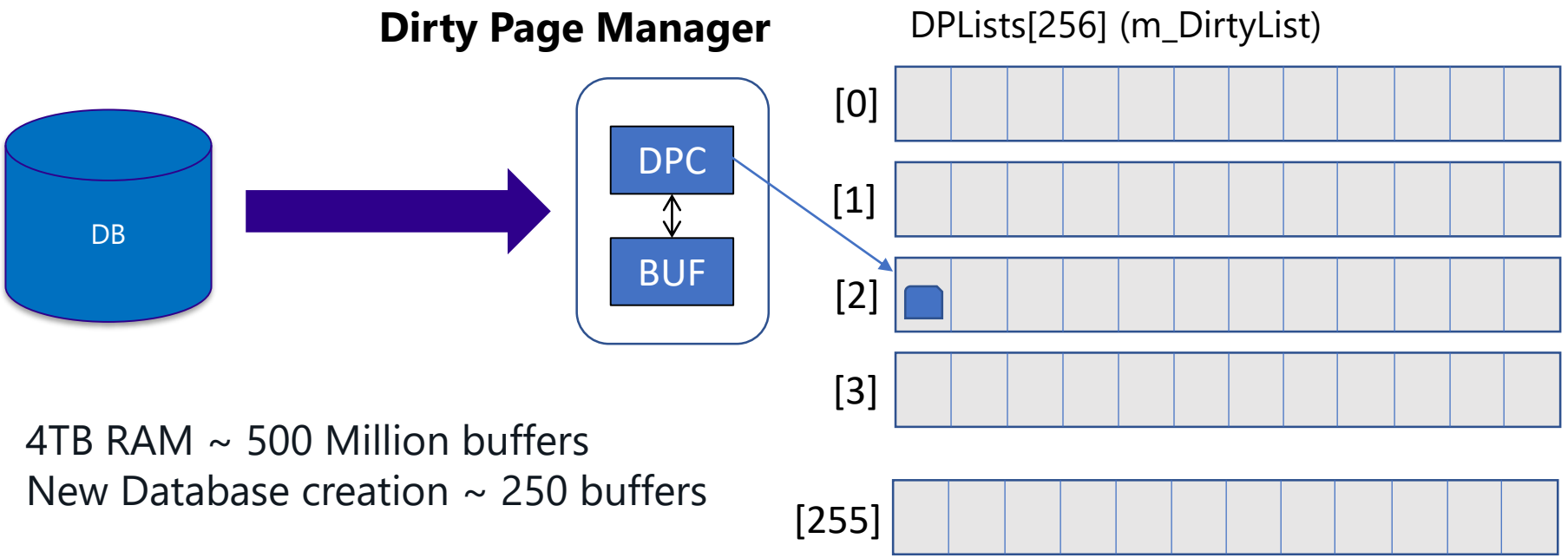
Advantages

- Better heuristics for recovery time estimate
- Reduce checkpoint-related I/O spikes (more gradual flush)
- Reduce full buffer pool scans (hard checkpoint, backup, etc.)

Automatic Checkpoint



Indirect Checkpoint



4TB RAM ~ 500 Million buffers
New Database creation ~ 250 buffers

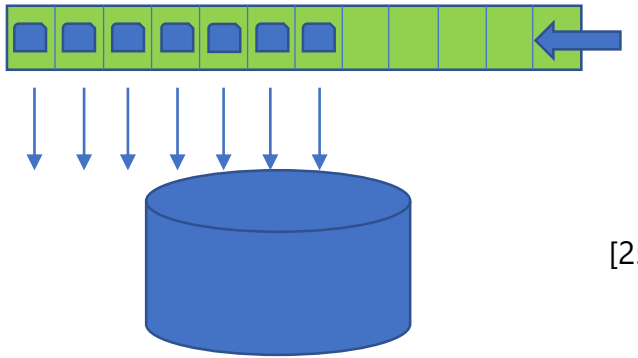
Background Recovery Writer

Do While

1. **Find the longest DPList**
2. **Collect Page IDs (under spinlock)**
3. **Sort the pages**
4. **Write the pages**

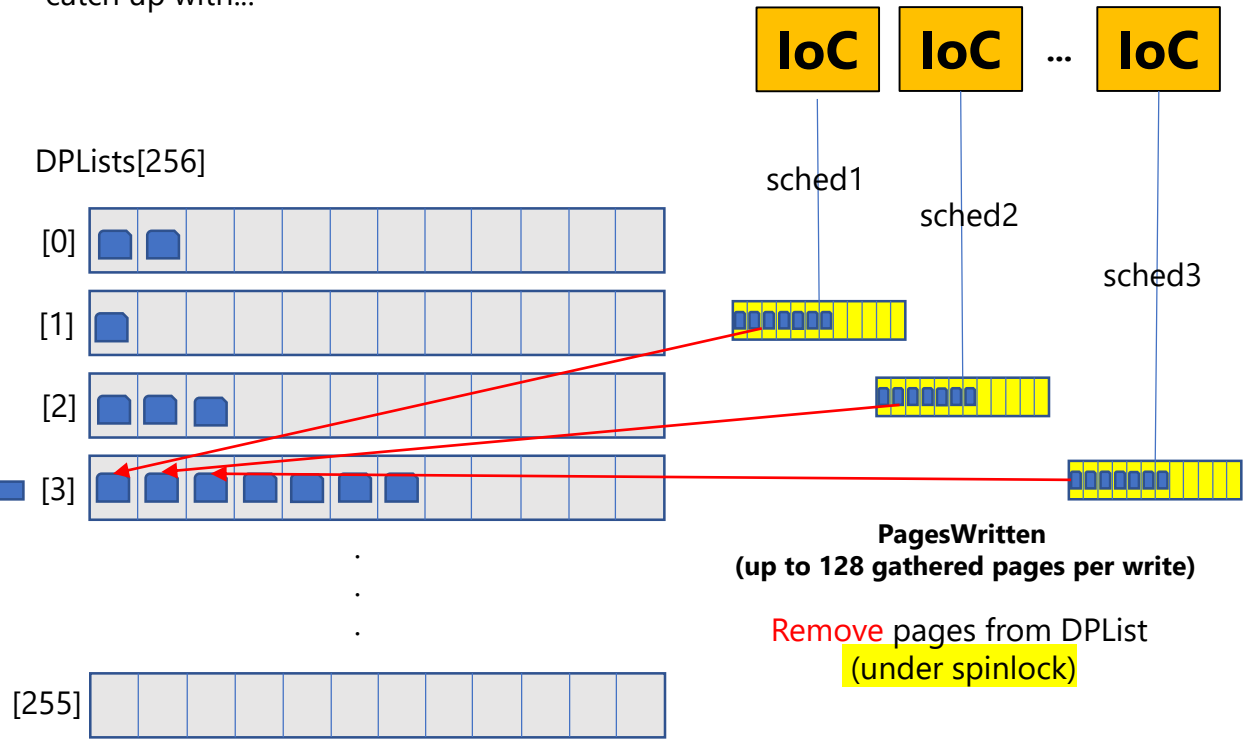
Until the target recovery time is met

PagesToWrite[128]



Recovery Write Helpers

When there are more outstanding dirty pages to catch up with...



PagesWritten
(up to 128 gathered pages per write)

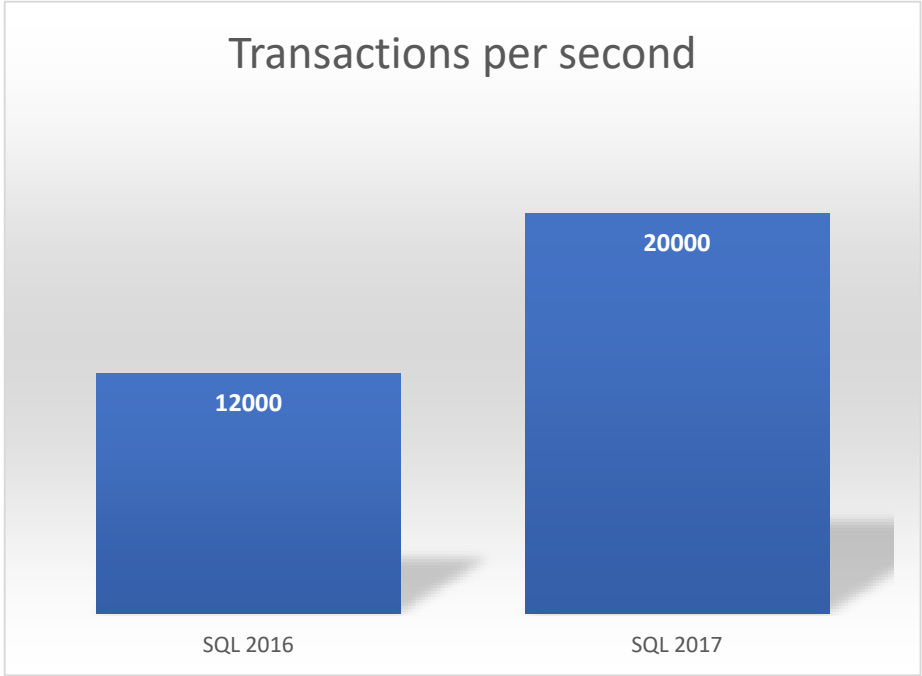
Remove pages from DPList
(under spinlock)

Enhancing Indirect Checkpoint even further

Limit helpers (once per scheduler)

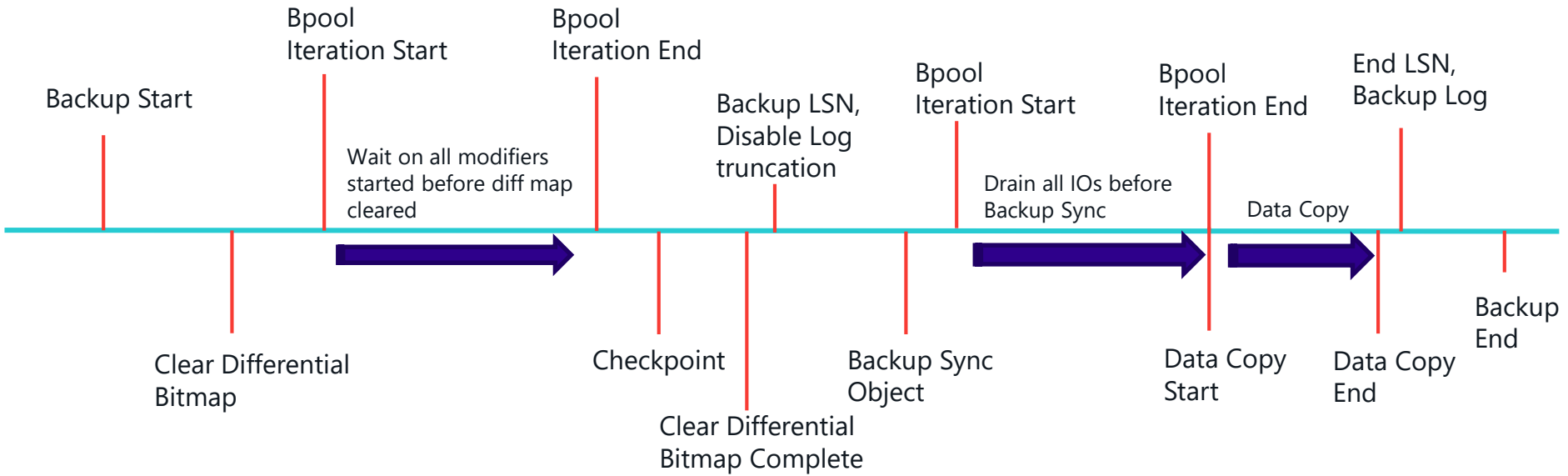
- TempDB
- User DB (if recovery time > 8 min)

New TF 3468 to disable indirect checkpoint on TempDB



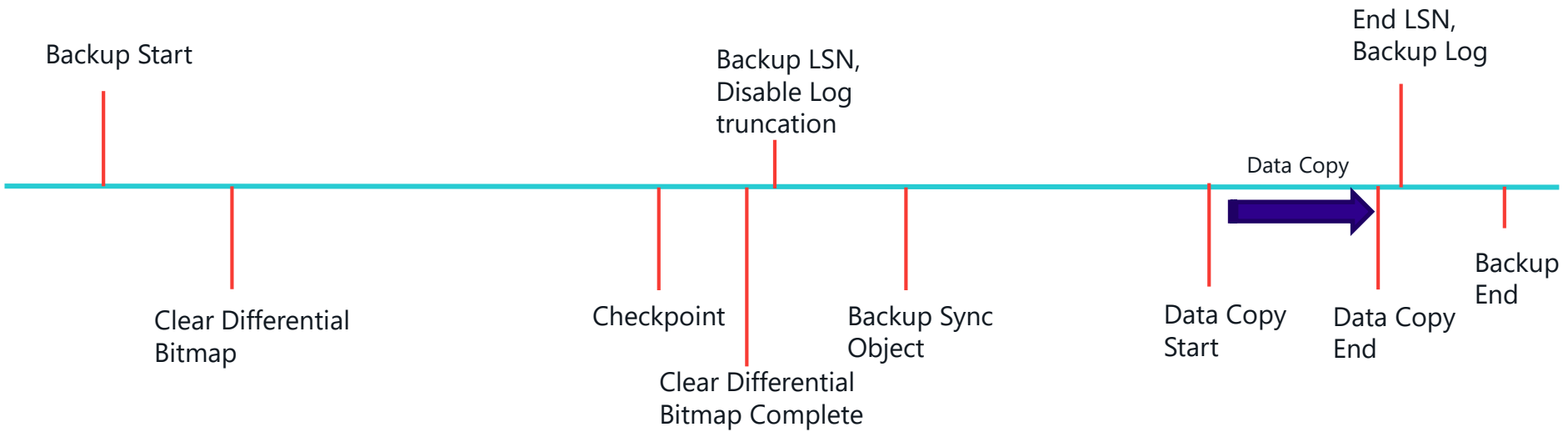
Faster Backup

Current Backup Flow

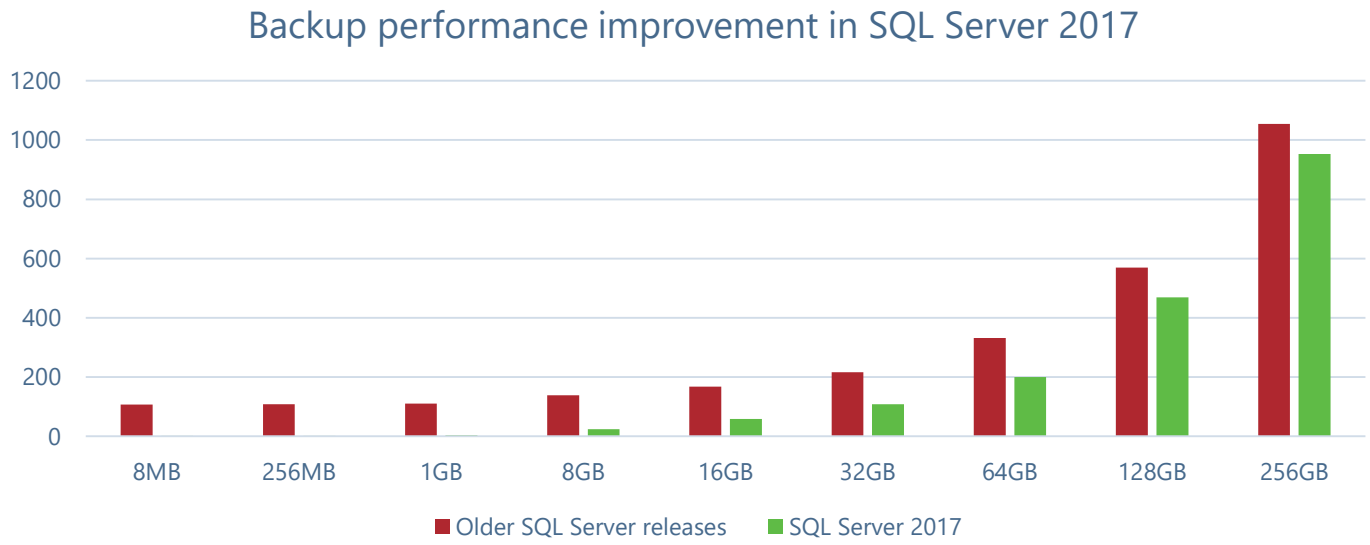


Faster Backup

SQL 2017 Backup Flow



Performance results



1) For databases less than **0.5GB** there is greater than **100x** improvement.
2) For databases around **1GB** there is around **30x** improvement.
3) For databases less than **10GB - 100GB** there is anywhere between **2x - 6x** improvement.
4) For databases greater than **100GB-0.5TB** there is approximately **10% – 20%** improvement.

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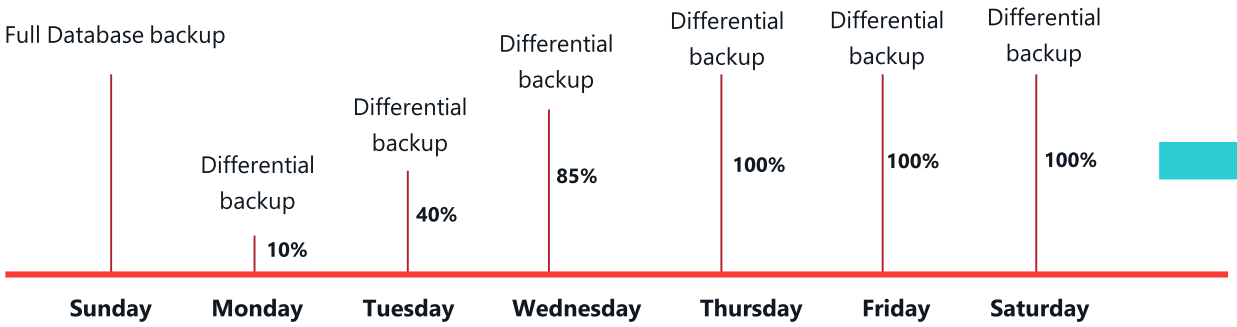
Smart Differential Backup

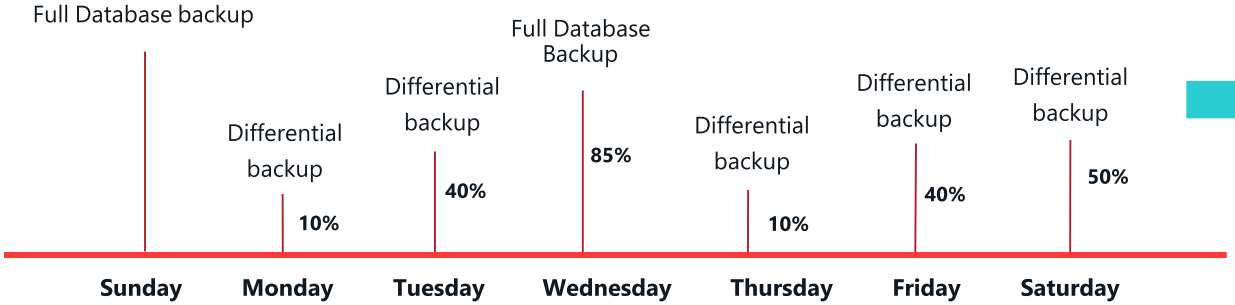
Current Differential Backup weekly cycle example



Restore chain too long impacting RTO.

Making Differential Backup smarter

modified_extent_page_count -> sys.dm_db_file_space_usage



Faster restore
Storage Savings

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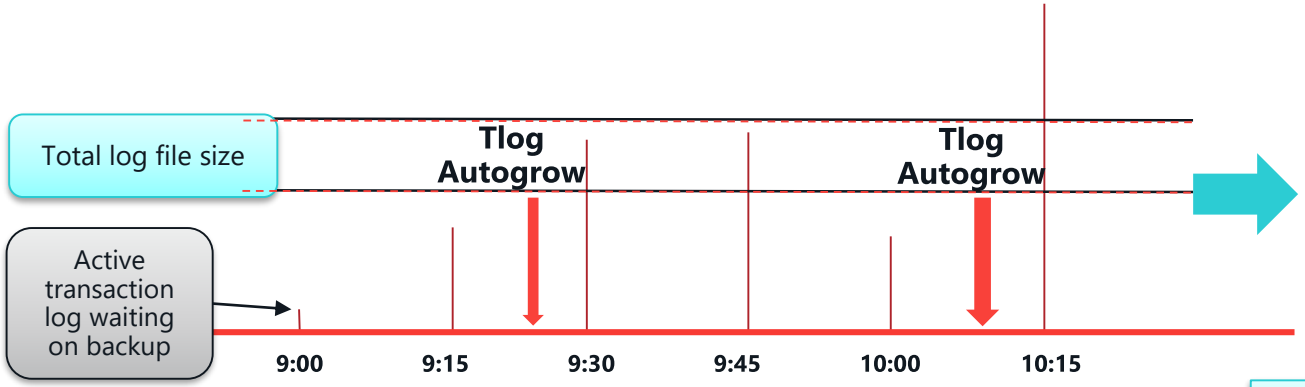
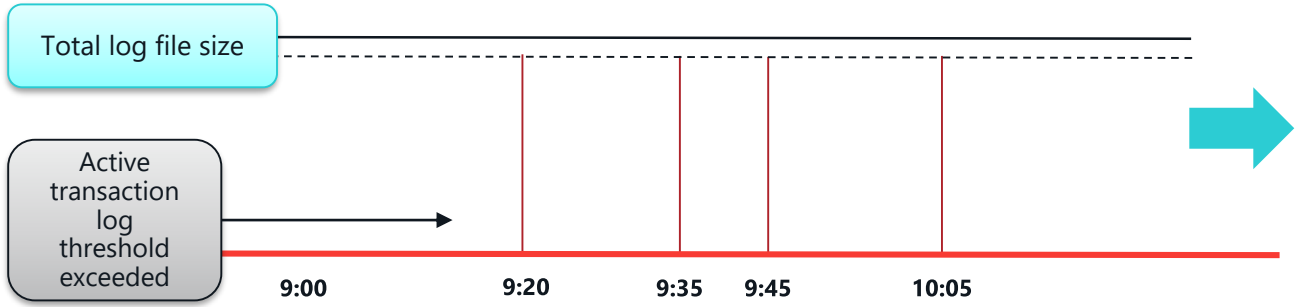
Smart Transaction log backup

Backup every 15 mins irrespective of Tlog activity



Not Adaptive
- Frequent Autogrows
- VLF Fragmentation
- Inconsistent backupsize

Smart Transaction Log Backup



sys.dm_db_log_stats(database_id)

Adaptive
- Minimal Autogrow
- No VLF Fragmentation
- Consistent backupsize

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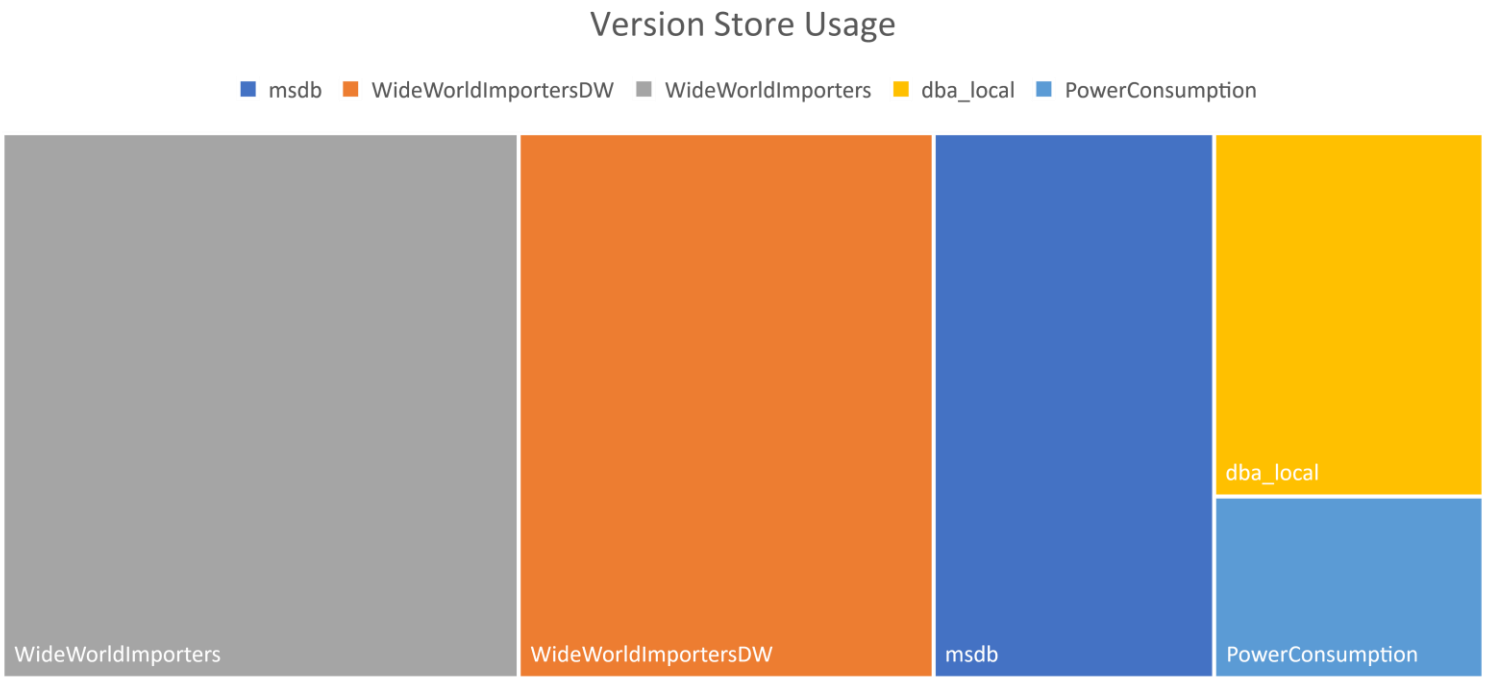
Building a Smarter Backup

Demo

TempDB space usage and planning

sys.dm_tran_version_store_space_usage



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What's next for SQL Server 2017?

Customer & Community Driven

Parallelism	New waits providing more accurate and actionable insights (see "SQL Server 2017: "Intelligence: Meet Database" session)
Statistics	Influence statistics creation and update parallelism; More accurate auto statistics update for incremental statistics
Resource Governor	Hard limit query execution times
TempDB	Add spill information to several DMVs and xEvents

Bookmarks

SQL Server Tiger Team Blog	http://aka.ms/sqlserverteam
Tiger Toolbox GitHub	http://aka.ms/tigertoolbox
SQL Server Release Blog	http://aka.ms/sqlreleases
BP Check	http://aka.ms/bpcheck
SQL Server Standards Support	http://aka.ms/sqlstandards
Trace Flags	http://aka.ms/traceflags
SQL Server Support lifecycle	http://aka.ms/sqllifecycle
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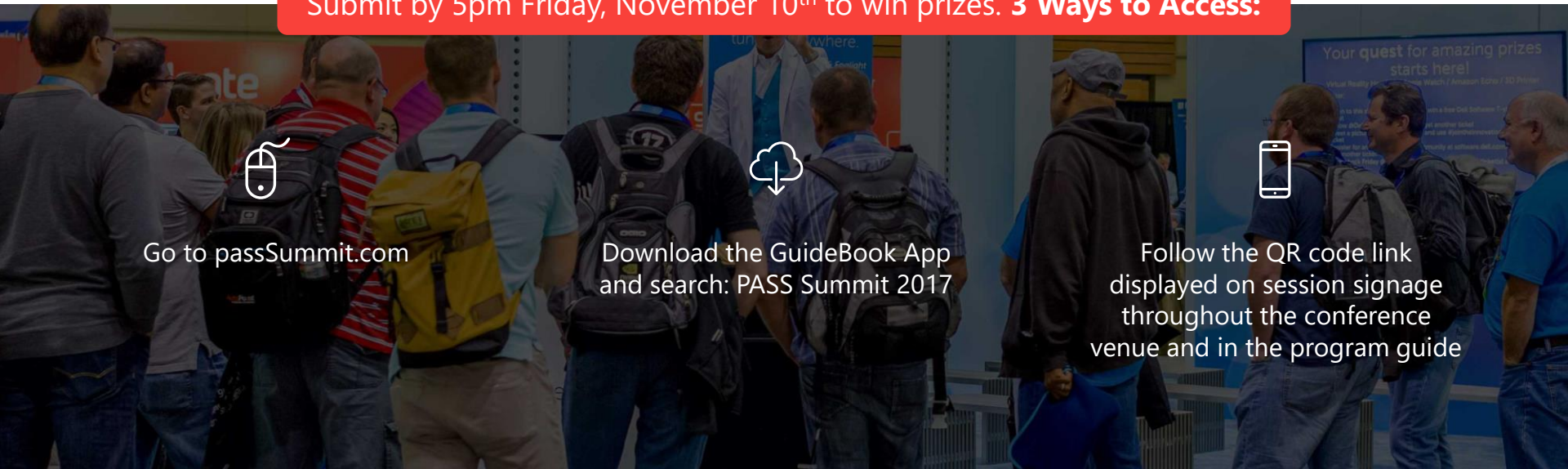

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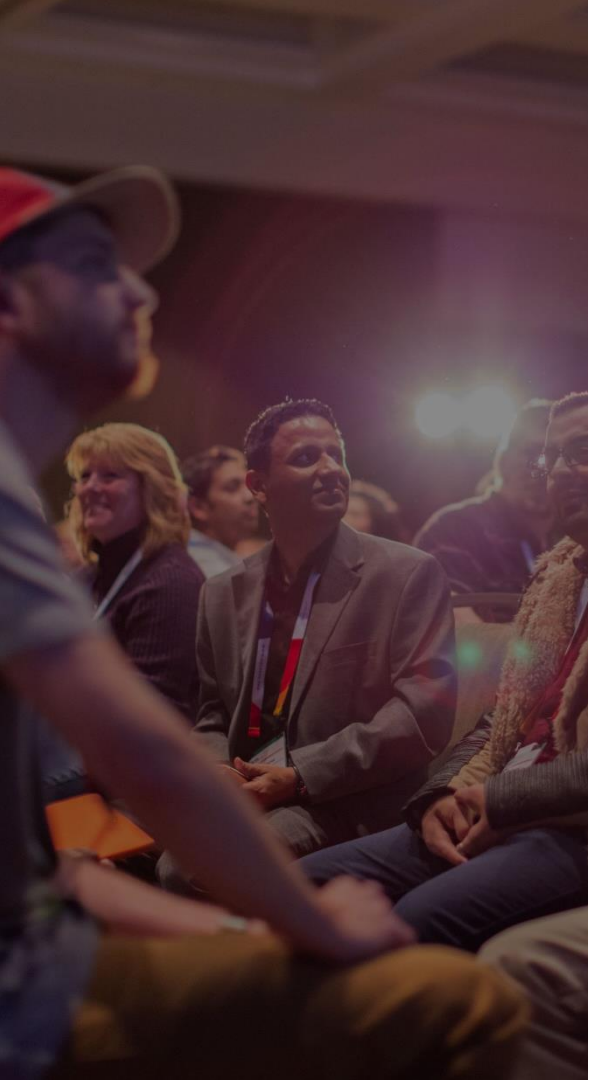

Thank You

Learn more from Parikshit Savjani, Pedro Lopes

@sqlpto

@talktoSavjani

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