# Improving Storage Subsystem Performance

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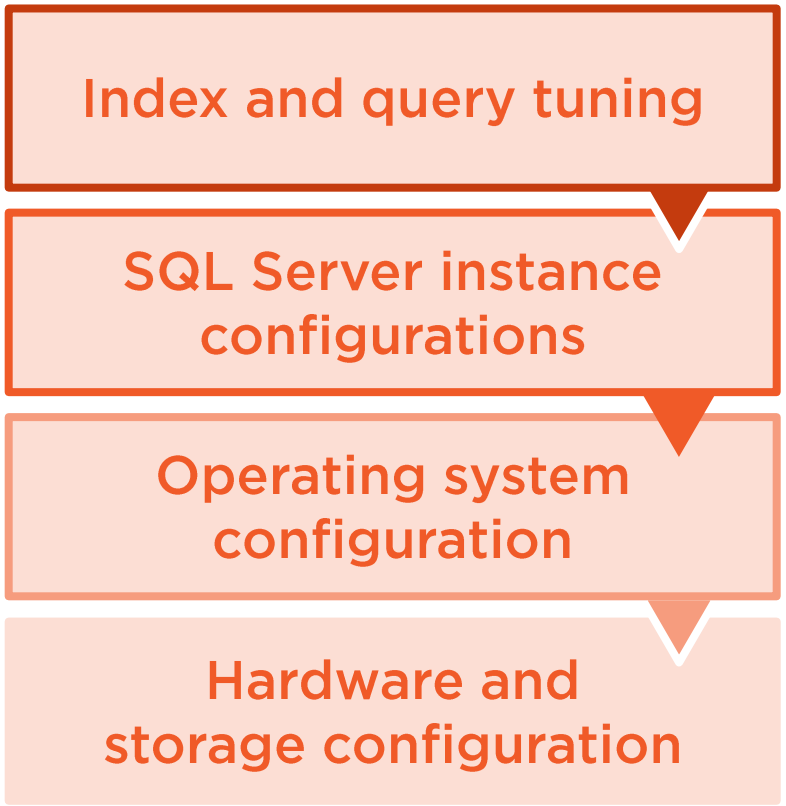
# Module Summary

**Things that can improve storage subsystem performance**

- Index and query tuning
- SQL Server instance configuration
- Operating system configuration
- Hardware and storage configuration

# Multiple Layers of Optimization




Multiple items for possible optimization and improvement in each stack layer

Investigate and address these in each layer

Nobody has ever complained that a database server is too fast...

# Workload Tuning

Use “bad man list” DMV queries to find most expensive stored procedures and queries

Focus on top five SPs or queries in each list and prioritize area where instance is under stress

Make it a team effort and an iterative process, and repeat as necessary

# Index Tuning

Proper index tuning can have huge positive performance benefits

Consider your overall workload and individual table volatility

Consider data compression and clustered column store indexes

# Demo

"Bad man list" queries

# Demo

## Queries to find index tuning opportunities

# Demo

## Using SQL Server data compression and clustered columnstore indexes

# Instance-Level Configuration Settings

Many configuration settings should be changed from their default values

- **Backup checksum default**
- **Backup compression**
- **Cost threshold for parallelism**
- **Max degree of parallelism**
- **Max server memory**
- **Optimize for ad hoc workloads**
- **Tempdb configuration**

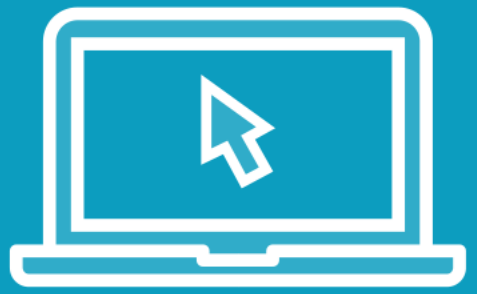
# SQL Server tempdb Settings

Start with 4-8 tempdb data files to reduce allocation contention

Use dedicated, fast local storage and consider flash if workload requires it

Enable TF 1118 prior to SQL Server 2016

# Demo



## Changing instance-level configuration settings

# SQL Server Database Property Settings

Use a MAIN filegroup with at least two data files

Use a reasonable auto growth size in MB

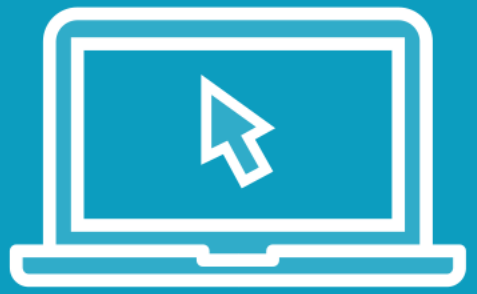
Control VLF counts in log files

Grow log file in relatively large chunks

Auto update statistics asynchronously

Consider using Delayed Durability

# Demo



## Changing database properties

# ALTER DATABASE SCOPED CONFIGURATION

Enable/disable legacy cardinality estimation

Enable/disable parameter sniffing

Enable/disable query optimizer hotfixes

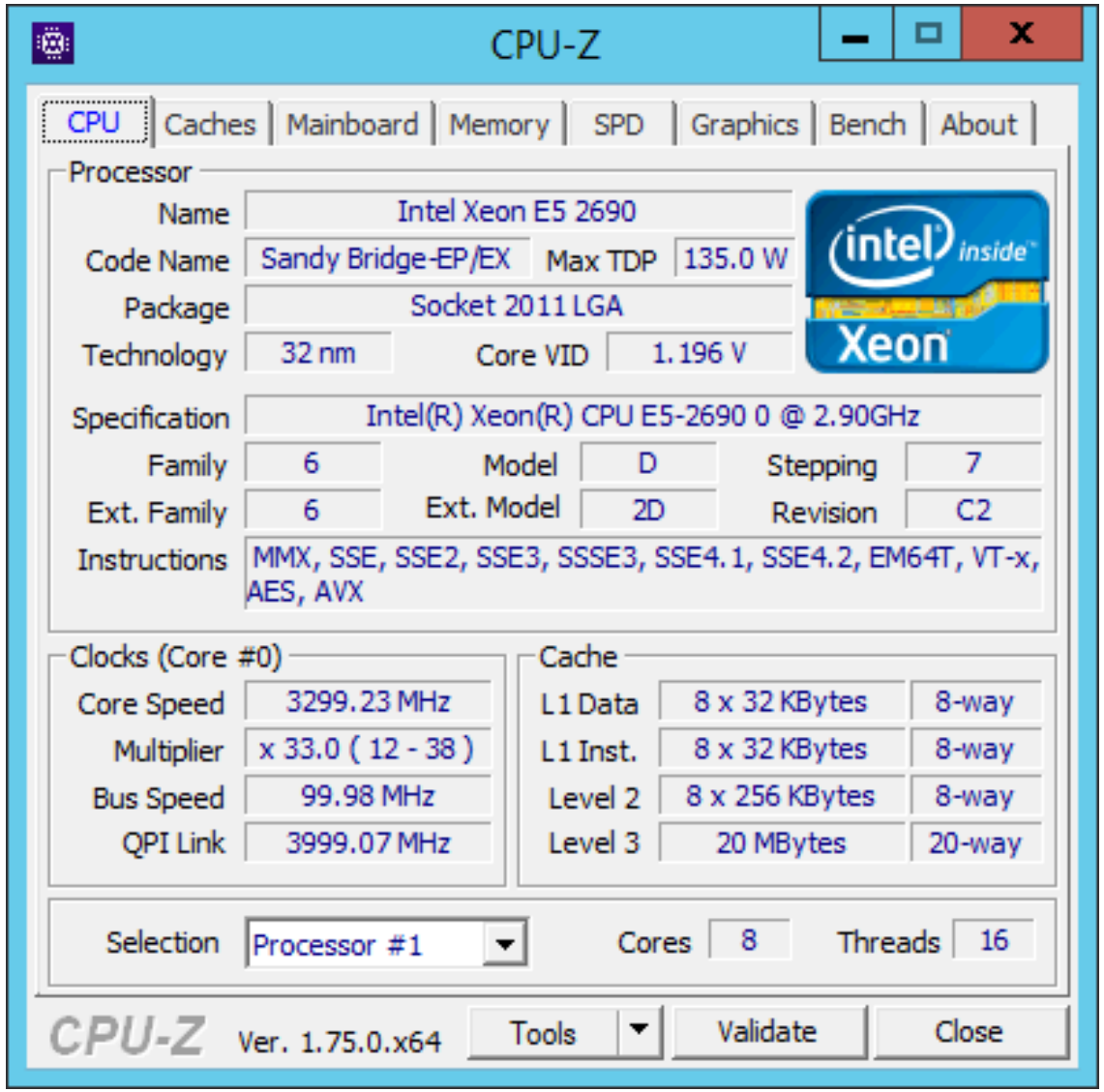
Set max degree of parallelism at database level

Clear plan cache for a single database

# Demo

## ALTER DATABASE SCOPED CONFIGURATION

CPU-Z can be used to confirm net effect of power management settings



# Demo

## Using CPU-Z to check power management

# Demo

## Windows Power Plan

# Demo

## Using Resource Governor to limit I/O

# Demo

## Granting OS rights to SQL Server

# Server Hardware Configuration Settings

Intel hyper-threading

Intel Turbo Boost

BIOS/UEFI power management

Node interleaving (NUMA)


Virtualization support

Memory slot population

# What We Covered

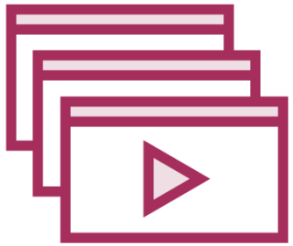
**Things that can improve storage subsystem performance**

- Index and query tuning
- SQL Server instance configuration
- Operating system configuration
- Hardware and storage configuration

# Where to go next?

# You Have Lots of Options!


Take scripts from this course and measure your storage subsystem performance



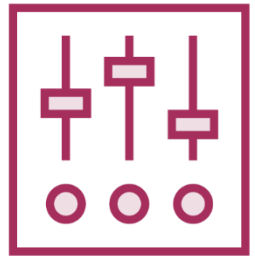
Other Pluralsight courses by Glenn Berry

My blog and my articles on sqlperformance.com

Next time you have an issue, spend 15 minutes using tools you have seen in this course

# Course Summary

Use available queries and tools to understand your storage subsystem performance



Make all needed configuration changes to get best storage performance

Run benchmark and performance tests on all logical drives

Analyze and consider all layers of the system to improve performance