

SQL Server: Improving Storage Subsystem Performance

INTRODUCTION



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Module Summary



**Importance of storage subsystem
performance for SQL Server**

**Three main metrics
for storage performance**

What this course will cover



Storage Subsystem Performance Is Critical

Database performance is often limited by storage performance

Many workloads will not fit in SQL Server buffer pool

Different workloads have different storage requirements

Many DBAs are not knowledgeable about storage



Don't ignore your storage!



Storage Performance Metrics



Three main metrics for storage performance

- Latency
- Input/output operations per second
- Sequential throughput

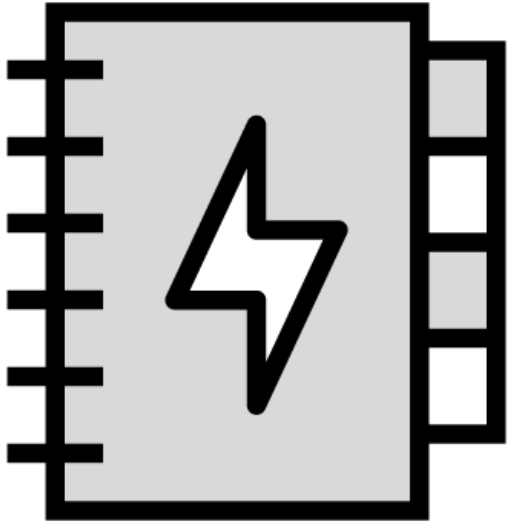
Latency

The time it takes for an I/O to complete
(sometimes called response time or service time)

Measurement starts when the OS sends a request to the drive (or controller) and ends when the drive finishes processing the request



Latency Is Not the Only Measure of Performance



Storage vendors tend to emphasize measurement that makes their product look best

SQL Server workloads can be quite different from other server workloads

Make sure you understand how storage metrics are related

Input/Output Operations per Second

Number of read or write operations per second

Directly related to latency; constant latency of 1ms means a drive can process 1,000 I/Os per second with a queue depth of 1

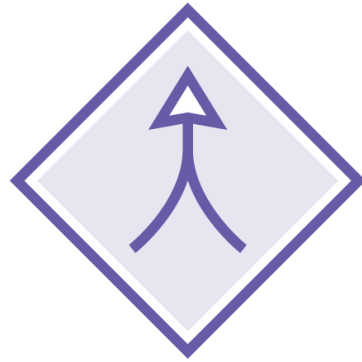
$\text{IOPS} = \text{queue depth} / \text{latency}$



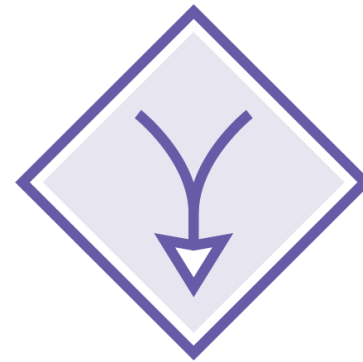
Different Types of IOPS



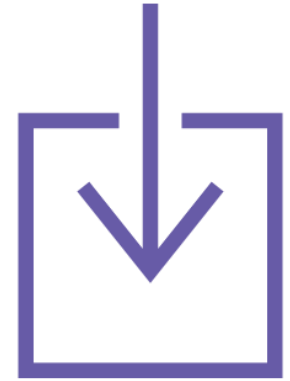
Total IOPS



Random
read IOPS



Random
write IOPS



IOPS is
also related to
queue depth

Sequential Throughput

Measure of data volume over time, usually measured in MB/sec or GB/sec (also known as bandwidth)

Throughput = IOPS x transfer size



The Importance of Sequential Performance

**Critical for many
common SQL
Server activities**

**Full database
backups and
restores**

**Initializing HA
copies, replication
subscribers**

**Index creation and
rebuids**

**DW/reporting
large sequential
scans**



COURSE OBJECTIVE

Provide a thorough understanding of how to measure and analyze storage subsystem performance from a SQL Server perspective

Using tools and queries from Windows and SQL Server, measure current and historical storage subsystem performance

Using collected metrics, analyze and understand storage subsystem performance

How to run and interpret both synthetic storage benchmarks and some actual SQL Server storage tests



COURSE OBJECTIVE

Explain different types of storage and how to configure them for different SQL Server workloads

Internal storage, direct-attached storage, storage area networks, SMB file shares with Storage Spaces Direct

Differences between magnetic and flash storage

Differences between different types of flash storage



COURSE OBJECTIVE

Cover various ways to improve storage subsystem performance for SQL Server

Includes hardware and storage selection and configuration

Proper operating system configuration

SQL Server configuration

Workload and index tuning



Course Focus and Structure



Measuring and Analyzing Storage Subsystem Performance



Testing and Benchmarking Storage Subsystems



Understanding Storage Types Suitable for SQL Server Workloads



Understanding the Effects of RAID Levels on SQL Server Workloads



Storage Subsystem Performance



What We Covered



Importance of storage subsystem performance for SQL Server

Three main metrics for storage performance

What this course will cover

Course structure

