Understanding the Effects of RAID Levels on SQL Server Workloads

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Module Summary

- How RAID levels are affected by SQL Server workload type
- How availability requirements affect desired RAID level
- How performance and redundancy are affected by RAID level

Common RAID Levels

RAID 1

RAID 5

RAID 10

RAID 6

RAID 1 (Mirroring)

RAID 1

Data is written to two different disks in parallel

No parity information is used, so no parity write performance overhead

Usable capacity is 50% of raw capacity

RAID 5 (Striping with Parity)

RAID 5

- Data is striped across all disks in array
- Parity information is calculated and striped across all disks in array in a separate write
- Writing parity information decreases overall write performance
- Capacity overhead is 1/N of raw capacity, where N is number of disks in array
- Can only lose one disk in array

RAID 10 (Mirroring + Striping)

RAID 10

Data is striped across all disk sets in array, with each disk set being a two-disk RAID 1 mirror

No parity information is used, so no parity write performance overhead

Usable capacity is 50% of raw capacity

Can usually lose more than one disk in array

RAID 6 (Striping with Double Parity)

RAID 6

- Data is striped across all disks in array
- Parity information is calculated and striped across all disks in array in two separate writes
- Writing more parity information decreases overall write performance even more
- Capacity overhead is 2/N of raw capacity
- Can lose up to two disks in array

RAID Does Not Replace Backup/Restore Plans

RAID is not a substitute for a good backup/restore strategy

RAID is not a substitute for an effective HA/DR strategy

Appropriate RAID level reduces the chances of unplanned downtime

RAID 10 and RAID 6 are most robust common RAID levels

Primary SQL Server Workload Types

Online Transaction Processing (OLTP)

Reporting against OLTP database(s)

Relational Data Warehouse (DW)

Online Analytical Processing (OLAP)

OLTP Workload I/O Access Patterns

Frequent writes to data files and log file

Frequent reads from data files if active part of database does not fit in buffer pool

Writes to a single database log file are sequential

DW and Reporting I/O Access Patterns

Frequent sequential reads from data file(s) if database does not fit in buffer pool

Very little use of log file (except during data loads)

Sequential read I/O performance is very important

OLAP Workload I/O Access Patterns

Frequent random reads from cube files

Random read I/O performance is very important

Sequential write performance to cube files is important during cube generation

SQL Server File Types

Different file types have different I/O patterns, which also vary based on activity

Use Performance Monitor, Resource Monitor, and DMV queries to measure

Don't just guess

SQL Server Workloads and RAID Level Choice

Understand workload characteristics!

Read/write ratio for different file types and workloads can be different, as various activities occur

Also important to understand workload's sequential vs. random reads and writes

These characteristics influence desired RAID level and storage type

- E.g., parity-based RAID levels have a write performance penalty, so avoid using for write-intensive workloads

What We Covered

- How RAID levels are affected by SQL Server workload type
- How availability requirements affect desired RAID level
- How performance and redundancy are affected by RAID level