SQL Server 2012: Evaluating and Sizing Hardware

Module 2: Choosing the Correct Hardware for Your Workload

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Introduction

- SQL Server workload types
- OLTP workloads
- DW/DSS workloads
- OLAP workloads
- Mixed workloads
- Database maintenance workloads
- Database backup workloads
- Database restore workloads
- Effects of HA/DR technology on workload
- Workload size and intensity

SQL Server Workload Types

- **Several common SQL Server workload types**
  - The workload type will influence your hardware and storage choices
- **Very common to have a mixture of workload types**
  - Actual mixed workload characteristics in a single database
  - Mixed workload characteristics from multiple databases
  - Mixed workload from database maintenance, backups, and HA/DR effects
- **Effects of workload are seen in CPU usage patterns**
  - Single-threaded or multi-threaded query workloads
  - Volume of concurrent queries
- **Storage subsystem usage is affected by workload types**
  - Sequential or random I/O workload
  - Read or write workload
  - Changing points of I/O activity depending on workload patterns
    - Reading from data files, writing to transaction log file, etc.

OLTP Workloads

- **One of the most common workload types**
- **Higher numbers of short-duration transactions**
  - Relatively high percentage of write activity
- **Most queries are fairly simple, and short duration (less than 1 sec)**
  - Most queries execute on a single logical processor core
  - Single-threaded processor performance is very important
- **Sequential write activity to the transaction log file**
  - Writing to the transaction log file can be a common bottleneck
- **Combination of random reads and writes from data file(s)**
  - Can have a high level of write activity
  - Random I/O performance is very important
- **TPC-E OLTP benchmark is useful for evaluating OLTP systems**
  - Good tool for comparing and sizing systems

DW/DSS Workloads

- **Another common workload type**
  - Relational data warehouse or decision support systems
- **Higher numbers of long-duration select queries**
  - Relatively high percentage of read activity
  - Very little write activity, except during data loads
- **Most queries are fairly complex, long duration (more than 1 sec)**
  - Many queries may execute on multiple, logical processor cores
    - They are parallelized by the query processor
  - Total number of logical cores is very important
    - Single-threaded processor performance is still important
- **Sequential write activity to the transaction log file during loads**
  - Writing to the transaction log file can be a bottleneck during data loads
- **Combination of sequential and random reads from data file(s)**
  - Sequential I/O performance is very important
  - Random I/O performance is also important

OLAP Workloads

- **A less common workload type, but becoming more popular**
- **High numbers of MDX queries**
  - Very high percentage of random read activity from cube file(s)
  - Very little write activity, except during cube builds and refreshes
- **Most queries are fairly complex, and long duration (more than 1 sec)**
  - Many queries may execute on multiple, logical processor cores
  - Total number of logical cores is very important
    - Single-threaded processor performance is still important
  - Total amount of physical RAM is very important
- **Sequential write activity to the cube file(s) during loads**
- **Sequential reads from source data file(s) during loads**
  - Sequential performance is very important

Mixed Workloads

- **Very unusual to have a single "pure" workload type on a server**
- **Various reasons for this situation**
  - OLTP database that also has a reporting workload
  - DW database that is updated frequently
  - Multiple databases with different workload types
  - Multiple databases with same workload type
- **Database maintenance activity**
  - Index maintenance, statistics updates, DBCC CHECKDB activity
- **Database backup and restore activity**
  - Full, differential, and log backups
  - Native or 3rd-party compression
- **HA/DR activity**
  - AlwaysOn AG replicas, database mirroring, log shipping

Database Maintenance Workloads

- **Index maintenance and index creation operations**
  - Sequential reads from data file(s)
  - Sequential and random writes to data file(s)
  - Sequential writes to log file
  - Some extra CPU activity
- **Compressing indexes with data compression**
  - Same as index creation, but lower sequential writes to data file(s)
  - Significant extra CPU activity (control with MAXDOP option)
- **DBCC CHECKDB operations**
  - Sequential reads from data file(s)
    - Will read in parallel when data files are on multiple logical drives
  - Significant extra CPU activity
    - Very little when using WITH PHYSICAL_ONLY option

Database Backup Workloads

- **Full database backups**
  - Sequential writes to backup file(s)
  - Sequential reads from data file(s)
  - Sequential reads from log file
- **Differential database backups**
  - Similar to full database backups, but more random reads from data file(s)
- **Transaction log backups**
  - Sequential reads from log file
- **Using native backup compression**
  - Reduced sequential I/O write requirements
  - Extra CPU activity (typically 5-10%)
- **Using 3rd party backup compression**
  - Reduced sequential I/O write requirements
  - Extra CPU activity (can be much higher, depending on compression setting)

Database Restore Workloads

- **Full database restores**
  - Sequential reads from backup file(s)
  - Sequential writes to data file(s)
  - Sequential writes to log file
- **Differential database restores**
  - Similar to full database restores, but more random writes to data file(s)
- **Transaction log restores**
  - Similar to full database restores, but more random writes to data file(s)
- **Using native backup compression**
  - Reduced sequential I/O read requirements
  - Extra CPU activity (typically 5-10%)
- **Using 3rd-party backup compression**
  - Reduced sequential I/O read requirements
  - Extra CPU activity (can be much higher, depending on compression setting)

Effects of HA/DR Technology on Workload

- **Traditional failover cluster instance with shared storage**
  - No effect on the workload
- **Log shipping**
  - Virtually no effect on the workload
- **Database mirroring**
  - Extra read activity on the principal database log file
- **Transactional replication**
  - Extra read activity on the publication database log file
  - Read and write activity in the distribution database (if local distributor)
- **AlwaysOn availability groups**
  - Extra read activity on the primary database log file

Workload Size and Intensity

- **Common measurements of workload intensity**
  - Transactions per second
  - Batch requests per second
- **Number of concurrent users**
  - Another measurement of workload intensity
- **Number of databases**
  - Higher number of databases can randomize your I/O workload
- **Size of databases**
  - Affects disk space requirements
  - Usually affects buffer pool memory requirements
- **Log generation rate**
  - MB/minute
- **Watch Erin Stellato's Baselining and Benchmarking course**
  - http://bit.ly/ZlWyQ9

Summary

- **There are several different basic workload types**
  - OLTP
  - DW/DSS
  - OLAP
- **There are also mixed workload types**
  - Some databases have mixed workloads
  - Multiple databases create a mixed workload
  - Maintenance and backup/restore activity create mixed workloads
  - HA/DR technologies create extra workload activity
- **Consider your overall workload when selecting and sizing hardware**
  - Also very important for storage subsystem sizing and configuration

What is Next

- **Module 3 will cover processor selection for SQL Server 2012**
  - Workload type and size considerations
  - Determining your server form factor
  - Overall budget considerations
  - SQL Server 2012 licensing considerations
  - The importance of single-threaded processor performance
  - The importance of total core counts for scalability
  - Using TPC-E benchmark results to compare processor performance
  - Using Geekbench to compare processor performance
  - Processor power efficiency considerations