Interfacing With Databases

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Background Information / Key Words

- Server
- Database
- Table
- Index
Server

- A machine that runs your application
- Can be physical or virtual
  - Physical
    - All hardware is for that machine
  - Virtual
    - Many machines share the same hardware
SQL Instance

- A SQL DBMS software running on a server
  - SQL Server
  - Oracle
  - PostgreSQL
- Usually a Service running in the background
Database

- A structured set of data
- Can have multiple databases per server
Table

- Collection of data in a database
- Has rows and columns
Databases Explained by Excel

- Server = Your Computer
- SQL Instance = Excel Application
- Database = Workbook
- Table = Worksheet
Index

- How data is organized and retrieved in tables
- Non-clustered Index
  - The index at the back of a reference book
    - Separate index of: Topic, Page Number
    - Page Number points to the data in the book (table)
  - Without index, you must read entire book
  - With index, you must read multiple times for data
- Clustered Index
  - Index with the data right there
    - Phone book: Name, Phone Number - sorted by Name
Performance Considerations
Server Scalability

- When possible, do bulk of processing in code not in the query
  - Usually only one database server
  - Can have multiple application servers
Data Usage

- Read heavy applications
  - SELECT statements
  - May benefit from more indexes
    - More is not always better
  - Can have concurrent selects on same table
- Write heavy applications
  - INSERT/UPDATE/DELETES
  - Benefit from less indexes
  - Will cause blocking during writes on same table
Blocking vs Deadlocking

- Blocking: When a query must wait on another to complete
- Deadlocking: When neither query can complete because of shared resources

- What do you think is better?
  - Blocking > Deadlocking
- Consider what other processes use the same tables
- Deadlocks can cause rollbacks
  - Can take hours to complete
  - Will lock the table during this time
Reduce Number of Connections

- Pull back all the data you need in one query
  - Connections take time
- Be mindful of amount of memory
  - Storing query results can be expensive
  - Memory is finite
Use Indexes Wisely

- Take advantage of the indexes you have
- Take advantage of covering indexes
- May use indexes from other tables to speed up queries
- When creating new indexes
  - Think about how the table is used
  - How is data most often being retrieved
Avoid SELECT *

- Retrieves more data than needed
- Can’t take advantage of covering indexes
- Column name clashes
- Unknown effects when table structures change
Development vs Production

- Differences in hardware specs
- Data size differences
- Concurrent users
- Extra security layers
Monitoring
Performance Stats

- Windows performance monitor
- Ingest performance counters for later review
  - CPU
  - Memory
  - Disk Queue lengths
  - Disk read/write times
- Monitors performance across multiple servers
Performance Stats
Event Logs

- Aggregate windows event log folders
- Alert on high levels of errors
Endpoint Availability

- Monitor response times
  - Performance under peak load
URL Uptime

- Ping URL endpoints
  - Application endpoints
  - 3rd party interfaces
- Track Service Level Agreements (SLAs)
Database Metrics

- Size
- Backups
- Indexes
  - Usage
  - Fragmentation
  - Last rebuild date
- SQL Server
  - Agent Jobs
  - Procedure Cache
  - Server Service Broker Events
Database Size
Procedure Cache (SQL Server)

- SQL Server saves CPU by caching execution plans in memory
  - Similar queries reuse plans
- Can have big performance issues from bad plans
  - Single use plans
  - Toggling plans
- Too many plans eat up server memory
Server Service Broker (SQL Server)

- Alerts on SQL Events
- Deadlocks, blocking, lock escalation
- Security Events
  - Logins, access modified, role changes
  - Audit changes
Why Care?

- Metrics for performance tuning
- Troubleshoot errors
- Sizing servers for future growth
- Catch potential security threats
- Shorten or avoid downtime with alerts
  - Helps meet recovery time objectives (RTO)
- Hard evidence of service level agreements (SLAs)
  - Usually heavy monetary consequences for not meeting agreements
Questions?