SQL Server for the Sysadmin

“It’s all about me, and no one else but me.”

Jeff Rouse

AVP / Database Administration Manager
Republic Bank & Trust

- IT Industry for 25+ years
  - ~10 Years in Infrastructure
  - ~15 Years with SQL Server
- Worn a Lot of Hats
  - Systems Administrator
  - Network Engineer (Cisco)
  - Sr. Consultant for Microsoft Solution Partners
  - Enterprise Application Developer – Dynamics CRM / SharePoint
  - SQL Server DBA
- Leader Local SQL User Group (pass.org)

What is SQL Server?

- SQL Server Database Engine (RDBMS)
- SQL Server Reporting Services
- SQL Server Integration Services
- SQL Server Analysis Services

- Replication
- Full Text Search

What is SQL Server?

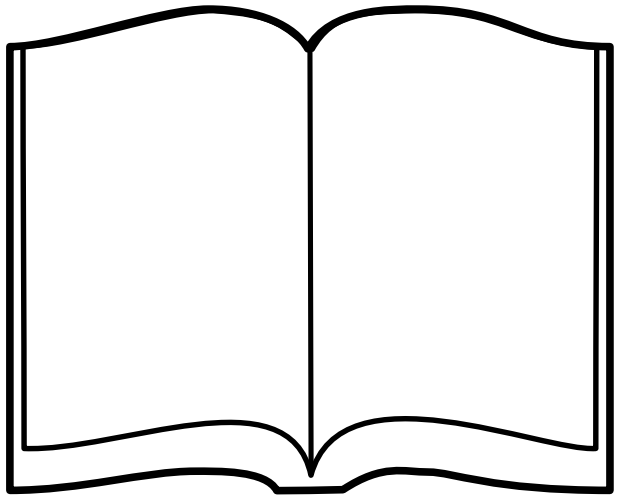
- SQL Server Database Engine – `SQLServer.exe`
  - Relational Engine – Query Processor
    - *Execution Plans*
  - Storage Engine
- SQL Server Operating System (`SQLOS`)
  - Memory Management
  - CPU Scheduling
  - I/O Management
  - Exception handling
  - SQL CLR (*Common Language Runtime*)

What is a Database?

- Tables
- Indexes
- Views
- Stored Procedures
- Function

- Data Files
- Log Files

IMAGINE: Book with Empty Pages



Table(s)

- First Name
- Last Name
- Phone Number
- Where they live
- Favorite food
- Favorite color
- Pets name
- What they drive

Indexes

- How do I find the Smiths?
- Who likes Pizza?
- Who has a dog?

Which Resource is Most Important to SQL Server?

- MEMORY
- CPU / PROCESSOR
- STORAGE

Which Resource is Most Important to SQL Server?

MEMORY

CPU / PROCESSOR

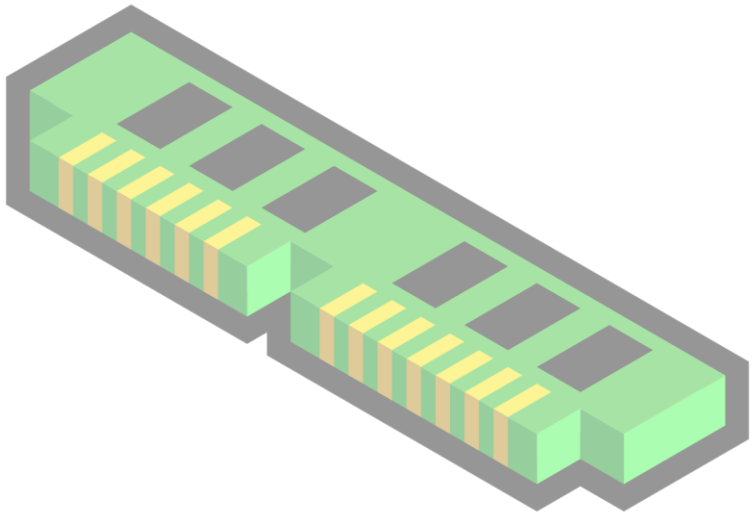
STORAGE

IT DEPENDS!

It's all about me!

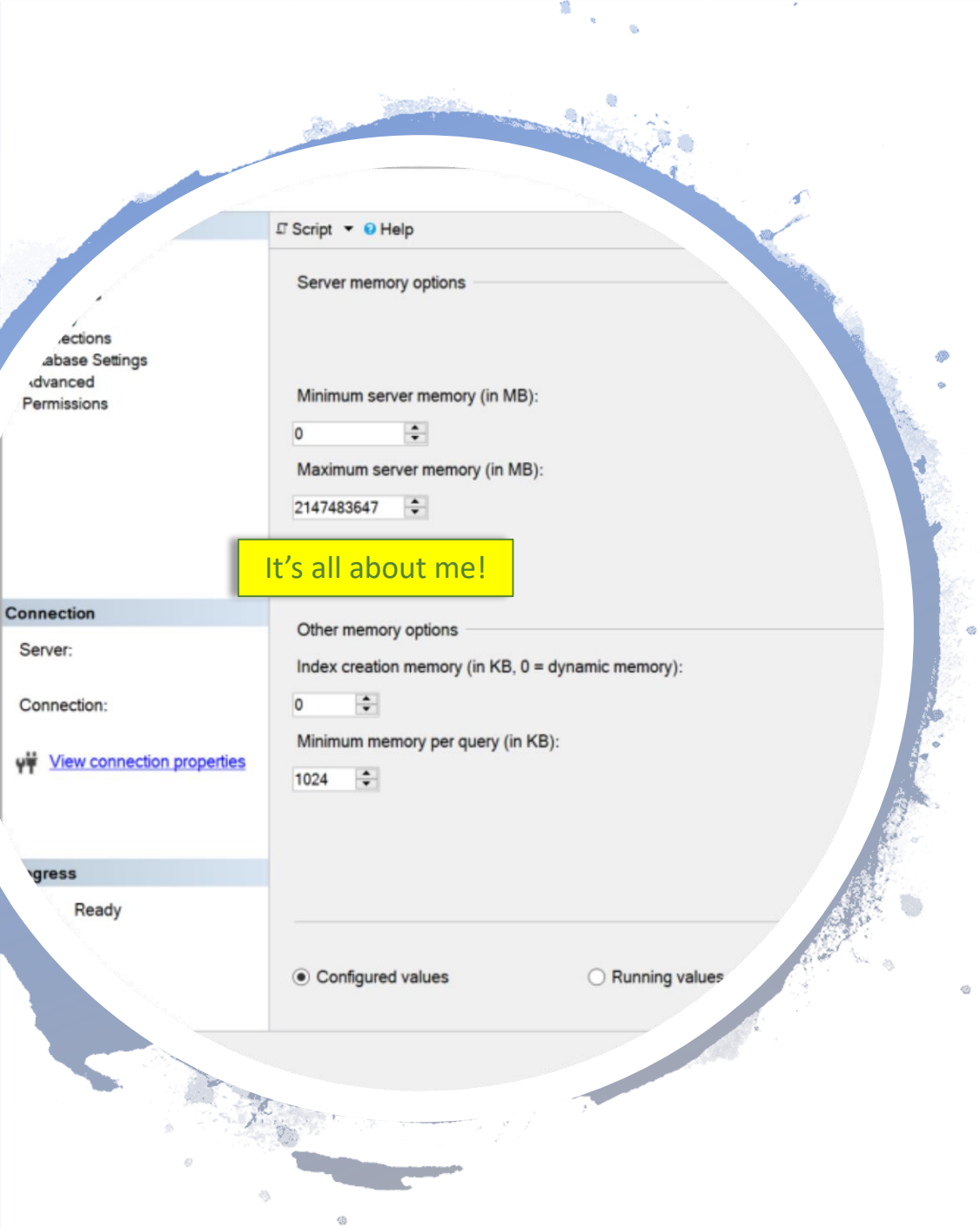
How Does SQL Server Use *Memory*?

- Memory is used to improve performance
- Caches the data that it "experiences"
- Caches Execution Plans
- It will use **ALL** the Memory*



Memory Makes Up for a **LOT** Sins

- Applications or Reports that needlessly retrieve **TOO** much data
- Tables do not have good indexes
- CPUs that can’t build query plans fast enough
- Slow (cheap) storage



SQL puts the *"Me"* in **Me**mory

It's All About Me,

and No One Else But Me!!!

- SQL Assumes it is alone
- Default Memory Setting 2147483647MB!!!
- SQL is very stingy with Memory.
- Reluctant to give it up.

How Does SQL Server Use *CPU*?

WAIT! It's all about me!

Query Processing

- Relational Engine (a.k.a. Query Optimizer)
- Execution Plan
  - The sequence in which the source tables are accessed.
  - The methods used to extract data from each table.
  - The process of selecting one execution plan from potentially many possible plans is referred to as "query optimization"

How Does SQL Server Use *CPU*?

SQL Server Task Scheduling

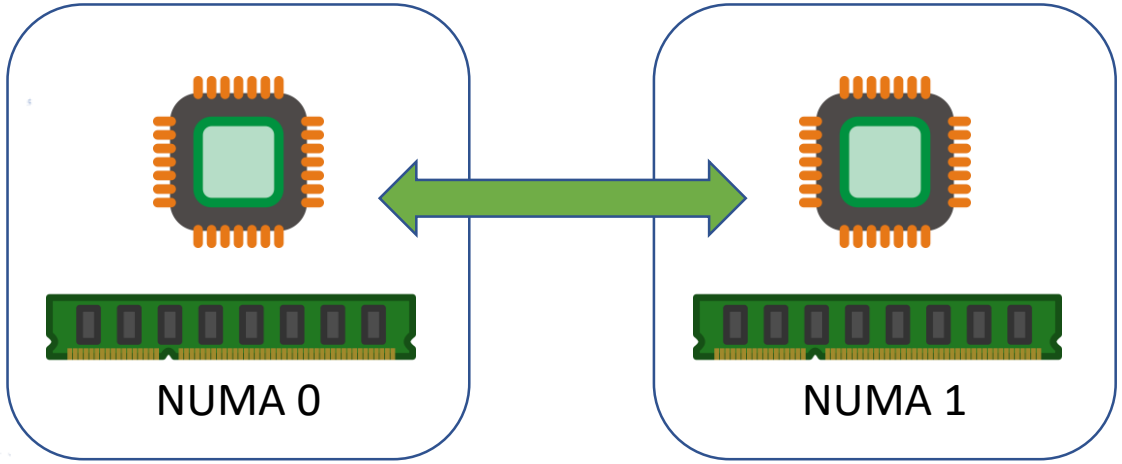
- **Requests** – logical chunks of “things to do”.
  - Queries, batches, system operations.
  - Exists in various states throughout their lifetime.
  - *WAIT*! Can accumulate when there is lot going on.
- **Tasks** – Unit of work
  - One or more per Request
  - Serial Request = 1 Task at a time
  - Parallel Requests = Concurrent Active Tasks
- **Worker Thread** – Logical O/S thread
  - Serial Requests = 1 Thread performs each task
  - Parallel Requests = 1 Master Worker; Coordinates Child Workers
- **Scheduler** – Manages Worker Threads that need CPU Time
  - Mapped to each CPU.
  - Maximum of 4ms time slice.
  - Cooperative or Non-Preemptive Scheduling

How Does SQL Server Use *CPU*?

Parallel Query Processing

- More than One Processor?
  - Query Optimizer Identifies Operations that Might Benefit
  - Inserts operators into plan to identify as Parallel Execution Plan
  - Eligible for more than one thread
  - Number thread determined at execution

How Does SQL Server Use *CPU*?



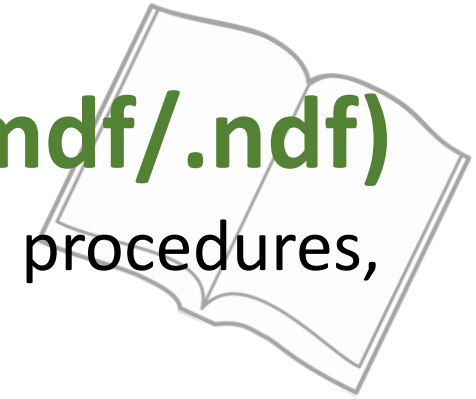
NUMA

- CPU & RAM connected via system bus
- System divided into NUMA Nodes
- Each Node contained 1(or more) CPU, connected to bank of RAM.
- Access to RAM on the local NUMA node is MUCH faster

Virtualization?!?! Next time. ☹

How Does SQL Server Use *Storage*?

It's all about me!



Data Files (.mdf/.ndf)

- Tables, stored procedures, views, etc.

Logs File (.ldf)

- Play by Play of changes to the data.

How Does SQL Server Use *Storage*?

my_Data_File.mdf

my_Log_Files.ldf

1. Record what's going to change (log file).
2. Change it (data file).
3. Record that is changed (log file).

tempdb – The trash can of SQL Server

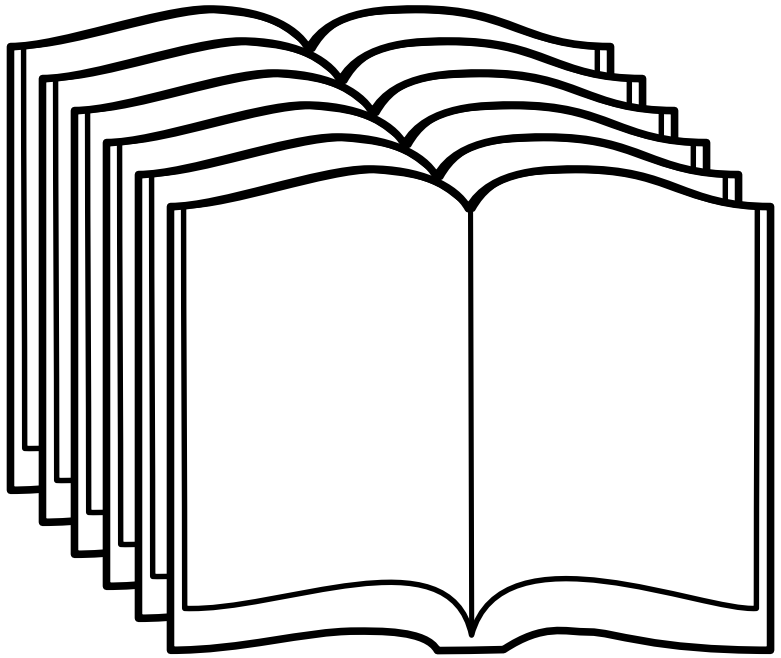
It's all about me!

- System database
- Stores Temporary Tables
- Big sort operations
- Special Transaction Modes

```
CREATE TABLE #MyReport       (PilotID INT, DogfightsWon INT,
                             DogfightsLost INT, TowersBuzzed INT)
INSERT INTO #MyReport        (PilotID, DogfightsWon,
                             DogfightsLost, TowersBuzzed)
  SELECT p.PilotID, SUM(p.DogfightsWon), SUM(p.DogfightsLost), SUM(p.TowersBuzzed)
  FROM dbo.Pilots p
  INNER JOIN dbo.Instructors i ON ....
```

Indexes

- An index has a row for ever record in the table.
- SQL Server has to add/update every index.
- Even ***unused*** indexes



Which Resource is Most Important to SQL Server?

- Can Improve performance
- Caches The Data
- Covers Our Sins

- Git' er 'Dun
- Thread Count
- Don't forget NUMA!

- Log Files are Important
- Tempdb = Trash Can (necessary, but can stink)
- Indexes can Help or Hurt

THANK YOU!!!

It's all about me!

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