Waits and Queues and You

Thomas LaRock
Senior DBA, Confio Software
Who Am I?

- Microsoft Certified Database Administrator
- Microsoft MVP
- Microsoft Most Valuable Professional
- PASS

follow me @SQLRockstar

http://thomaslarock.com
Learning to Drive
Learning to DBA
Car Engine
SQL Server is a Black Box

INPUT  SQL  OUTPUT
Describe Execution Model
Agenda

- Describe Execution Model
- Use some DMVs
Agenda

- Describe Execution Model
- Use some DMVs
- Show why we measure waits (use case)
Execution Model Example
Your Tax Dollars at Work
Execution Model (TSA)

- Passport checked
- Assigned a lane
- Put stuff on belt
  - Freedom Pat
- Head to gate
Execution Model (SQLOS)

- Init
- Runnable
- Running
- Waiting
- Done
**Execution Model (SQLOS)**

- **CPU 1**
  - SPID 77 – Running

- **CPU 1 Queue**
  - SPID 81 – Runnable
  - SPID 91 – Runnable

- **Waiter Queue**
  - SPID 62 – ASYNC_NETWORK_IO
  - SPID 63 – CXPACKET
  - SPID 67 – PAGEIOLATCH_SH
  - SPID 74 – LCK_M_S
  - SPID 79 – LATCH_EX
  - SPID 87 – WRITELOG
Execution Model (SQLOS)

CPU 1
SPID 77 – Running

CPU 1 Queue
SPID 81 – Runnable
SPID 91 – Runnable
SPID 67 – Runnable

Waiter Queue
SPID 62 – ASYNC_NETWORK_IO
SPID 63 – CX PACKET
SPID 67 – PAGEIOLATCH_SH
SPID 74 – LCK_M_S
**SPID 77 – LCK_M_IX**
SPID 79 – LATCH_EX
SPID 87 – WRITELOG
Execution Model (SQLOS)

CPU 1
SPID 81 – Running

Waiter Queue
SPID 62 – ASYNC_NETWORK_IO
SPID 63 – CXPACKET
SPID 67 – PAGEIOLATCH_SH
SPID 74 – LCK_M_S
SPID 79 – LATCH_EX
SPID 87 – WRITELOG
SPID 77 – LCK_M_IX
Execution Model (SQLOS)

CPU 1
SPID 77 – Running

Waiter Queue
SPID 62 – ASYNC_NETWORK_IO
SPID 63 – CXPACKET
SPID 67 – PAGEIOLATCH_SH
SPID 74 – LCK_M_S
SPID 79 – LATCH_EX
SPID 87 – WRITELOG

CPU 1 Queue
SPID 81 – Runnable
SPID 91 – Runnable
Execution Model (SQLOS)

CPU 1
- SPID 77 – Running

CPU 1 Queue
- SPID 81 – Runnable
- SPID 91 – Runnable

Waiter Queue
- SPID 62 – ASYNC_NETWORK_IO
- SPID 63 – CX PACKET
- SPID 67 – PAGEIOLATCH_SH
- SPID 74 – LCK_M_S
- SPID 79 – LATCH_EX
- SPID 87 – WRITELOG
Execution Model (SQLOS)

CPU 1
SPID 77 – Running

CPU 1 Queue
SPID 81 – Runnable
SPID 91 – Runnable

Waiter Queue
SPID 62 – ASYNC_NETWORK_IO
SPID 63 – CXPACKET
SPID 67 – PAGEIOLATCH_SH
SPID 74 – LCK_M_S
SPID 79 – LATCH_EX
SPID 87 – WRITELOG
Execution Model (DMVs)

Init -> Runnable
Runnable -> Waiting
Waiting -> Running
Running -> Done
Execution Model (DMVs)

sys.dm_exec_sessions

sys.dm_exec_requests = 'runnable'

sys.dm_exec_requests = 'running'

sys.dm_os_waiting_tasks

sys.dm_exec_connections
Sample Wait Types

1.

2.

3.

4.

5.
Sample Wait Types

1.

2.

3.

4.

5. LCK_M_S, LCK_M_U, LCK_M_X...
Sample Wait Types

1. 

2. 

3. 

4. 

5. LCK_M_S, LCK_M_U, LCK_M_X...
   • Waiting to acquire locks
Sample Wait Types

1.

2.

3.

4. PAGEIOLATCH_SH, PAGEIOLATCH_EX...

5. LCK_M_S, LCK_M_U, LCK_M_X...
   - Waiting to acquire locks
Sample Wait Types

1.

2.

3.

4. PAGEIOLATCH_SH, PAGEIOLATCH_EX...
   • Physical disk reads

5. LCK_M_S, LCK_M_U, LCK_M_X...
   • Waiting to acquire locks
Sample Wait Types

1. 

2. 

3. WRITELOG

4. PAGEIOLATCH_SH, PAGEIOLATCH_EX...
   - Physical disk reads

5. LCK_M_S, LCK_M_U, LCK_M_X...
   - Waiting to acquire locks
Sample Wait Types

1. 

2. 

3. WRITELOG
   - Waiting for a log flush to complete

4. PAGEIOLATCH_SH, PAGEIOLATCH_EX...
   - Physical disk reads

5. LCK_M_S, LCK_M_U, LCK_M_X...
   - Waiting to acquire locks
Sample Wait Types

1.

2. CXPACKET

3. WRITELOG
   • Waiting for a log flush to complete

4. PAGEIOLATCH_SH, PAGEIOLATCH_EX...
   • Physical disk reads

5. LCK_M_S, LCK_M_U, LCK_M_X...
   • Waiting to acquire locks
Sample Wait Types

1. 

2. CXPACKET
   - Parallelism

3. WRITELOG
   - Waiting for a log flush to complete

4. PAGEIOLATCH_SH, PAGEIOLATCH_EX...
   - Physical disk reads

5. LCK_M_S, LCK_M_U, LCK_M_X...
   - Waiting to acquire locks
Sample Wait Types

1. ASYNC_NETWORK_IO, NETWORKIO

2. CXPACKET
   - Parallelism

3. WRITELOG
   - Waiting for a log flush to complete

4. PAGEIOLATCH_SH, PAGEIOLATCH_EX...
   - Physical disk reads

5. LCK_M_S, LCK_M_U, LCK_M_X...
   - Waiting to acquire locks
Sample Wait Types

1. ASYNC_NETWORK_IO, NETWORKIO
   • Waiting on the network

2. CXPACKET
   • Parallelism

3. WRITELOG
   • Waiting for a log flush to complete

4. PAGEIOLATCH_SH, PAGEIOLATCH_EX...
   • Physical disk reads

5. LCK_M_S, LCK_M_U, LCK_M_X...
   • Waiting to acquire locks
Why Measure Waits?

- Think about how you currently resolve performance issues, does it look like this...?
Why Measure Waits?

Think about how you currently resolve performance issues, does it look like this...?

Conventional Tools Measure Database Health

Database

Statistic Total
CPU used by this session 2,317,399
CPU used when call started 2,317,399
Num blocks created 36,203
DBWR checkpoint buffers written 101,603
DBWR checkpoints 34
DBWR transaction table writes 1,046
SQL*Net roundtrips to/from client 18,550,471
Active task count during cleanup 36
background checkpoints completed 36
background checkpoints started 36
background timeouts 7,234
branch node alights 7
buffer is not pinned count 78,660,498
buffer is pinned count 34,924,641
bytes received via SQL*Net from c 1,159,332,214
bytes sent via SQL*Net to client 665,135,799
calls to get snapshot data: kongas 49,785,137
calls to kongas 432,277
calls to kongas 15,427
change write time 15,859
cleanup - number of tcuget calls 42,993

It’s your Code!

It’s your Database!

Unclear view of performance leads to finger pointing.
Why Wait Time Analysis Rocks

- Allows you to focus on *the* problem
  - Four possible resource bottlenecks
Why Wait Time Analysis Rocks

- Allows you to focus on *the* problem
  - Four possible resource bottlenecks
- Waits help you to answer the BIG question:
  - “Is this a problem?”
Why Wait Time Analysis Rocks

- Allows you to focus on *the* problem
  - Four possible resource bottlenecks
- Waits help you to answer the BIG question:
  - "Is this a problem?"
- Helps to prioritize
  - Fix the ones you can fix now
Why Wait Time Analysis Rocks

- Allows you to focus on *the* problem
  - Four possible resource bottlenecks
- Waits help you to answer the BIG question:
  - “Is this a problem?”
- Helps to prioritize
  - Fix the ones you can fix now
- Does not rely on Health Stats alone
  - Perfmon counters only?
Use Case (or, My Story)

Top 15 SQL Statements

% O/S CPU Utilization

Round-trip Time (ms)
How To Measure?

- 3rd party tools
- Native tools
  - DMVs
  - Perfmon
  - xEvents
  - MDW/UCP
Know difference between “wait” and “queue”

- Wait – Any time a session is waiting
- Queue – A measure of system resource and utilization (think perfmon)
Know What You Are Measuring

- Know difference between “wait” and “queue”
  - Wait – Any time a session is waiting
  - Queue – A measure of system resource and utilization (think perfmon)

- Difference between OLTP and OLAP
  - Which one has more ad-hoc queries?
  - Which one is more likely to see parallelism?
  - Which one is likely to see more blocking/locking?
Know What You Are Measuring

- Know difference between “wait” and “queue”
  - Wait – Any time a session is waiting
  - Queue – A measure of system resource and utilization (think perfmon)

- Difference between OLTP and OLAP
  - Which one has more ad-hoc queries?
  - Which one is more likely to see parallelism?
  - Which one is likely to see more blocking/locking?

- What does all that mean to the DBA?
For More Information

For More Information

- https://sqlserverperformance.wordpress.com/
- http://thomaslarock.com/presentations
- http://speakerrate.com/speakers/3000-sqlrockstar
THANK YOU DALLAS!
NEXT STOP: LOUISVILLE!
Questions?