



DAY 2 – Indexing, Statistics & Concurrency

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DAY 2

Module 3: Indexing, Statistics & Concurrency

Module 4: Wait Stats, Blocking & Concurrency

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WHAT ARE WAITS?

What is a Wait?

SQL Server wants to do work, but it is waiting for something.

Examples:

Waiting for disk

Waiting for CPU

Waiting for another query

Waiting for memory

Real-Life Example



You are ready to go to office:

Bus is late → you wait

Traffic signal red → you wait

Someone blocking the door → you wait

SQL Server behaves exactly like this.

What is a BOTTLENECK?

A system resource cannot keep up with demand.

Examples:

CPU cores saturated

Slow storage subsystem

Poor concurrency design

Inefficient query patterns

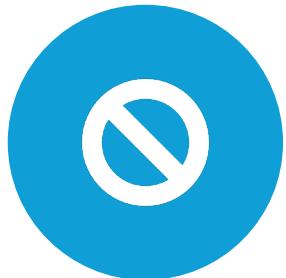
Golden Rule for DBAs



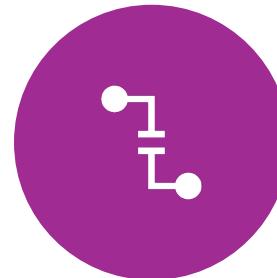
All bottlenecks



create waits,



but not all waits



indicate a bottleneck.

Waits vs Bottlenecks

Term	Meaning
Wait	What SQL Server is waiting for
Bottleneck	The real reason behind the wait

Waits vs Bottlenecks

Aspect	Wait	Bottleneck
Meaning	SQL Server is waiting	Resource cannot meet demand
Nature	Symptom	Root cause
Action	Investigate	Fix resource/design
Example	CXPACKET wait	CPU saturation
Example	PAGEIOLATCH	Slow disk subsystem

Key Wait Types

Wait Type	Resource	What it Indicates	Common Root Cause	Fix Direction
CXPACKET	CPU (parallelism)	Thread imbalance	Bad estimates, over-parallelism	Tune queries, stats, MAXDOP
PAGEIOLATCH_*	Disk I/O	Slow reads/writes	Storage latency, missing indexes	Improve I/O, indexing
LCK_M_*	Locks	Blocking	Long transactions, poor design	Reduce scope, isolation tuning
SOS_SCHEDULER_YIELD	CPU	CPU pressure	CPU saturation	Reduce CPU load, tune queries



PART 2: CAPTURE WAIT STATS

LAB 1 – Capture Baseline

Tool:

- `sys.dm_os_wait_stats`

```
SELECT *
FROM sys.dm_os_wait_stats
ORDER BY wait_time_ms DESC;
```

What You See

- Wait type
- Total wait time
- Number of waits



PART 3: KEY WAITS

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CXPACKET (Parallelism Wait)

Meaning

- Queries are running in **parallel**, but threads are not balanced.

Real-Life Example

- 10 workers assigned:
- 2 are working
- 8 are waiting

CXPACKET

When CXPACKET is OK

- ✓ Reporting queries
- ✓ Large data processing

When CXPACKET is Bad

- ✗ OLTP system
- ✗ Many small queries

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PAGEIOLATCH_* (Disk I/O Wait)

Meaning

- SQL Server is waiting for **data to come from disk into memory**

Real-Life Example 📦

- You ordered item, delivery truck is late.

Root Causes

- Slow disk
- Missing indexes
- Large table scans

3 LCK_M_* (Lock Waits)

Meaning

- One query is blocking another.

Real-Life Example



- One person locked the room, others wait outside.

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SOS_SCHEDULER_YIELD (CPU Pressure)



Meaning



Too many queries want CPU at the same time.



Real-Life Example



Too many thoughts, brain overloaded.

PART 4: BLOCKING vs DEADLOCK

Blocking (Simple)



One query **holds a lock**,
others wait.



✓ Blocking clears once first
query finishes.

Deadlock (Dangerous)



Two queries **block each other permanently**.



✗ SQL Server kills one query automatically.

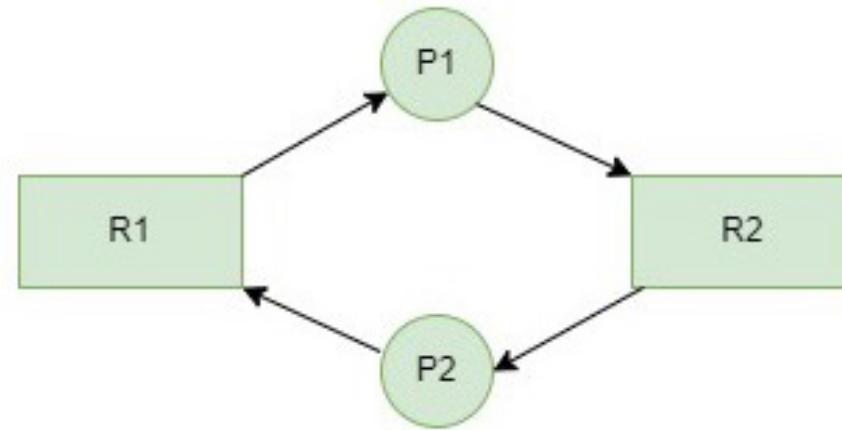
Blocking vs Deadlock

Aspect	Blocking	Deadlock
Nature	Linear wait	Circular wait
Resolution	Ends naturally	SQL Server kills victim
Frequency	Very common	Less common
Fix	Reduce lock time	Redesign access order

Real-Life Example



- Person A waits for Person B
 - Person B waits for Person A
- Deadlock



PART 5: HANDS-ON – SIMULATE BLOCKING (CSC LAB)

Session 1

```
BEGIN TRAN;  
UPDATE Orders  
SET OrderStatus = 'PROCESSING'  
WHERE OrderID = 100;  
(Do NOT commit)
```

Session 2

```
SELECT *  
FROM Orders  
WHERE OrderID = 100;
```

What Happens

- Session 2 is blocked
- User complains: “screen frozen”

Check Blocking

```
SELECT  
    session_id,  
    blocking_session_id,  
    wait_type  
FROM sys.dm_exec_requests;
```

PART 6: DEADLOCKS & DEADLOCK GRAPHS

What is a Deadlock Graph?

A **visual diagram** showing:

- Which queries were involved
- Which resources they wanted
- Why SQL Server killed one query

PART 7: ISOLATION LEVELS

What is Isolation Level?

Isolation level controls:

- “How much data one query can see from another query”

Common Isolation Levels

Level	Behavior
READ COMMITTED	Default, blocking occurs
REPEATABLE READ	More blocking
SERIALIZABLE	Maximum blocking
SNAPSHOT	Uses versioning

Isolation Levels — Conceptual View

Isolation Level	Allows Reads	Blocks Writes	Blocking Level
READ UNCOMMITTED	Dirty reads	No	Lowest
READ COMMITTED	No dirty reads	Yes	Medium
REPEATABLE READ	Stable reads	Yes	High
SERIALIZABLE	Full isolation	Yes	Very High

Real-Life Example



- Reading a newspaper
- Someone edits same page
- Snapshot = you read old copy peacefully

PART 8: ROW VERSIONING

Row Versioning (RCSI & Snapshot)

- Readers read **old versions of rows** instead of blocking writers.
- **Where versions are stored**
- **TempDB**

RCSI (Read Committed Snapshot Isolation)

- Default READ COMMITTED behavior
- Uses row versions
- Readers don't block writers
- Best for OLTP

SNAPSHOT Isolation

- Transaction-level versioning
- Consistent view for entire transaction
- More TempDB usage

What is Row Versioning?

Instead of blocking:

- SQL Server keeps **older copy of data**
- Readers read old version
- Writers update new version

RCSI (Recommended for CSC OLTP)

```
ALTER DATABASE YourDB  
SET READ_COMMITTED_SNAPSHOT ON;
```

Benefit

- Massive reduction in blocking
- Better concurrency

Row Versioning Comparison

Feature	Traditional Locking	RCSI	SNAPSHOT
Reader blocks writer	Yes	No	No
TempDB usage	Low	Medium	High
Concurrency	Lower	High	Very High
Complexity	Simple	Moderate	Higher

PART 9: HANDS-ON - FIX BLOCKING USING RCSI

Before

- SELECT waits on UPDATE
- Users complain

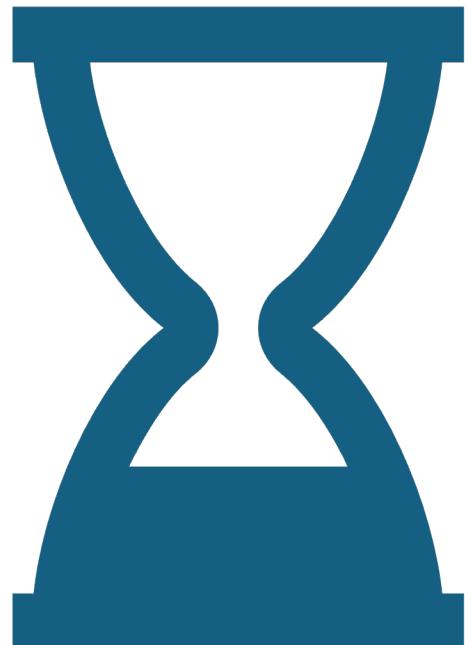
After RCSI

- SELECT reads old version
- UPDATE continues
- No blocking





PART 10: CSC INCIDENT – END-TO-END WALKTHROUGH



Problem

Slow application during peak hours

Investigation

- ✓ Checked wait stats
- ✓ Found LCK_M_* waits
- ✓ Identified blocking query

Fix

- ✓ Enabled RCSI
- ✓ Reduced blocking
- ✓ No code change

SUMMARY

Term	Simple Meaning
Wait	SQL Server waiting
Bottleneck	Real cause
CXPACKET	Parallel imbalance
PAGEIOLATCH	Disk wait
LCK_M_*	Blocking

SUMMARY

Term	Simple Meaning
SOS_SCHEDULER_YIELD	CPU pressure
Blocking	Temporary wait
Deadlock	Circular wait
Isolation Level	Visibility control
RCSI	Blocking killer



**Thank you for
your support and
patience**

**Surendra Panpaliya
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