How to improve performance understanding DB2 Isolation levels

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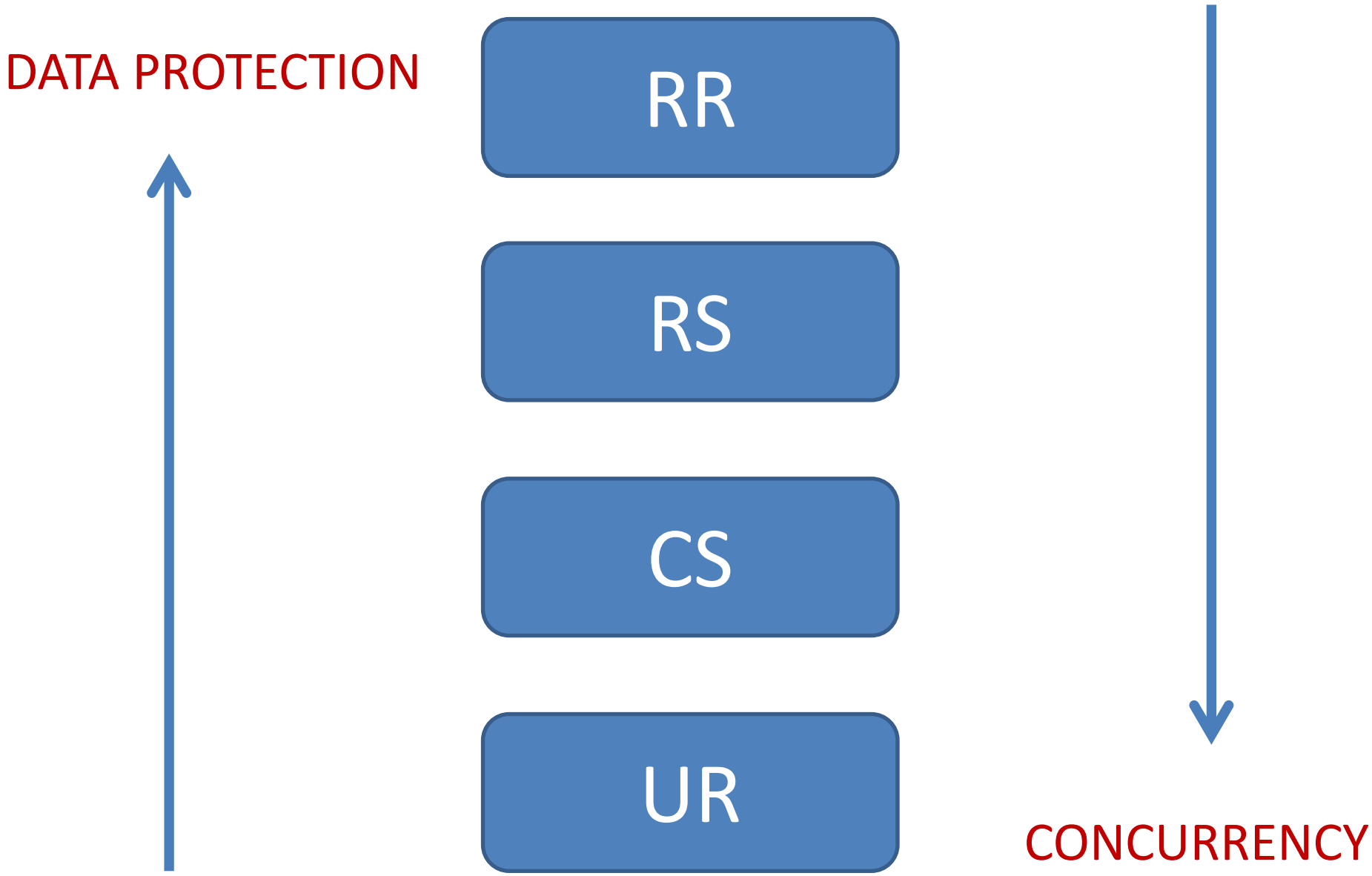
Trade off



Understanding Repeatable Read

- Your query will always return the same result within an UOW
- What that means?

```
db2hadr@server1:~
[db2hadr@server1 ~]$
[db2hadr@server1 ~]$
[db2hadr@server1 ~]$ db2 "select EMPNO,FIRSTNME from employee where FIRSTNME like 'B%' with rr"

EMPNO  FIRSTNME
------ ------------
000150 BRUCE

  1 record(s) selected.
```

```
Object                                  Lock     Object     Lock       Lock     Is       Locked
Name                                    Mode     Type       Status     Count    Blocker  By
--------------------------------------- -------- ---------- ---------- -------- -------- --------
Internal Variation                      S        Variation  Granted           2 No              -
Internal Plan                           S        Plan       Granted           1 No              -
DB2HADR.EMPLOYEE                        S        Table      Granted           2 No              -
```

Understanding RR

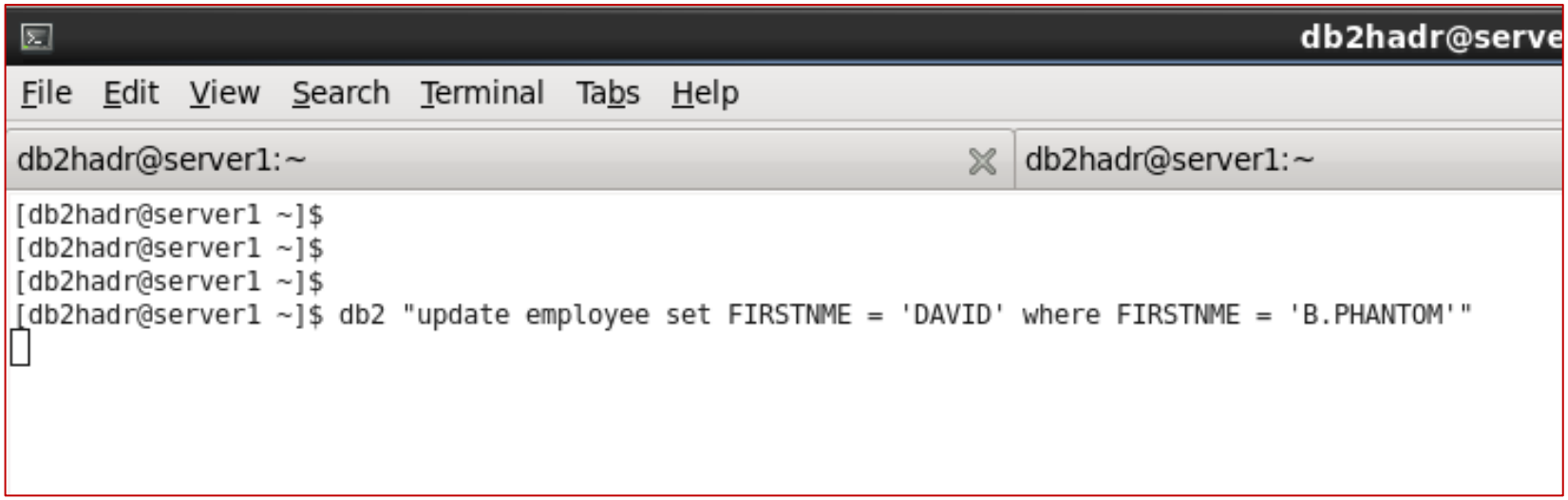
- Lock S (share) – Concurrent applications can only read data

- In this case all the table is locked (that's not the rule)

- Concurrent applications trying to modify the table => lock waiting

Understanding RR

- Trying to modify any row on that table leaves the concurrent application in locking waiting



Application Status	Object Name	Lock Mode	Object Type	Lock Status	Lock Count	Is Blocker	Locked By
Lock Waiting	Internal Plan	S	Plan	Granted	1	No	11
Lock Waiting	DB2HADR.EMPLOYEE[0]	IX [S]	Table	-	-	No	11
Lock Waiting	Internal Variation	S	Variation	Granted	1	No	11
UOW Waiting in the application	Internal Plan	S	Plan	Granted	1	Yes	-
UOW Waiting in the application	DB2HADR.EMPLOYEE	S	Table	Granted	1	Yes	-
UOW Waiting in the application	Internal Variation	S	Variation	Granted	1	Yes	-

Improving Performance RR

- Ensure locklist and maxlock (db cfg) have appropriate values

- Creating an index can avoid table scan and lock the entire table

- Frequently commit

Understanding Read Stability

- "The read stability isolation level locks only those rows that an application retrieves during a unit of work“
- What that means ?

db2hadr@server1:~

```
[db2hadr@server1 ~]$
[db2hadr@server1 ~]$
[db2hadr@server1 ~]$ db2 "select EMPNO,FIRSTNME from employee where FIRSTNME like 'B%' with rs"

EMPNO  FIRSTNME
------ ------------
000150 BRUCE

  1 record(s) selected.
```

Application Status	Object Name	Lock Mode	Object Type	Lock Status	Lock Count	Is Blocker	Locked By
UOW Waiting in the application	Internal Plan	S	Plan	Granted	1	No	-
UOW Waiting in the application	DB2HADR.EMPLOYEE	NS	Row	Granted	1	No	-
UOW Waiting in the application	DB2HADR.EMPLOYEE	IS	Table	Granted	1	No	-

Understanding RS

- Lock NS (scan share) – Concurrent applications can only read data

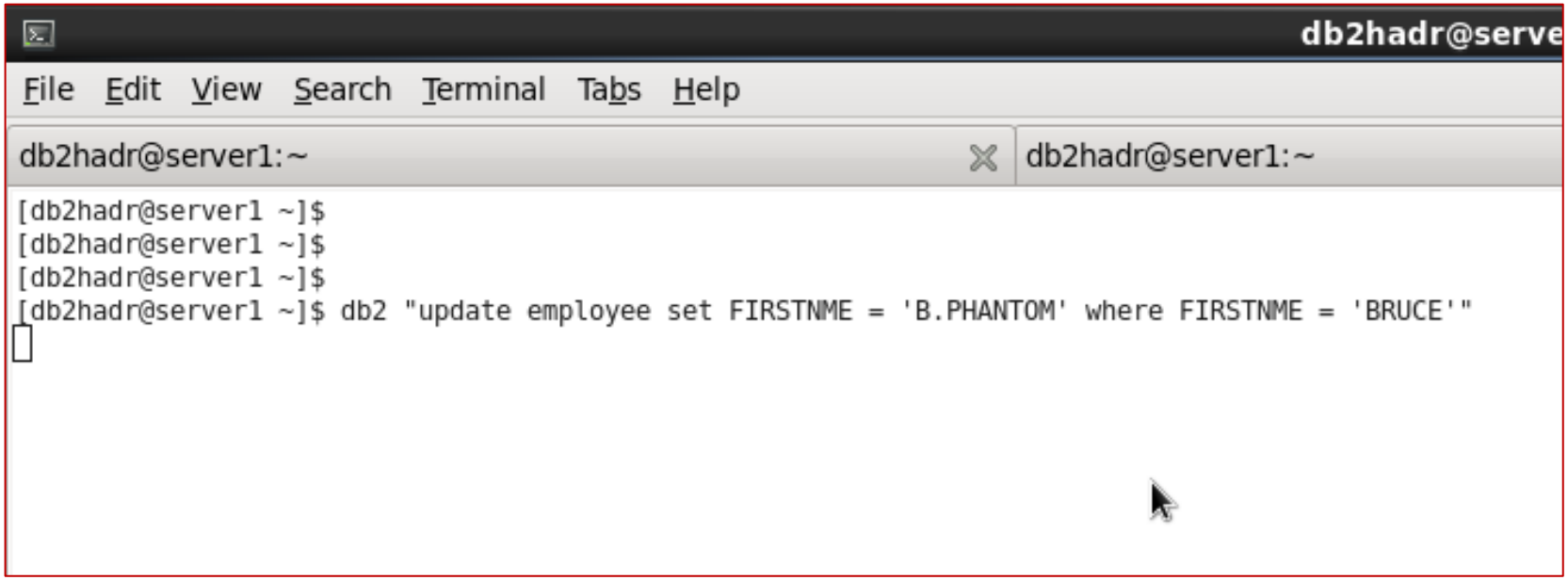
- Lock is on the rows

- Rows returned on the query are locked.

- Concurrent applications trying to modify those rows => lock waiting

Understanding RS

- Trying to update a row returned on that query leaves the concurrent updating application in lock waiting



Application Status	Object Name	Lock Mode	Object Type	Lock Status	Lock Count	Is Blocker	Locked By
Lock Waiting	Internal Plan	S	Plan	Granted	1	No	11
Lock Waiting	DB2HADR.EMPLOYEE[0]	X [NS]	Row	-	-	No	11
Lock Waiting	DB2HADR.EMPLOYEE	X	Row	Converting	1	No	11
Lock Waiting	DB2HADR.EMPLOYEE	IX	Table	Granted	1	No	11
Lock Waiting	Internal Variation	S	Variation	Granted	1	No	11
UOW Waiting in the application	Internal Plan	S	Plan	Granted	1	Yes	-
UOW Waiting in the application	DB2HADR.EMPLOYEE	NS	Row	Granted	1	Yes	-
UOW Waiting in the application	DB2HADR.EMPLOYEE	IS	Table	Granted	1	Yes	-

Understanding RS

- Trying to update a row that it was not returned on that query

=> Phantom Row

db2hadr@server1:~ | db2hadr@server1:~

```
[db2hadr@server1 ~]$
[db2hadr@server1 ~]$
[db2hadr@server1 ~]$
[db2hadr@server1 ~]$ db2 "update employee set FIRSTNME = 'B.PHANTOM' where FIRSTNME = 'DAVID'"
DB20000I  The SQL command completed successfully.
[db2hadr@server1 ~]$
```

Phantom Row !!!

Application Status	Object Name	Lock Mode	Object Type	Lock Status	Lock Count	Is Blocker	Locked By
UOW Waiting in the application	Internal Plan	S	Plan	Granted	1	No	-
UOW Waiting in the application	DB2HADR.EMPLOYEE	NS	Row	Granted	1	No	-
UOW Waiting in the application	DB2HADR.EMPLOYEE	IS	Table	Granted	1	No	-

Understanding RS

- The same statement in the same UOW

db2hadr@server1:~ | db2hadr@server1:~

```
[db2hadr@server1 ~]$
[db2hadr@server1 ~]$
[db2hadr@server1 ~]$ db2 "select EMPNO,FIRSTNME from employee where FIRSTNME like 'B%' with rs"

EMPNO  FIRSTNME
------ ------------
000150 BRUCE

  1 record(s) selected.

[db2hadr@server1 ~]$ db2 "select EMPNO,FIRSTNME from employee where FIRSTNME like 'B%' with rs"

EMPNO  FIRSTNME
------ ------------
000150 BRUCE
000200 B.PHANTOM

  2 record(s) selected.

[db2hadr@server1 ~]$
```

Phantom Row !!!

Understanding Cursor Stability

- "The cursor stability isolation level locks any row being accessed during a transaction while the cursor is positioned on that row"
- What ? Why ? How ?

```
db2hadr@server1:~
[db2hadr@server1 ~]$
[db2hadr@server1 ~]$
[db2hadr@server1 ~]$
[db2hadr@server1 ~]$
[db2hadr@server1 ~]$ db2 "select EMPNO,FIRSTNME from employee where FIRSTNME like 'B%'"

EMPNO  FIRSTNME
------ ------------
000150 BRUCE

  1 record(s) selected.
```

CS is DB2 default isolation level

```
Application                    Object                                  Lock     Object     Lock       Lock     Is      Locked
Status                         Name                                    Mode     Type       Status     Count    Blocker By
------------------------------ --------------------------------------- -------- ---------- ---------- -------- ------- --------
UOW Waiting in the application Internal Plan                           S        Plan       Granted           1      No        -
```

Understanding Uncommited Read

- "The uncommitted read isolation level allows an application to access the uncommitted changes of other transactions“
- What that means?

db2hadr@server1:~ db2hadr@s

```
[db2hadr@server1 ~]$
[db2hadr@server1 ~]$
[db2hadr@server1 ~]$
[db2hadr@server1 ~]$ db2 -m "update employee set FIRSTNME = 'UNCOMMITED'"
  Number of rows affected : 42
DB20000I  The SQL command completed successfully.
[db2hadr@server1 ~]$
```

Application Status	Object Name	Lock Mode	Object Type	Lock Status	Lock Count	Is Blocker	Locked By
UOW Waiting in the application	Internal Plan	S	Plan	Granted	1	No	-
UOW Waiting in the application	DB2HADR.EMPLOYEE	X	Row	Granted	42	No	-
UOW Waiting in the application	DB2HADR.EMPLOYEE	IX	Table	Granted	1	No	-

Understanding UR

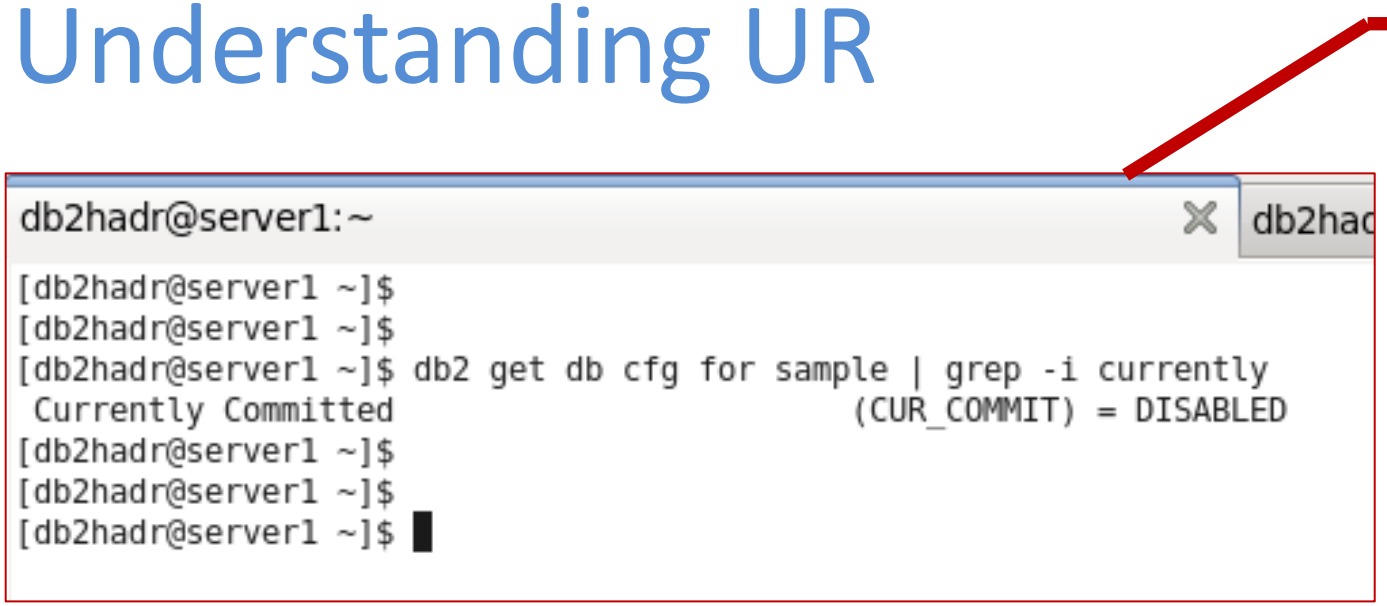
db2hadr@server1:~ | db2hadr@server1:~

```
[db2hadr@server1 ~]$
[db2hadr@server1 ~]$
[db2hadr@server1 ~]$ db2 "select EMPNO,FIRSTNME from employee fetch first 10 rows only"

EMPNO  FIRSTNME
------ ------------
000010 CHRISTINE
000020 MICHAEL
000030 SALLY
000050 JOHN
000060 IRVING
000070 EVA
000090 EILEEN
000100 THEODORE
000110 VINCENZO
000120 SEAN

  10 record(s) selected.

[db2hadr@server1 ~]$ db2 "select EMPNO,FIRSTNME from employee fetch first 10 rows only with ur"

EMPNO  FIRSTNME
------ ------------
000010 UNCOMMITED
000020 UNCOMMITED
000030 UNCOMMITED
000050 UNCOMMITED
000060 UNCOMMITED
000070 UNCOMMITED
000090 UNCOMMITED
000100 UNCOMMITED
000110 UNCOMMITED
000120 UNCOMMITED

  10 record(s) selected.
```

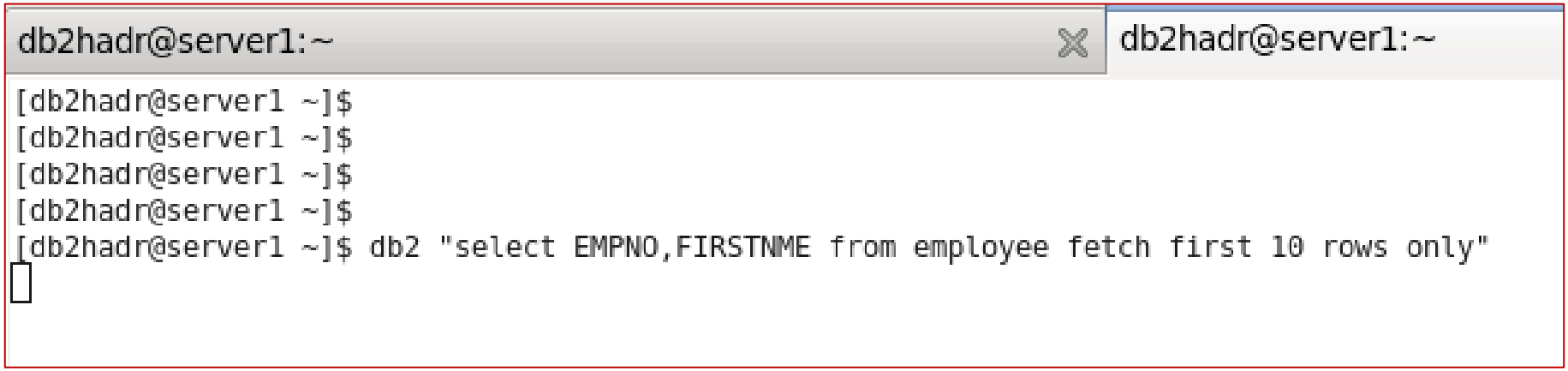
Currently commited behavior (CS)

UR

Understanding UR



Currently commited OFF



Lock waiting

select substr(ai.appl_name,1,20) as appl_name ,substr(ai.primary_auth_id,1,10) as auth_id , ap.agent_id as app_handle,ap.lock_waits as lock_waits, ap.lock_wait_time / 1000 as Total_Wait_S,(ap.lock_wait_time / ap.lock_waits) as Avg_Wait_ms from sysibmadm.snapappl_info ai, sysibmadm.snapappl ap where ai.agent_id = ap.agent_id and ap.lock_waits > 0"

APPL_NAME	AUTH_ID	APPL_HANDLE	LOCK_WAITS	TOTAL_WAIT_S	AVG_WAIT_MS
pmrepagent	INFOD	356	3	0	0
pmrepagent	INFOD	537	5	0	2
pmrepagent	INFOD	739	10	0	6
pmrepagent	INFOD	456	13	0	2

Considerations

- A slowness reported by the user could be related to lock

- Choose the best isolation level that fits your business/application requirement

- You can use locktimeout (db cfg) to identify if you have lock problem (return error to the application)

If you enjoyed and learned!!
vote Éric !! ☺
Thank you!

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