

VanillaCore Walkthrough

Part 6

Introduction to Databases

DataLab

CS, NTHU

Outline

- Lock-Based Concurrency Control
 - 2PL
 - S2PL
 - Conservative Locking
- Code Tracing
 - S2PL in VanillaDB

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Lock-Based Concurrency Control

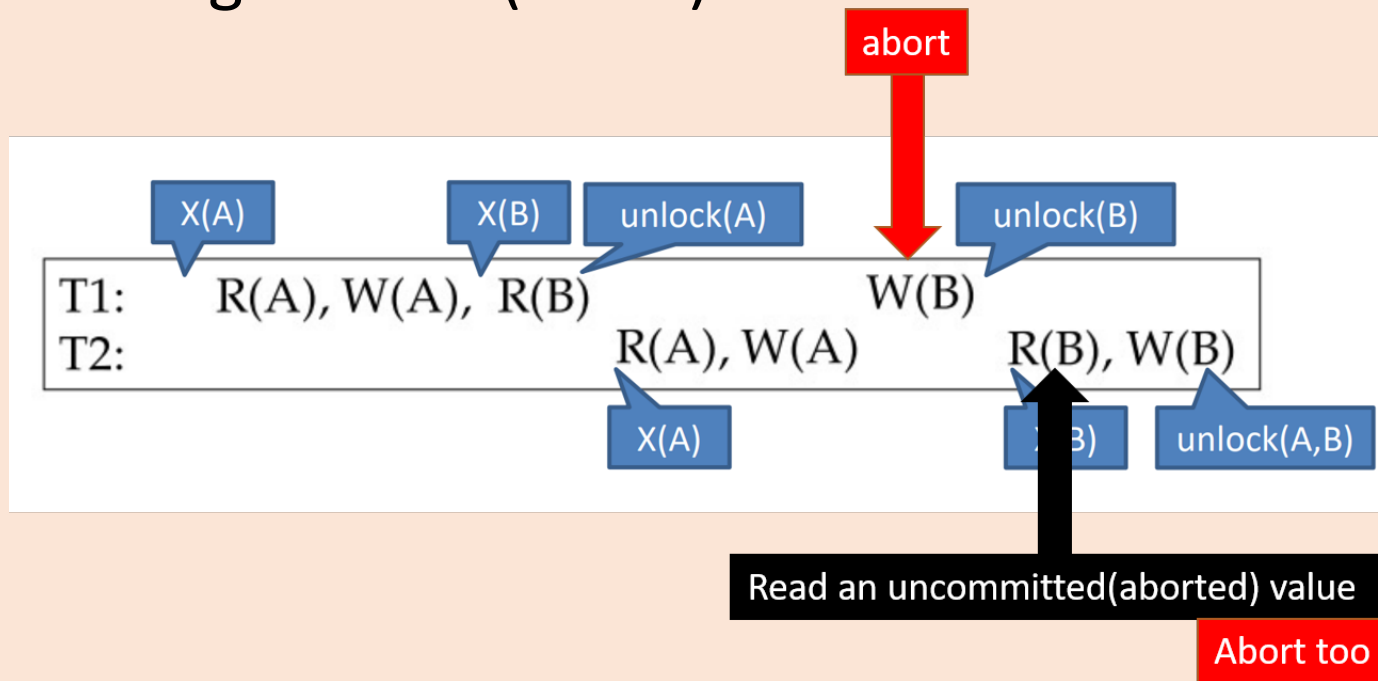
- For isolation and consistency, a DBMS should only allow **serializable, recoverable** schedules
 - No WR
 - No RW
 - No WW
- Locks are useful in this scenario

2 Phase Locking (2PL)

- 2 types of locks
 - Shared (S) lock
 - Exclusive (X) lock
- Phase 1: Growing Phase
 - Must obtain locks before read/write
- Phase 2: Shrinking Phase
 - Releases locks ✓
 - ~~• Acquires locks ✗~~

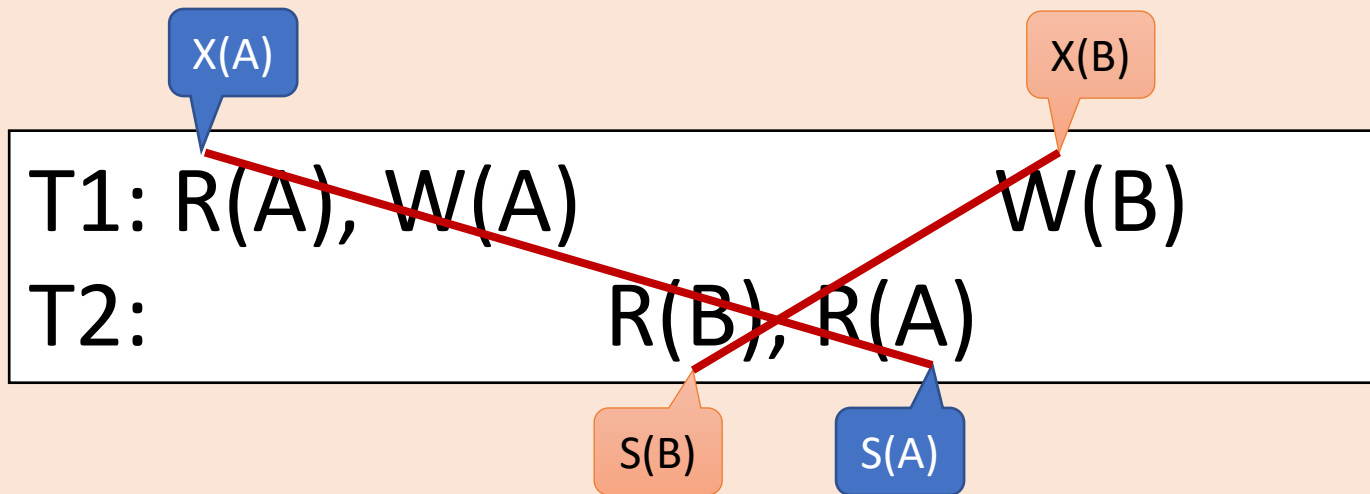
Problems of 2PL

- Cascading rollback(abort)



Problems of 2PL

- Deadlock



Let's fix cascading rollback

Strict 2PL

- Holds all locks until the tx commits

S2PL Example

2PL Cascading rollback



T1:	R(A), W(A) , R(B)	W(B)
T2:	R(A), R(A)	R(B), W(B)

S2PL

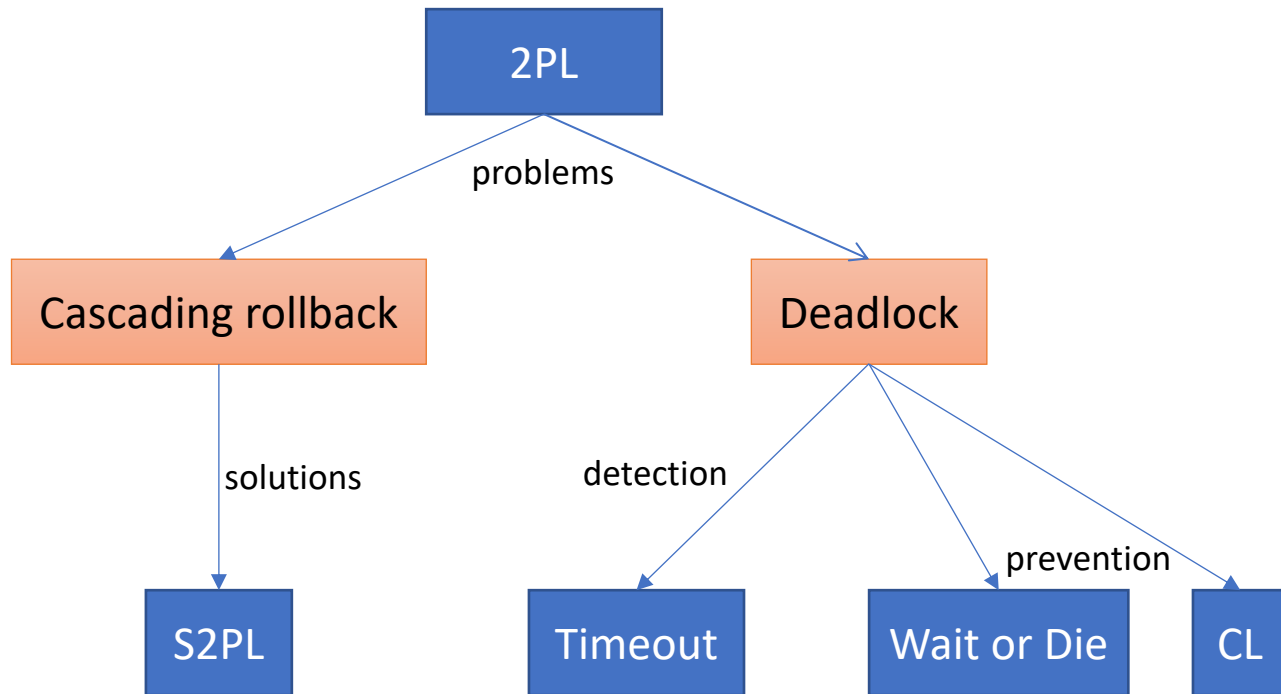
T1:	R(A), W(A) , R(B), W(B)	Release X(A), X(B)
T2:	Do NOT release X(A)	R(A), R(A), R(B), W(B)

Let's fix deadlock

Deadlock detection & prevention

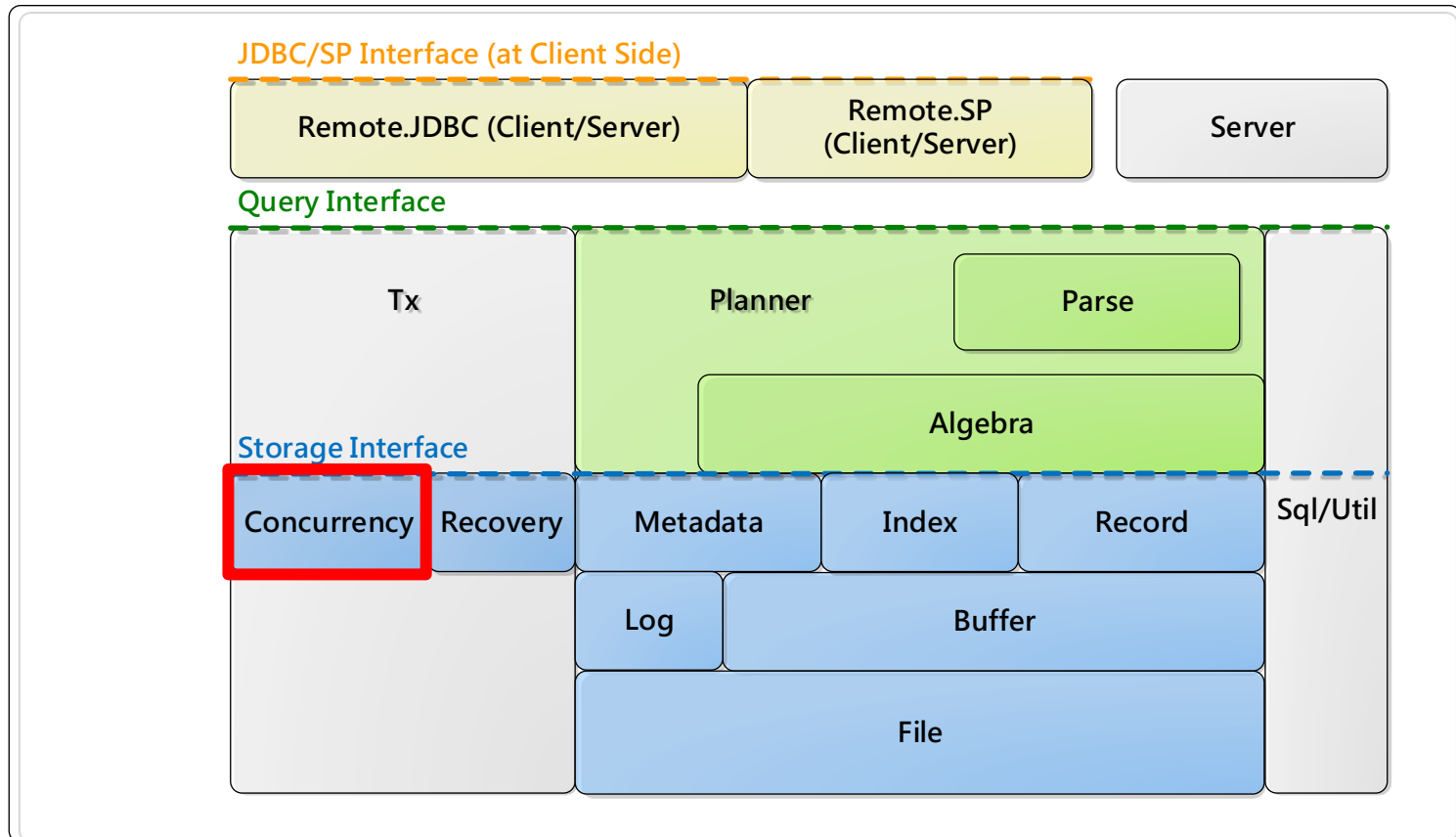
- Timeout (deadlock detection)
- Wait-Die (deadlock prevention)
 - Tx number as ages
 - Old man wait
 - Young men go die (abort)
- **Conservative locking** (deadlock prevention)
 - Locks all objects at once
 - However, we may not know which objects to lock
 - Stored procedure 
 - we've known the read/write set
 - Ad-hoc queries 

Summary of lock-based CC



Code Tracing

VanillaDB



Outline

- Lock-Based Concurrency Control
 - 2PL
 - S2PL
 - Conservative Locking
- Code Tracing
 - S2PL(**early lock release**) in VanillaDB

Package Structure



tx package

Concurrency package

implement

TransactionLifecycleListener

ConcurrencyMgr

has a

LockTable

extends

ReadCommittedConcurrencyMgr

RepeatableReadConcurrencyMgr

SerializableConcurrencyMgr

throw

LockAbortException

- org.vanilladb.core.storage.tx
 - Transaction.java
 - TransactionLifecycleListener.java
 - TransactionMgr.java

- org.vanilladb.core.storage.tx.concurrency
 - ConcurrencyMgr.java
 - LockAbortException.java
 - LockTable.java
 - ReadCommittedConcurrencyMgr.java
 - RepeatableReadConcurrencyMgr.java
 - SerializableConcurrencyMgr.java

TransactionLifecycleListener

```
16 package org.vanilladb.core.storage.tx;
17
18 public interface TransactionLifecycleListener {
19
20     void onTxCommit(Transaction tx);
21
22     void onTxRollback(Transaction tx);
23
24     void onTxEndStatement(Transaction tx);
25
26 }
27
```

Release all locks on tx commit

```
public class SerializableConcurrencyMgr extends ConcurrencyMgr {
    public SerializableConcurrencyMgr(long txNumber) {
        txNum = txNumber;
    }
    @Override
    public void onTxCommit(Transaction tx) {
        lockTbl.releaseAll(txNum, false);
    }
    @Override
    public void onTxRollback(Transaction tx) {
        lockTbl.releaseAll(txNum, false);
    }
}
```

Event-Driven Architecture

```
public Transaction(TransactionMgr txMgr, TransactionLifecycleListener concurMgr,
    TransactionLifecycleListener recoveryMgr, TransactionLifecycleListener bufferMgr, boolean readOnly,
    long txNum) {
    this.concurMgr = (ConcurrencyMgr) concurMgr;
    this.recoveryMgr = (RecoveryMgr) recoveryMgr;
    this.bufferMgr = (BufferMgr) bufferMgr;
    this.txNum = txNum;
    this.readOnly = readOnly;

    lifecycleListeners = new LinkedList<TransactionLifecycleListener>();
    addLifecycleListener(txMgr);
    addLifecycleListener(recoveryMgr);
    addLifecycleListener(concurMgr);
    addLifecycleListener(bufferMgr);
}

    public void commit() {
        for (TransactionLifecycleListener l : lifecycleListeners)
            l.onTxCommit(this);

        if (logger.isLoggable(Level.FINE))
            logger.fine("transaction " + txNum + " committed");
    }
```

How to use concurrencyMgr?

- RecordPage

```
private Constant getVal(int offset, Type type) {  
    if (!isTempTable())  
        tx.concurrencyMgr().readRecord(new RecordId(blk, currentSlot));  
    return currentBuff.getVal(offset, type);  
}
```

- SerializableConcurrencyMgr

```
public void readRecord(RecordId recId) {  
    lockTbl.isLock(recId.block().fileName(), txNum);  
    lockTbl.isLock(recId.block(), txNum);  
    lockTbl.sLock(recId, txNum);  
}
```

