Distributed Database

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Unit-I
Transaction

- Transaction is a collection of operations that form a single logical unit of work which is called transaction. For example transfer of money from one account to another is a transaction consisting of two updates, one to each account.

ACID Properties of Transaction

A-Atomicity

C-Consistency

I-Isolation

D-Durability

Atomicity

- In atomicity it is important that either all actions of a transaction be executed completely or in case of some failure, partial effects of a transaction be undone.
- Or we can say that either all operations of the transactions are reflected properly in the database or none are.

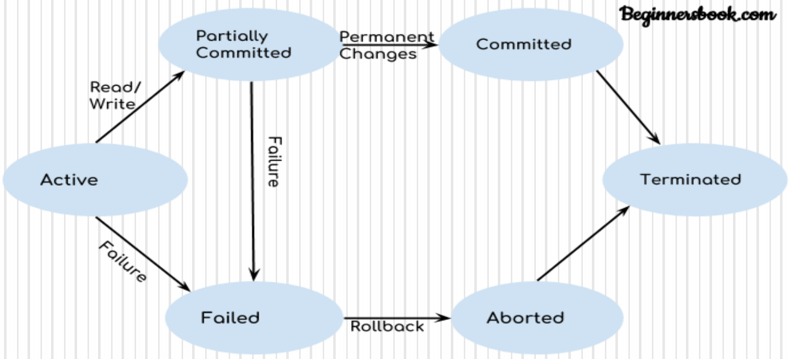
Consistency

- In consistency property if database was in a consistent state before the initiation of a transaction, then at the end of transactions the database will also be in a consistent state.

Isolation

- In Durability after a transaction completes successfully, the changes it has made to the database persist, even if there are system failure.

Transaction State



Schedules

- When several transactions are executing concurrently then the order of execution of various instructions are known as a schedule.

Types of Schedules

- Serial Schedule
- Non Serial Schedule
- Conflict Schedule
- View Schedule

Serial Schedule

- Two Schedules A and B are called serial schedule if the operations of each transactions are executed consequencelly without any interleaved operations from the other transactions.
- On this schedule transactions are performed in serial order T1 then T2 or T2 then T1.

Example
Schedule A

T1	T2
Read Item(X)	
X:X-N	
Write Item(X)	
Read Item(Y)	
Y:Y+N	
Write Item(Y)	
	Read Item(X)
	X:X+M
	Write Item(X)

Cont…
Schedule B

T2	T1
	Read Item(X)
	X:X+M
	Write Item(X)
Read Item(X)	
X:X-N	
Write Item(X)	
Read Item(Y)	
Y:Y+N	
Write Item(Y)	

Non Serial Schedule

- Schedule C is called non serial schedule if the operations of each transactions are executed non-consecutively with interleaved operations from the other transactions.

Schedule C

T1	T2
Read Item(X)	
X:X-N	
	Read Item(X)
	X:X+M
Write Item(X)	
Read Item(Y)	
	Write Item(X)
Y:Y+N	
Write Item(Y)	

Testing Of Serializability

- Precedence graph G=(V,E),V is the set of vertices which consist of all transactions participating in the schedule and E is the set of edges which consist of all edges Ti-Tj for which one of the three conditions holds.

Cont…

- Ti executes Write(Q) before Tj executes Read(Q)
- Ti executes Read(Q) before Tj executes Write(Q)
- Ti executes Write(Q) before Tj executes Write(Q)

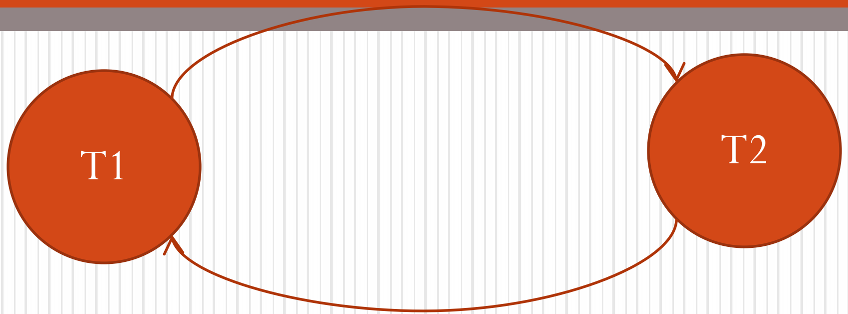
Cont…

- If P.G. contains cycle then it is not conflict serializable.
- If P.G. contains no cycle then it is called conflict serializable.

Examples

T1	T2
Read(A)	
	Read(A)
	Write(A)
	Read(B)
Write(A)	
Read(B)	
Write(B)	
	Write(B)

Cont…



P.G contains cycle then it is not conflict serializable

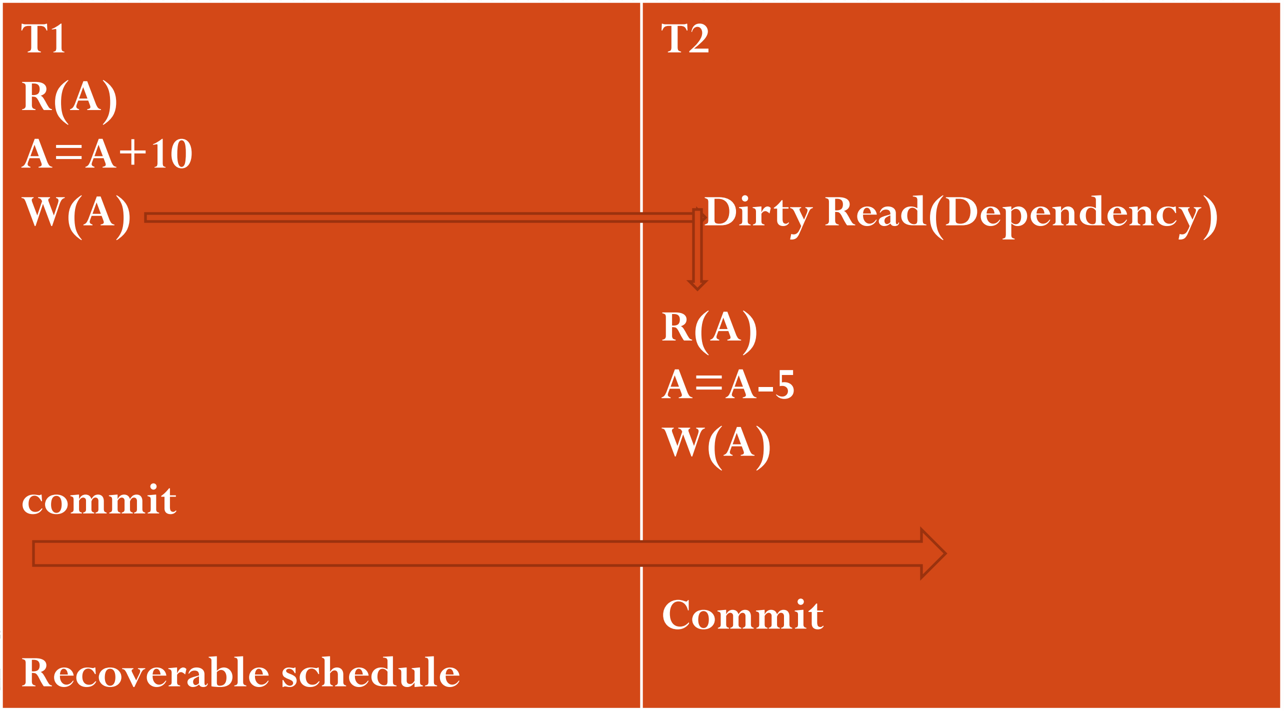
Recoverable and Cascadless Schedule

Recoverable Schedule: A recoverable schedule is one where , for each pair of transactions T1 and T2 such that if T2 reads data item by T1 then the commit operation of T1 appear before the commit T2.

Examples

T1	T2
R(A) db A=10,A=15	
A=A+10	
W(A) lb A=20	
	R(A) A=20
	A=A-5 A=15
Roll back	W(A) A=15
	Commit
Failure	Commited Transaction can
Commit	not roll back
Irrecoverable schedule	

Cont…



T1

R(A)

A=A+10

W(A)

Dirty Read(Dependency)

T2

R(A)

A=A-5

W(A)

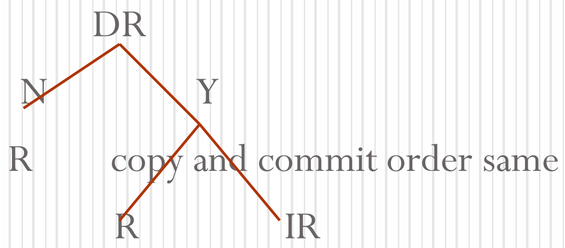
commit

Commit

Recoverable schedule

Cont…

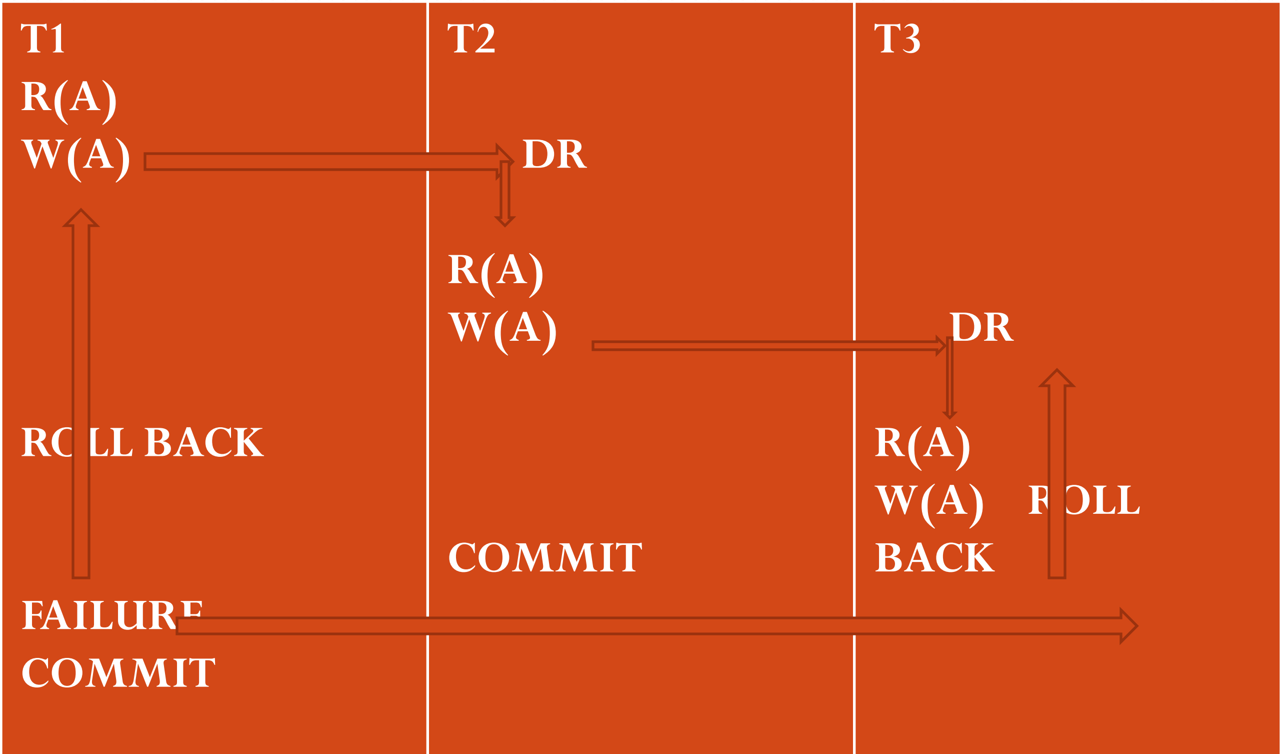
- If there is no dirty read then it is always recoverable schedule.
- If order of dirty read and order of commit is same then it is also recoverable schedule.



Cascadeless Schedule

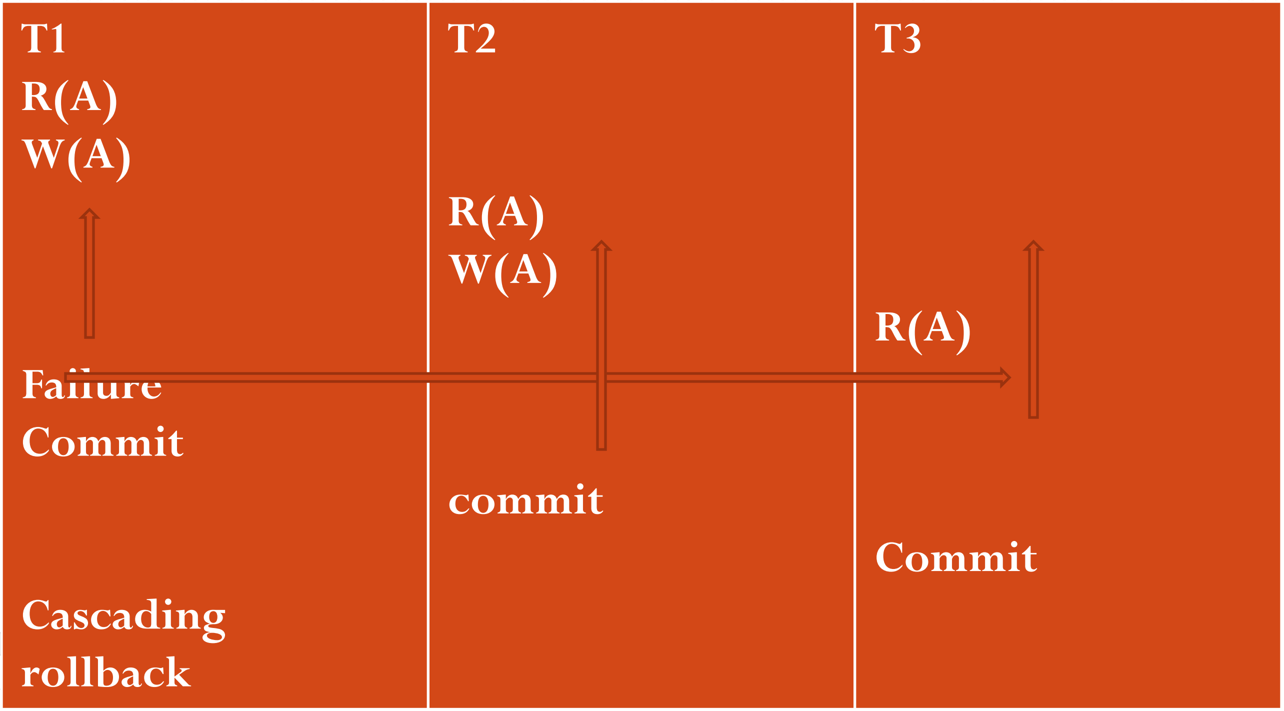
- If in a schedule ,a transaction is not allowed to read a data item until the last transaction that has written it is committed or aborted, then such a schedule is called as a cascade less schedule.

Example



T1	T2	T3
R(A)		
W(A)	DR	
	R(A)	
	W(A)	DR
ROLL BACK		R(A)
		W(A) ROLL
	COMMIT	BACK
FAILURE		
COMMIT		

Cont…



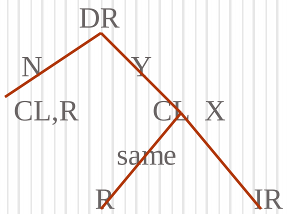
T1	T2	T3
R(A)		
W(A)		
	R(A)	
	W(A)	
		R(A)
Failure		
Commit		
	commit	
		Commit
Cascading rollback		

Cont…

T1	T2	T3
R(A)		
W(A)		
Commit		
	R(A)	
	W(A)	
	commit	
		R(A)
		W(A)
		commit
Cascade less schedule		

Cont..

- If there is no dirty read then schedule is cascade less schedule.



DR

N Y

CL,R CL X

same

R IR