EXTENDED TRANSACTION MODELS

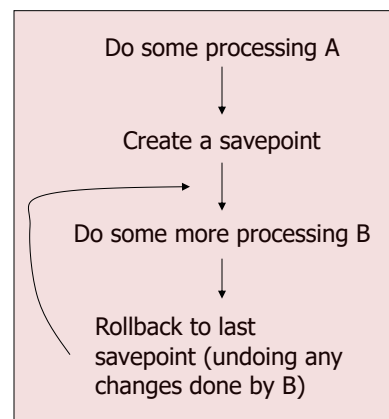# Savepoints

Transaction Execution

- Idea: allow the state of a transaction to be rolled back to a certain point in execution
- Not necessary to roll back the entire transaction

Do some processing A

↓

Create a savepoint

↓

Do some more processing B

↓

Rollback to last savepoint (undoing any changes done by B)

Nested Transactions (1)

- Idea: Allow transactions to be nested inside other transactions
- Child transaction's changes not visible to parent, siblings until commit
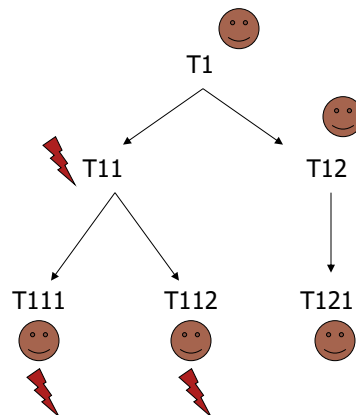- Failure of a child transaction does not imply failure of the parent

T1

T11   T12

T111   T112   T121
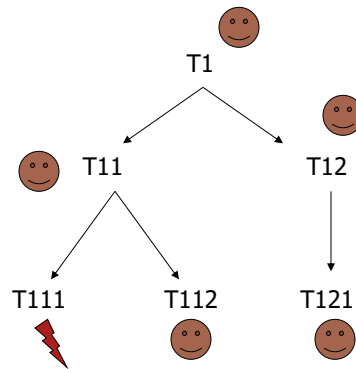
Nested Transactions (2)

- Abort of a transaction forces all of its descendants to abort

- Commit is *tentative*
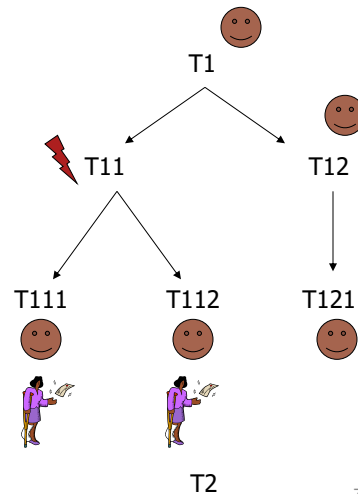
- *Lock inheritance*

- *Lock anti-inheritance*

T1

T11   T12

T111   T112   T121

Multi-Level Transactions (1)

- Allows a transaction's changes to be made visible to everyone when it commits
  - Nested: visible to parent
- Compensating transaction
 - Each transaction has its own specific compensating transaction

T1

T11

T12

T111

T112

T121

T2

Multi-Level Transactions (2)

- Motivation: sharing of low-level resources in layered software systems
- Ex: insert records into database:
  - Find page on disk with free space
  - Insert records
  - Update indexes
  - Commit
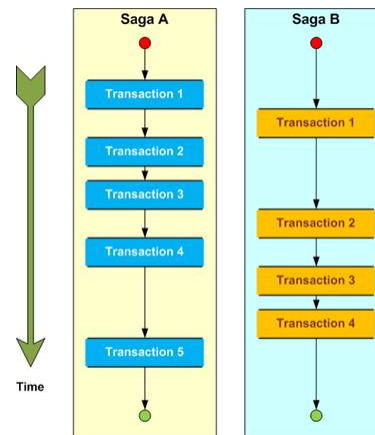- Nested would require page to be locked to further allocation until commit

T1

T11

T12

T111

T112

T121

T2
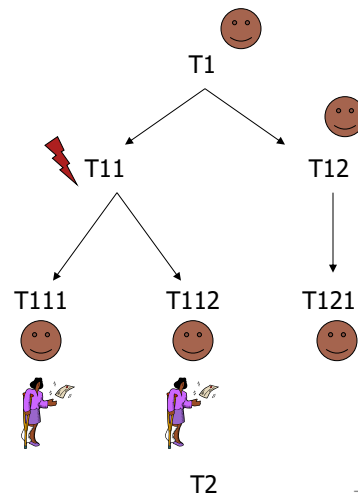
Sagas (1)

- Transactions are incompatible with long-lived applications
  - Locks must be held to ensure ACID properties
- Sagas relax ACID properties
- A saga is a sequence of transactions
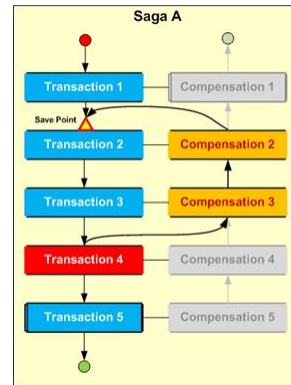 - "long-lived transaction"

Sagas (2)

- Each transaction T_i has a corresponding compensating transaction CT_i
- If T_k aborts in a transaction, then the compensations

$$CT_{k-1},\ldots,CT_2,CT_1$$

  are executed, in that order
  - Explicit rollback
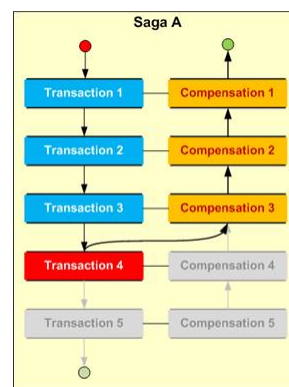
Sagas (3)

- Sagas also support forward recovery using savepoints
- If state is persisted between transactions, then compensating transactions roll back to that savepoint
- Saga continues from that point forward

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