Correctness Criteria for Concurrent Execution of Closed Nested Transactions

Sathya Peri, IIT Patna, India, sathya@mun.ca
K.Vidyasankar, Memorial University, St John’s, Canada, vidya@mun.ca
Accepted at ICDCN 2011
Nesting of Transactions

- A transaction is nested:
  - if it invokes another transaction
- Composing of transaction can be achieved through nesting
  - Composition: basis of modular programming
- Different types of nesting: Closed, Open and Flat
Our Focus: Closed Nesting

- We focus only on nested transactions with read and write operations
- Let P be a parent transaction which invokes a sub-transaction S
- In closed nesting, when the sub-transaction S commits
  - its effects are not visible to other ‘external’ transactions immediately, i.e., it is local
  - they become visible when its parent transaction P commits
- Abort of the sub-transaction S has no affect on P
Requirements of Correctness for STMs

- All transactions including aborted transactions read consistent values
  - Different from traditional databases
  - Referred to as all-reads-consistency
- Aborted transactions should not affect the transactions that follow it
  - Referred to as non-interference
- These seemingly simple requirements are difficult to achieve in the context of nested STMs
Correctness Criteria for Concurrent Execution of Nested Transactions

- Several implementations for nested transactions in past few years
- Drawback of existing solutions for nested transactions:
  - No precise correctness criteria satisfying both all-reads-consistency & non-interference properties;
  - And can be efficiently verified
Our contribution

- Closed Nested Opacity: Extending opacity to closed nested transactions
  - Looks for single equivalent serial schedule
  - Satisfies all-reads-consistency

- Abort Shielded Consistency:
  - Aborted transactions do not affect transactions following it
  - Looks for a set of equivalent serial sub-schedules
  - Satisfies non-interference as well

- Notion of conflicts for optimistic executions
  - Develop conflict preserving subclasses for these criteria that can be verified in