Replicated Concurrency Control and Recovery- Design Document

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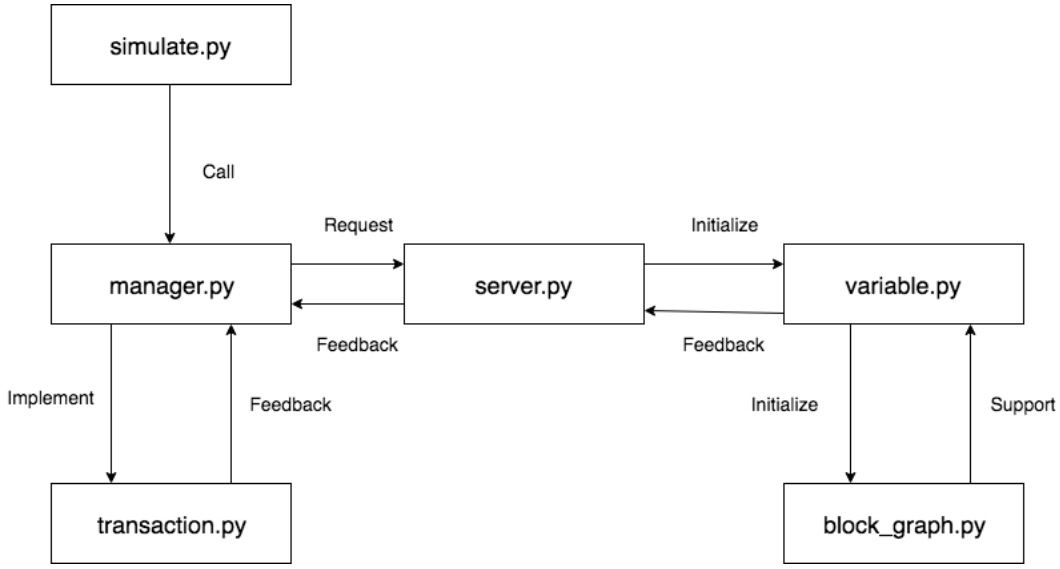
Execution

1. Requirements
   Python 3.6.x
2. Command for Read from stdin and print to stdout
   $ python3 simulate.py

Flow Chart



Components

1. simulate.py
   - This is an interface provided to user to add instructions to the transaction manager(manager.py).

2. blocking_graph.py
   - The node of the blocking graph to detect deadlock.

BlockingGraphElement
● int id: the id of this node (describes which transaction add this node). ● set prev: the edge from this node.
➢ void __init__: INT -> None

3. variable.py
   - This class describes the variable in each site(server).

Variable
● int id : INT : the id of this var ● int value: the value of this var, the init value is 10 times id ● dict locks: the lock table of this var, described as a hashmap(dict) in Python ● bool canRead: the flag implies whether this var is readable
➢ void __init__ : - Called by a transaction, to add a lock to this var - Integer -> None ➢ void addWriteLock : - Called by Variable itself, return ids of all transaction who hold a lock of this variable. - None -> None ➢ set getPrioLock: - Called by Variable itself, return ids of all transaction who hold a lock of this variable. - None -> Set ➢ void setValue: - Update the value of this variable - Integer -> None ➢ void releaseLock: - Release all locks acquired by a particular transaction - Integer -> None

4. server.py
   - This class describes the server(database).

Site
● int id: the id of this site ● dict vars: all vars hold by this site

● bool online: true if this site is now up.
➢ void __init__ ➢ bool exist: - Check whether this site contains a var. - Integer -> Boolean ➢ String dump: - Return variable information of this site. - None -> String ➢ Set fail: - Set this site down. Release all the locks and return all transactions' id who hold a lock on this site. - None -> Set ➢ bool recover: - Recover this site. - List<Integer> -> Boolean

5. transaction.py
   - This class describes the transaction. A transaction is first initiated by user from stdin, and received instructions from transaction managerself.

Transaction
● int id: the id of this transaction ● int timeStamp: the timeStamp when this transaction is initiated. A transaction is younger than anotherif and only if self.timeStamp > other.timeStamp ● bool readOnly: describe whether this transaction is read-only ● bool abort: ture if this transaction has been aborted ● list<int , int , int> changes: all changes to the sites made by this transaction ● list<int , int> log: all results read by this transaction ● String reason: store the reason why this transaction is aborted
➢ void __init__ ➢ void makeVarsCopy - Called by transaction manager when this transaction is read-onlyself to make a multi-version image of all readable vars in all online sites. - List<integer> -> None ➢ Void acquireWriteLock

- Acquire a write lock from a var - List<integer> , integer -> None ➢ bool canWrite - To check whether this transaction can write to a particular var. - List<integer> , integer -> Boolean ➢ Bool canRead - To check whether this transaction can read to a particular var. - List<integer> , integer -> Boolean ➢ void write - Read a readable vars in any online site - List<integer> , integer , integer -> None ➢ void write - Read a readable vars in any online site - List<integer> , integer -> None ➢ void acquireReadLock - Acquire a read lock from a var - List<integer> , integer -> None ➢ String commit - Commit all changes to target site. - Return all read results to the transaction manager. - Release all locks of this transaction. - List<integer> -> String ➢ void setAbort - Set this transaction aborted. - List<integer> , deque<Transaction> , String -> None

6. manager.py
   - Transaction manager, which control the whole process.

Manager
● List<integer> sites: store information of all sites ● dict curTrans: all transactions initiated by user from stdin. ● deque: describes the wait-list for all instructions.
➢ void __init__ ➢ String dumpAll - Called by user, return all info of all sites and vars.

- None -> String

➢ void run
- Check whether the instruction in wait list hold all the lock required by the system, if so, run it.
- None -> None

➢ void detDeadlock
- Deadlock detection function. Use the same cycle detection algorithm with topoSort. If a deadlock found, return all possible critical nodes.
- None -> None

➢ String formalize
- Formalize the input from stdin.
- String -> String

➢ String dumpBySite
- Return the value of the var from all sites.
- Integer -> Integer

➢ void parse
- Parse the inputdate from user.
- String , Integer -> None