Weekly Research Progress Report

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Problems discussed in last week's report

1. **Reading materials**

   a. Summarize the new policies
   b. Summarize the test-cases produced by Redis
   c. Replicate the test-cases introduced by Redis

2. **Integration of Jepsen I/O with RamCloud**

   a. Configure the installation of five instances
   b. Implement the client-side of RamCloud

Reading Materials

Generalized Isolation Level Definitions   ICDE, 2000

Previous work
The isolation levels were named READ UNCOMMITTED, READ COMMITTED, REPEATABLE READ, and SERIALIZABLE.

Dirty Write
T2 cannot write an object x if an uncommitted transaction T1 has already modified x.

T1	W[X]		C or A							
T2		W[X]								

Dirty Read
T1 to acquire a long writelock and T2 to acquire (at least) a short-term read-lock, and proscribing P2 requires the use of long read and write locks

T1	W[X]		C or A							
T2		R[X]								

Fuzzy Read

T1	R[X]		C or A							
T2		W[X]								

Restrictiveness of Preventative Approach

T1	R(X,5)	W(X,1)				R(Y,5)	W(Y,9)	C		
T2			R(X,1)	R(Y,5)	C					

Optimistic and multi-version mechanisms disallow non-serializable histories

T1	R(X,5)	W(X,1)	R(Y,5)	W(Y,9)			C			
T2					R(X,1)	R(Y,9)		C		

P1 disallows it.

T1	W(z1)	W(x1)	W(y1)		C						
T2						R(x1)	W(y2)	C			
T3				W(x3)					R(y2)	W(z3)	C

- T1 ---(ww)---> T2
- T1 ---(wr)---> T2
- T1 ---(ww)---> T3

New Generalized Isolation Specification
- **G0: Write Cycles**
    - x1 << x2, y2 << y1 (version depends on the actual operation)

T1	W(x1)				W(y1)	c				
T2		W(x2)	W(y2)	c						

- **G1a: Aborted Read**
    - if history contains an aborted transaction T1 and a committed transaction T2 such that T2 has read some object (maybe via a predicate) modified by T1

T1	W(x1)		A						
T2		R(x1)	C						

- **G1b: Intermediate Reads**
    - If it contains a committed transaction T2 that has read a version of object written by transaction T1 that was not T1's final modification of x.

T1	W(x1)		W(x1,1)		C				
T2		R(x1)		C					

- **G1c: Circular Information Flow**
    - If DSG(H) contains a directed cycle consisting entirely of dependency edges

- **G2: Anti-dependency Cycles**
    - if DSG(H) contains a directed cycle with one or more anti-dependency edges.

Level	Phenomena disallowed	Informal Description (T_i can commit only if:)
PL-1	G0	T_i's writes are completely isolated from the writes of other transactions
PL-2	G1	T_i has only read the updates of transactions that have committed by the time T_i commits (along with PL-1 guarantees)
PL-2.99	G1, G2-item	T_i is completely isolated from other transactions with respect to data items and has PL-2 guarantees for predicate-based reads
PL-3	G1, G2	T_i is completely isolated from other transactions, i.e., all operations of T_i are before or after all operations of any other transaction

Bac