Causal Memory*

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Abstract

We define and implement one member of a family of *causal memories* that we have developed. Causal memories are *weakly consistent* and admit more executions, hence allowing more concurrency, than either atomic or sequentially consistent memories. Informally, causal memories require the apparent order of writes to respect a shared memory analog of Lamport's potential causality. In this paper we:

- motivate weakly consistent memories, particularly their use as distributed shared memories;
- precisely and formally characterize one causal memory;
- demonstrate that our causal memory can be effectively programmed;
- present a simple implementation using reliable, "FIFO" message passing, and prove it correct;
- present a fault-tolerant causal memory implementation that tolerates lossy channels and stopping failures and prove it correct.

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