DISTRIBUTED SYSTEMS
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REPLICATION AND CONSISTENCY
System Model

- System consists of clients and replica managers
  - Assume all follow the specified protocols.
- The set of replica managers is the replicated shared object service (RSOS).
- Each replica manager
  - Maintains replica of every object
  - Performs object operations (reads and writes) atomically.
- Asynchronous messaging (???)
- Crash failures (replicas)
Many Definitions of consistency

- Strict Consistency
- Linearizability (Lamport)
- Sequential Consistency (Lamport)
- Causal Consistency
- FIFO Consistency
- Weak Consistency
- Release Consistency
- Entry Consistency
- Eventual Consistency
Definition of Linearizability

• An RSOS is **linearizable** if for any execution, there is some interleaving of the series of operations executed by the clients such that:
  1. The interleaved sequence is equivalent to a correct execution on a single copy of the objects. AND
  2. The order of the operations in the interleaving is consistent with the physical times at which the operations actually occurred.
Sequential Consistency

- An RSOS is **sequentially consistent** if for any execution, there is some interleaving of the series of operations executed by the clients such that:
  1. The interleaved sequence is equivalent to a correct execution on a single copy of the objects. AND
  2. The order of the operations in the interleaving is consistent with the order in which each client executed them.