

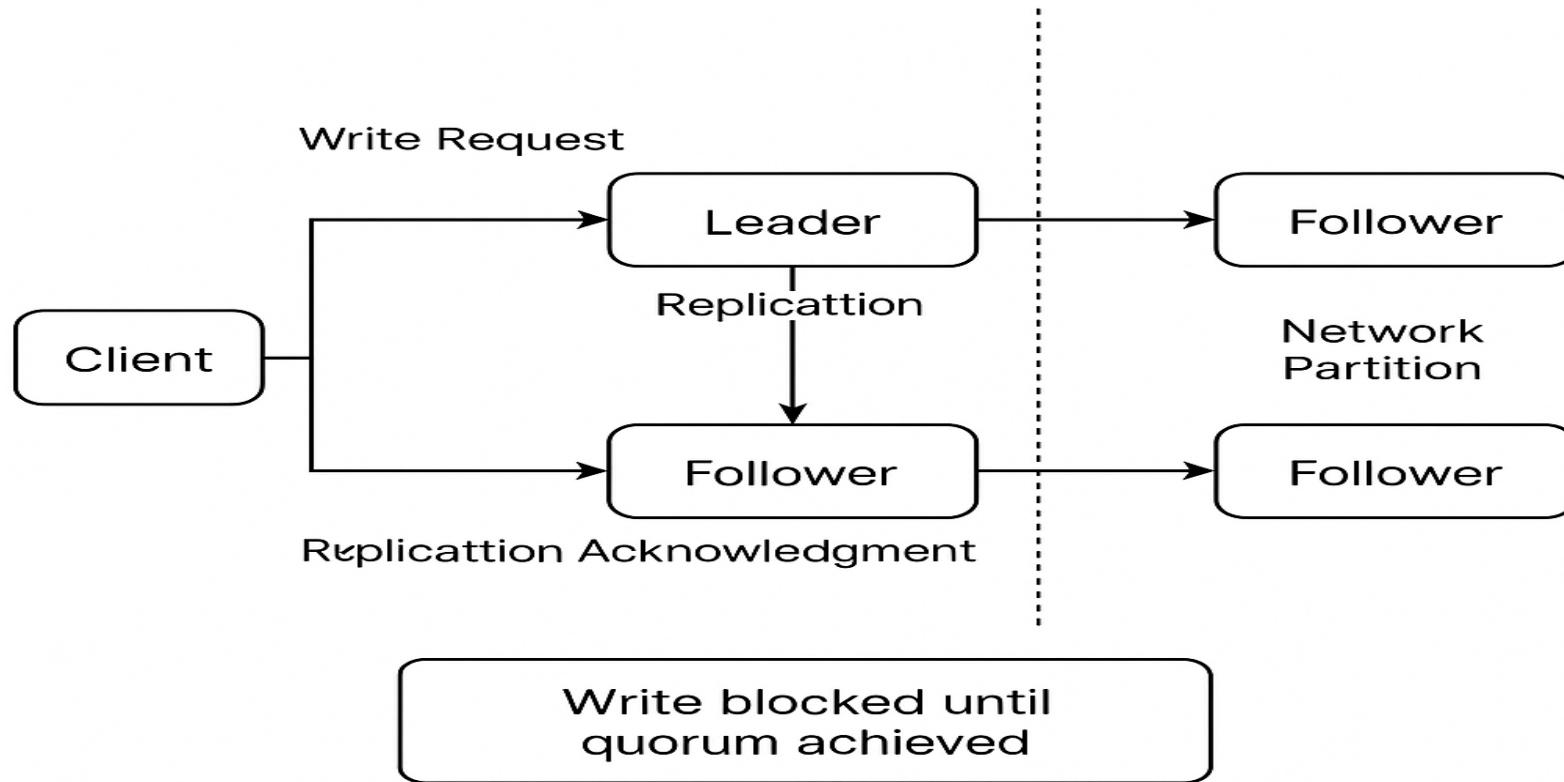
CAP Theorem Deep Dive: Balancing Consistency and Availability

Corrected architecture diagrams for CP (Consistency-First) and AP (Availability-First) systems.

Recap: Under a network partition, systems must choose to favor **Consistency (CP)** or **Availability (AP)**. The diagrams below depict the correct client flow and replication semantics for each choice.

CP (Consistency-First) — Leader + Quorum Writes

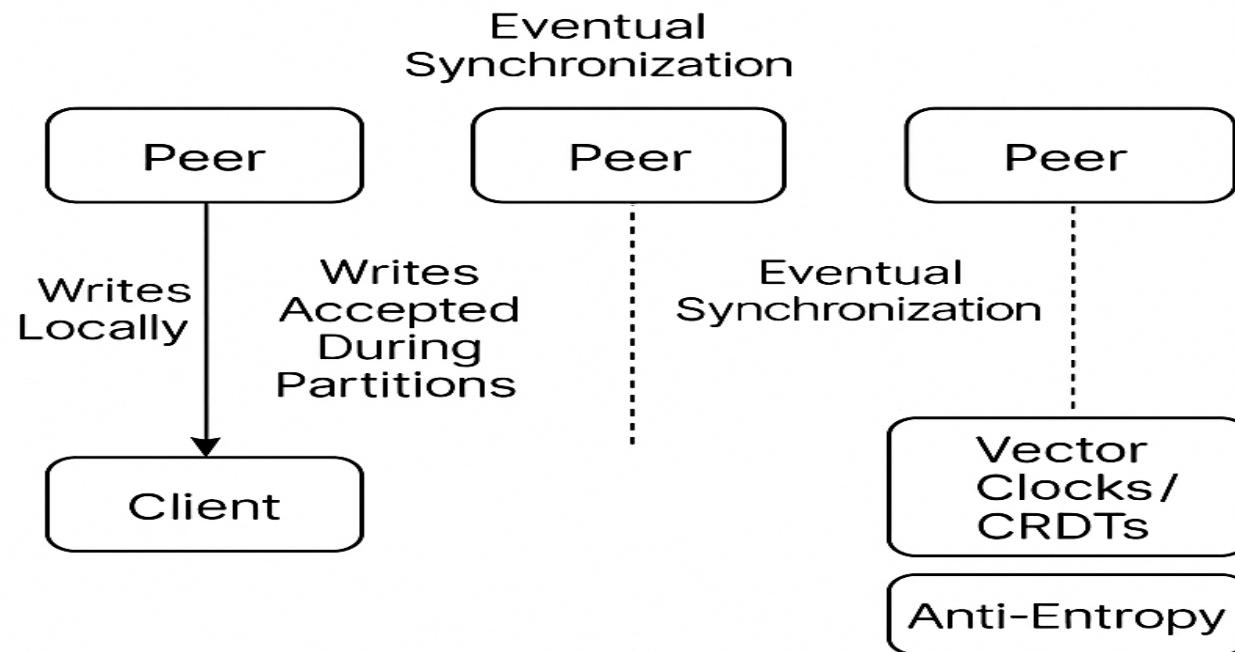
Consistency-First (CP) System Architecture



Writes are sent to a **Leader**. The leader replicates to followers and waits for a **quorum acknowledgement** before committing. During a partition, if quorum cannot be reached, the leader **rejects/blocks writes** to preserve correctness.

AP (Availability-First) — Multi-Peer, Eventual Consistency

Availability-First (AP) System Architecture



Peers accept **local reads/writes** even during a partition. Conflicts are resolved later via **vector clocks/CRDTs** and **anti-entropy** sync, leading to **eventual consistency** once connectivity is restored.

