Tradeoffs in System Design

Consistency vs Availability (CAP Theorem)

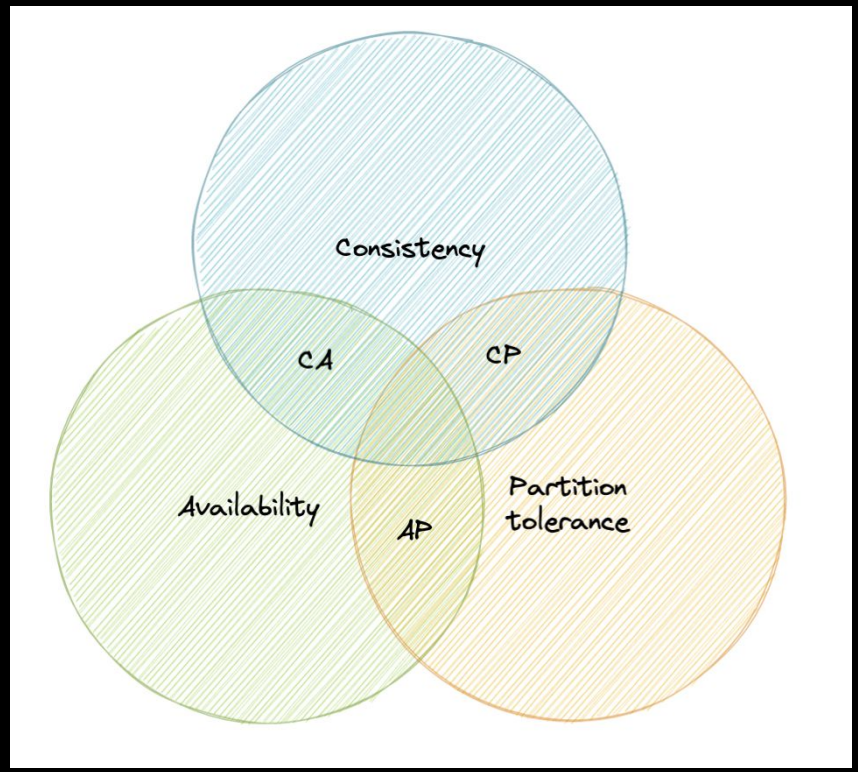

image source:
https://github.com/karanpratapsingh/system-design?tab=readme-ov-file#cap-theorem

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SQL vs noSQL Databases

SQL databases	noSQL databases
consistency	availability
predefined and strict schema	dynamic schema
traditionally scaled vertically	scale well horizontally

Synchronous vs Asynchronous Communication

Synchronous communication	Asynchronous communication
system waits for the response	system continues working and allows tasks to run in the background
requires both parties to be present simultaneously	can happen at different times

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Latency vs Throughput

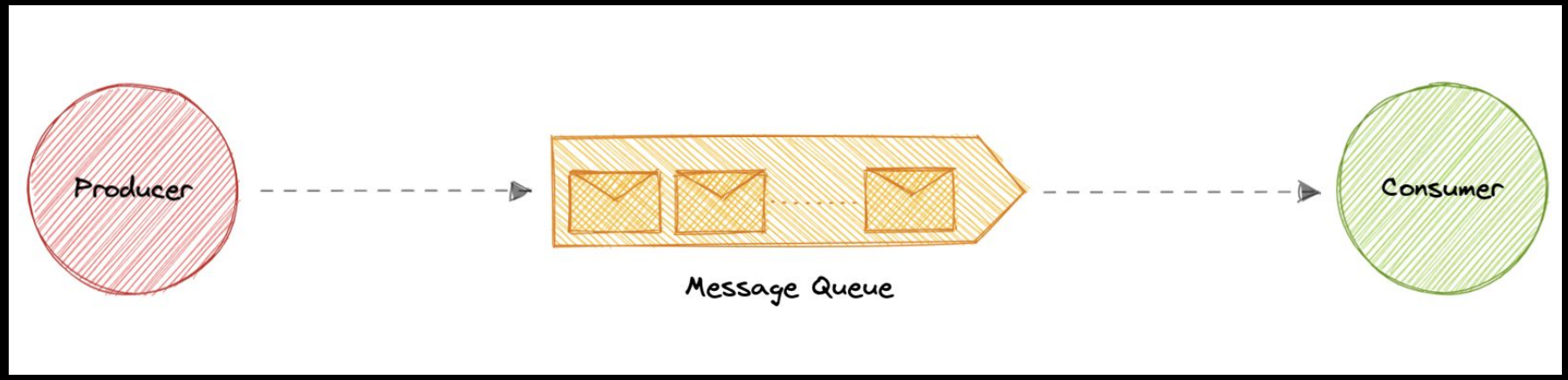

image source: https://github.com/karanpratapsingh/system-design?tab=readme-ov-file#message-queues

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Strong vs Eventual Consistency

Strong consistency	Eventual consistency
guarantees that all reads reflect the most recent write	ensures that all replicas converge to the same state eventually
higher latency due to synchronous synchronization	lower latency due to asynchronous synchronization

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Batch vs Stream Processing

Batch processing	Stream processing
data is processed gradually in batches	data is processed continuously in a stream
high latency	low latency

Monolithic vs Microservices Architecture

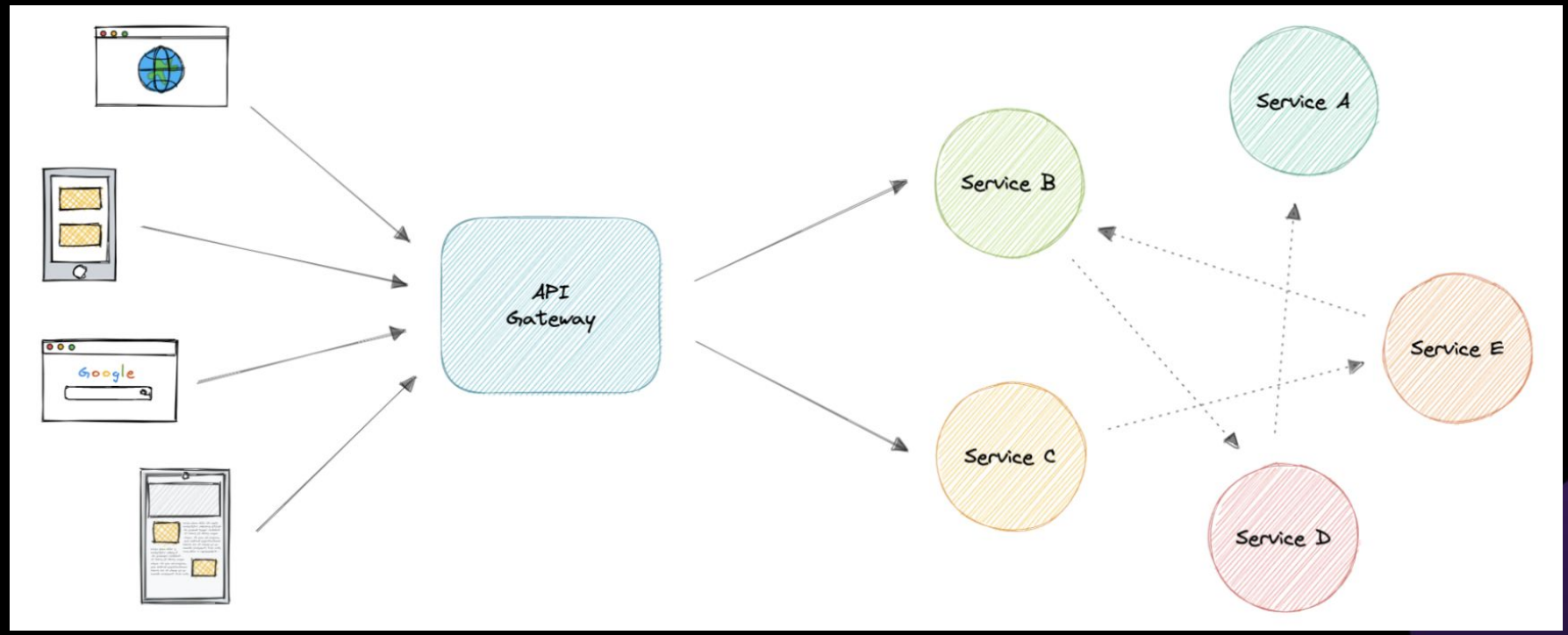

image source: https://github.com/karanpratapsingh/system-design?tab=readme-ov-file#api-gateway

Performance vs Scalability

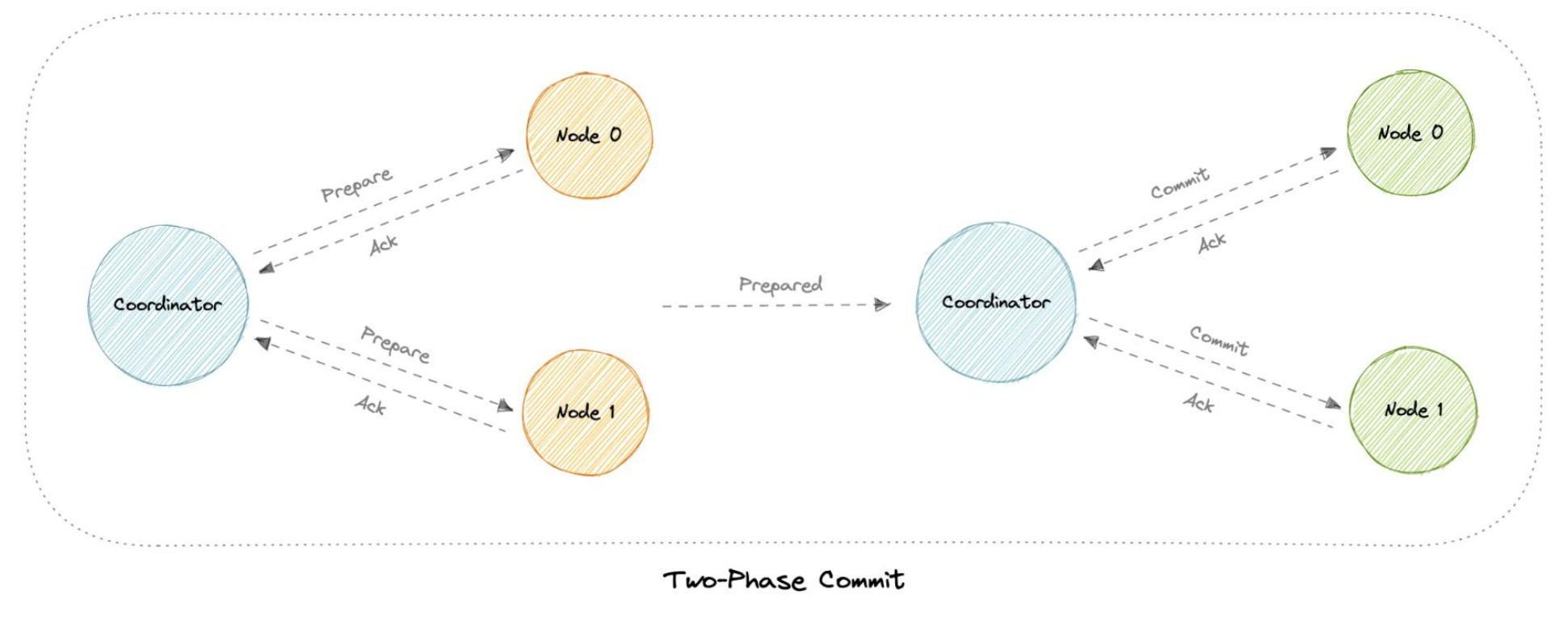

image source: https://github.com/karanpratapsingh/system-design?tab=readme-ov-file#two-phase-commit

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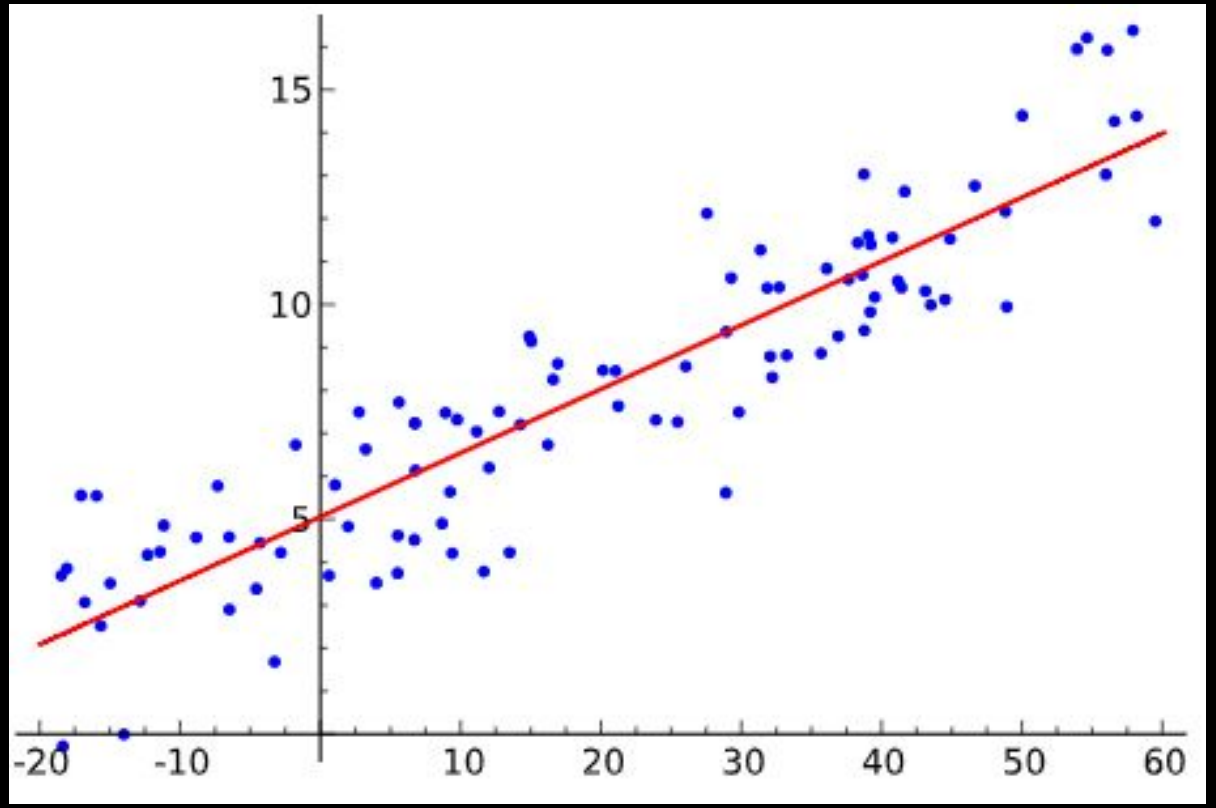
Accuracy vs Performance



Durability vs Performance

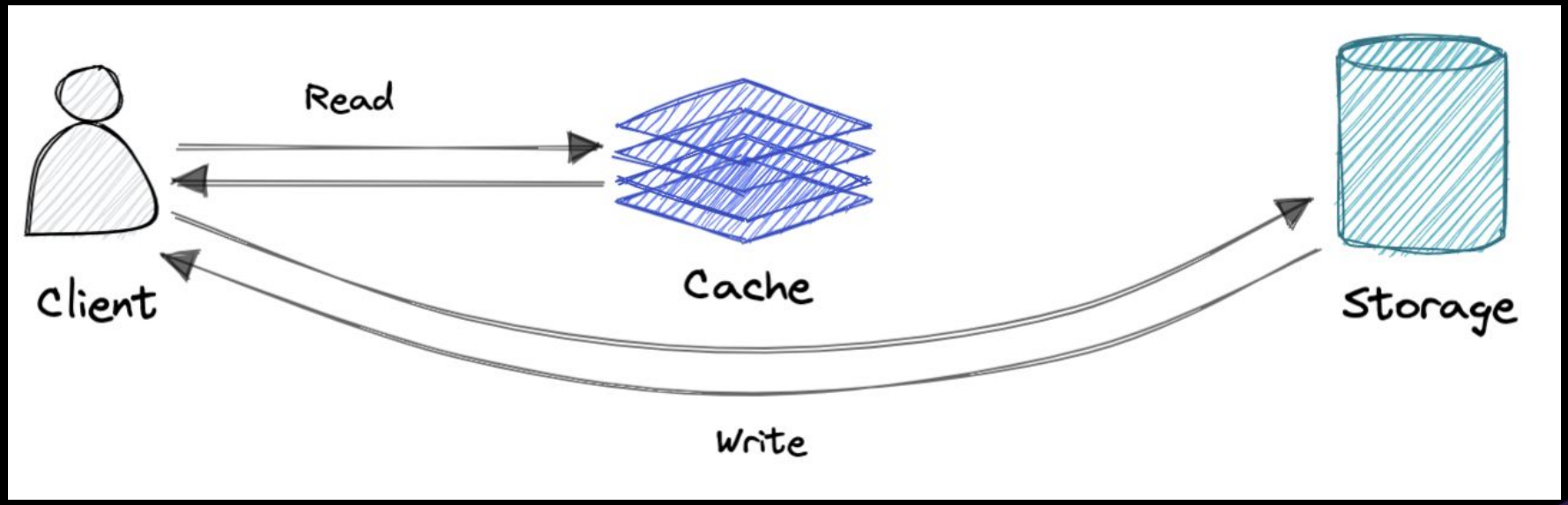


image source: https://github.com/karanpratapsingh/system-design?tab=readme-ov-file#write-around-cache