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Comparison b/n 2 different approaches to addressing the CAP theorem trade offs in distributed systems.

→ Eventual consistency : It prioritizes availability & partition tolerance over immediate consistency. It allows for divergent replicas to exist temporarily but ensures that all replicas eventually converge to consistent state
It is often used in systems where immediate consistency is not critical like social media feeds / recommendatn systems.

→ Strong consistency with partitioning : It focusses on maintaining consistency even in the presence of network partitions. It sacrifices availability under certain conditions to ensure that all nodes see the same data at the same time
Techniques like quorum based systems or distributed transactions are employed to achieve this level of consistency
It suits applications where data integrity & consistency are paramount.

Strategies or approaches to mitigate the limitations imposed by the CAP theorem in distributed systems.

→ Adoption of hybrid consistency model
These models combine elements of both eventual consistency and strong consistency to tailor consistency guarantees based on the specific requirements of different parts of the system

→ Eventual consistency : Instead of enforcing immediate consistency across all node, systems can

adopt eventual consistency
It allows temporary inconsistencies but guarantee that all replicas will converge to a consistent state over time

3) Impact of the CAP theorem on the design and implementatn of distributed systems.
The CAP thm significantly influences design & implementatn of distributed systems by necessitating trade offs b/n consistency, availability and partition tolerance
Architects must carefully consider the requirements of their applications & the constraints of their environment to design systems that appropriately balance these trade offs.
Additionally, the CAP theorem prompts the adoption of specific techniques & technologies such as eventual consistency or quorum based system, to achieve desired system behaviour while operating in distributed environments.

4) Explanatn of trade-offs described by CAP theorem and why its impossible for distributed data store to simultaneously guarantee all three properties

It states that in distributed system, its impossible to simultaneously guarantee all 3 properties of consistency, availability and partition tolerance.
Ensuring strong consistency (where all nodes see the same data at the same time)
and high availability (where the system remains operational despite failures) in the presence of network partitions requires synchronous communicatn

among nodes which introduces latency & increases the likelihood of failures
Partition tolerance necessitates allowing different parts of the system to operate independenty during network partitions, which can lead to inconsistences b/n nodes.
Therefore a trade off must be made b/n these properties based on specific requirement and priorities of the applicatn

5) Differences b/n CAP theorem and ACID properties

CAP theorem
Focusses on the trade offs b/n consistency, availability & partition tolerance in distributed system.
It highlights that its impossible for a distributed data store to simultaneously guarantee all 3 properties in the presence of network partitions.
ACID properties
Refers to set of properties that guarantee reliability & integrity of transactn in database system
ACID stands for atomicity, consistency, isolatn and durability
It deals with traditional centralized database system
ACID emphasize strong consistency & transactional integrity, CAP thm addresses the challenges specific to distributed environments where achieving strong consistency high availability and partition tolerance simultaneously is not feasible