Module 9–10 Summary: ACID Transactions, Recovery, NoSQL, and Vector RAG

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1. ACID Properties, 2PL, and ARIES Recovery

Transactions guarantee Atomicity, Consistency, Isolation, and Durability. Strict Two-Phase Locking (2PL) holds all exclusive locks until commit, preventing dirty reads and cascading aborts; conflict serializability is checked via acyclicity of the precedence graph. Write-Ahead Logging (WAL) writes log records before dirty pages flush, enabling Undo/Redo recovery.

2. Modern NoSQL and Vector Retrieval Systems

Document stores, key-value stores, and wide-column engines trade strict single-node joins for horizontal sharding. Vector databases index dense embeddings (HNSW, IVF-PQ) to power Retrieval-Augmented Generation (RAG) pipelines via approximate nearest-neighbor cosine search.