ABSTRACT

Comparative Analysis of Relational and Graph Models in a Multi-Model Cloud Database using Money Laundering Typologies Benchmark

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Many analytical workloads involve complex relationships that require multi-level query traversal, one case is money laundering. In a multi-model database environment, choosing the appropriate data model is challenging because the same workload can be implemented using either relational or graph models, yet their performance can differ significantly as query complexity and data volume increase.

For that reason this study conducts a performance benchmark of relational and graph models in Google Cloud Spanner using a synthetic Anti-Money Laundering (AML) dataset and five typology-driven query scenarios (Q1–Q5), ranging from simple interactions to deep multi-hop traversals. The benchmarks are executed across four incremental data ingestion phases (P1–P4) to evaluate query elapsed time and Central Processing Unit (CPU) utilization under increasing data volume and traversal depth.

The results show that performance differences between the two models remain around 5–20% for simple direct queries, showing similar performance between the two models. However, for complex AML typologies, the graph model scales more effectively, with around 50% lower elapsed time and up to 70% lower CPU time as data volume and query depth increase. Making it suitable for queries involving complex relationships compared to relational models.

Keywords: Anti-Money Laundering (AML), Multi-Model Database, Relational Data Model, Graph Data Model.