

Failure Personalities of Databases: How SQL Server, Oracle, and PostgreSQL Break—and How AI Predicts Recovery Paths

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Abstract: Enterprise computer databases including Microsoft SQL Server, Oracle and PostgreSQL have underpinned significant workloads in all industries. But all these systems have a different personality of how they degenerate in stress and how they regenerate after the outages. SQL server often exhibits chain of blocking and deadlock cascades, oracle Real Application Cluster (RAC) are vulnerable to new interconnect and node-level failure modes and PostgreSQL also faces the problem of autovacuum stalls and table bloat. These idiosyncratic breakdowns are important to understand and they can be utilized to create robust data platforms. In this paper, the comparative taxonomy of failure personalities in the three engines is developed, and the opportunities to use artificial intelligence (AI) to predict the recovery paths are discussed. Supervised classification of known categories of failure, and unsupervised models, which reveal latent behaviors, are the strategies that we consider in the detection of anomalies. The case studies of production workloads demonstrate the capacity of the AI-based prediction to decrease the mean time to recovery (MTTR) and enhance the operational resilience. By integrating technical analysis and applied AI, the paper will provide a unique model, which will fill the gap between database reliability engineering and predictive recovery, and will provide both academic and practical information to support enterprise-wide systems.

Keywords: SQL Server, Oracle RAC, PostgreSQL autovacuum, Blocking chains, AI anomaly detection