Research on the characteristics of vertical fragmentation in distributed databases and its applications.

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Abstract: This thesis investigates the characteristics of vertical fragmentation in distributed databases and explores its practical applications. Vertical fragmentation, which decomposes a relational table into subsets of attributes, is critical for optimizing query performance, enhancing data locality, and reducing communication costs in distributed systems. The study systematically analyzes fragmentation criteria, including attribute affinity, usage patterns, and transaction workloads, to develop efficient partitioning algorithms. A comprehensive evaluation of correctness, completeness, and reconstruction properties is conducted to ensure data integrity post-fragmentation. Furthermore, the research proposes a cost-based model to minimize join operations and network overhead. The practical application of the proposed fragmentation strategy is demonstrated through a case study on a distributed e-commerce platform, showing significant improvements in response time and resource utilization. The findings provide a robust framework for designing scalable distributed database architectures, offering both theoretical insights and practical guidelines for database administrators and system architects.

Keywords: vertical fragmentation, distributed database, characteristics, applications