Time-Series Databases

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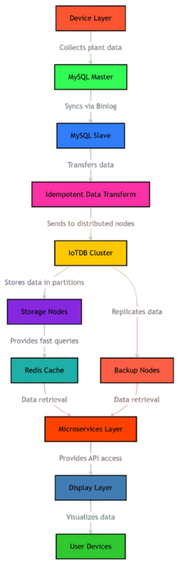
Paper Summary I : Ritesh Jha

The paper discusses the need for a high-performance time-series database (TSDB) to manage the vast plant data generated by the EAST (Experimental Advanced Superconducting Tokamak). The existing MySQL-based system struggles with large-scale data storage, slow query performance, and inefficient data retrieval. To address this, the authors introduce a MySQL-IoTDB Hierarchical Mechanism (MIHM), which offloads performance-intensive operations to an Apache IoTDB cluster while maintaining compatibility with the existing infrastructure. MIHM includes master-slave MySQL synchronization, idempotent data transformation, and distributed storage with replication for improved fault tolerance and scalability. It optimizes data ingestion, indexing, and query execution, reducing latency and improving efficiency. Test results show 20× faster write throughput and 100× faster query performance, significantly enhancing real-time data analysis and long-term storage. This system makes EAST's data architecture more robust and scalable, preparing it for future high-frequency fusion experiments and real-time monitoring needs.

Work Flow Diagram



References

Title : EAST plant data storage system based on IoT DB time series database
Xu, G., et al. EAST superconducting tokamak. AAPPS Bulletin, 2013
Wan, B., et al. EAST superconducting tokamak. Chinese Science Bulletin, 2015
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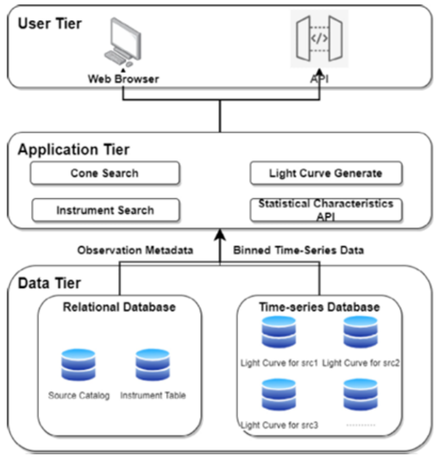
Paper Summary II : Ritwik Mohanty

LCGCT is a software tool designed to generate light curves with customizable time bins, specifically for time-domain astronomy. Traditional methods often require retrieving entire datasets before re-binning, which is inefficient. To address this, LCGCT employs a time-series database model, significantly improving storage efficiency and query speed. The study compares LCGCT with a PostgreSQL-based implementation, showing that LCGCT saves 75% of storage space and queries three times faster. It uses TDEngine, a time-series database optimized for high-speed read/write operations and low disk usage. The system architecture includes a client-server-database model, where users can access data via a web interface or API. The research evaluates LCGCT's accuracy using the MAXI/GSC X-ray source catalog, demonstrating agreement between generated and official light curves. The tool is effective in transient detection, burst identification, and time-domain astronomy research. Future work includes enhancing interoperability using Virtual Observatory (VO) standards.

Module Diagram



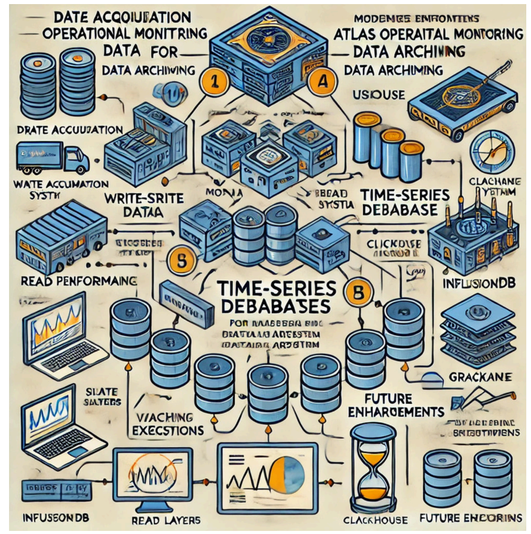
References

Title : LCGCT:A light curve generator in customisable-time-bin based on time-series database
Zhang, Z., Xu, Y., Cui, C., & Fan, D. (2024). LCGCT: A light curve generator in customisable-time-bin based on time-series database. Astronomy and Computing, 48, 100845.

Paper Summary III : Sanjana Das

The paper evaluates the performance of modern time-series databases for ATLAS operational monitoring data archiving, specifically comparing InfluxDB and ClickHouse with the existing P-BEAST system at CERN's Large Hadron Collider (LHC). The motivation behind the study is the need for a scalable, efficient, and reliable database solution for managing the ever-growing volume of monitoring data collected from the ATLAS experiment. The study analyzes these database technologies based on key performance metrics, including write and read performance, scalability, and usability.

Module Diagram



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Title: Performance Evaluation of Modern Time-Series Database Technologies for ATLAS Data Archiving
ATLAS Collaboration et al. The ATLAS experiment at CERN. J. Instrum., 2008.
Evans, L., & Bryant, P. LHC machine. J. Instrum., 2008.
Avolio, G., et al. Web-based monitoring for ATLAS. J. Phys., Conf., 2017.
Vasile, M., et al. Evaluating InfluxDB & ClickHouse for ATLAS. J. Phys., Conf., 2020.