



MySQL at Panasonic: Managing Terabytes of Data in Avionics

Presenter: Vijay Panwar

Date: 01 - 05 - 2024

Event: MySQL Summit 2024 at Oracle
Conference Center - Redwood Shores -
California

About Me

- Name: Vijay Panwar
- Experience: 10 + Years
- Work: Senior Software Engineer at Panasonic Avionics Corporation.
- Published: 12 Research papers mainly focused on MySQL database and use cases.
- Senior Member of IEEE



Agenda

Type of Data

Introduction to Data Management

Role of MySQL

Challenges

Scalability

Optimization

Type of Data Handling



In Flight Entertainment -
IFE



In Flight Connectivity -
IFC

Introduction to Data Management



Enhanced Decision-Making: Effective data management ensures that high-quality, accurate, and relevant data is readily available to decision-makers. Organizations can use this data to perform analytics and gain insights that inform strategic planning, operational adjustments, and tactical moves



Improved Efficiency and Productivity: Organized and well-managed data streamlines processes, reduces redundancy, and eliminates the inefficiencies associated with data silos. Teams spend less time searching for and correcting data errors and more time leveraging clean, accurate data for their tasks.



Scalability and Flexibility: As organizations grow, their data needs evolve. Effective data management systems are scalable, accommodating increased data volumes without performance degradation.

The Role of MySQL in Avionics Data

Why is MySQL chosen for data management?

MySQL is a popular choice for data management across various industries, including avionics, due to its reliability, performance, and flexibility.

Relational Database Model:

- Structured Data Storage
- Data Integrity and Relationships

Views:

- Data Abstraction and Simplification: MySQL allows the creation of views, which are virtual tables that provide a specific representation of the data
- Security: Views can also serve as a layer of security in avionics data management.

Stored Procedures:

- Efficiency and Performance
- Automation and Consistency

Challenges in Handling Large- Scale Data

Volume of Growth of Data: The sheer volume of data generated by avionic systems, including flight sensors, navigation systems, and passenger services, is immense. The systems need to accommodate not just current data volumes but also anticipate rapid growth.

Accuracy and Quality of Data: Ensuring the precision and reliability of avionics data is crucial, as it plays a vital role in important decision-making procedures. We carry out thorough data validation and cleansing procedures to uphold the quality of the data.

Management of Costs: Managing terabytes of data presents the challenge of balancing infrastructure and operational costs while maintaining high performance and data availability.

MySQL Database Architecture



Cloud Infrastructure



Data Sources



Data Ingestion
Layer



Data Processing &
Analytics



Data Backup &
Recovery - Backup
from read replica



Connectivity - App,
Lambda, S3

Scalability Solutions

Partitioning

- Range Partitioning: Data is partitioned according to a range of values, ideal for time-series data like flight logs.

Scalability Solutions



Implementing Auto-Scaling with Cloud Providers

Leveraging cloud-based solutions like Cloud RDS or Azure Database for MySQL enables auto-scaling of resources in response to workload changes.



Caching and Load Balancing

Integrating caching mechanisms and load balancers can mitigate peak load impacts. Caching frequently accessed data reduces the number of direct queries to the database, while load balancers distribute requests across database replicas or shards, ensuring no single database instance becomes a bottleneck.

Data Ingestion Techniques

Use of ETL Processes and Tools

- ETL (Extract, Transform, Load) processes are fundamental in migrating data from various sources into a MySQL database. They involve extracting data from its origin, transforming it into a format suitable for analysis and storage, and finally loading it into the database.

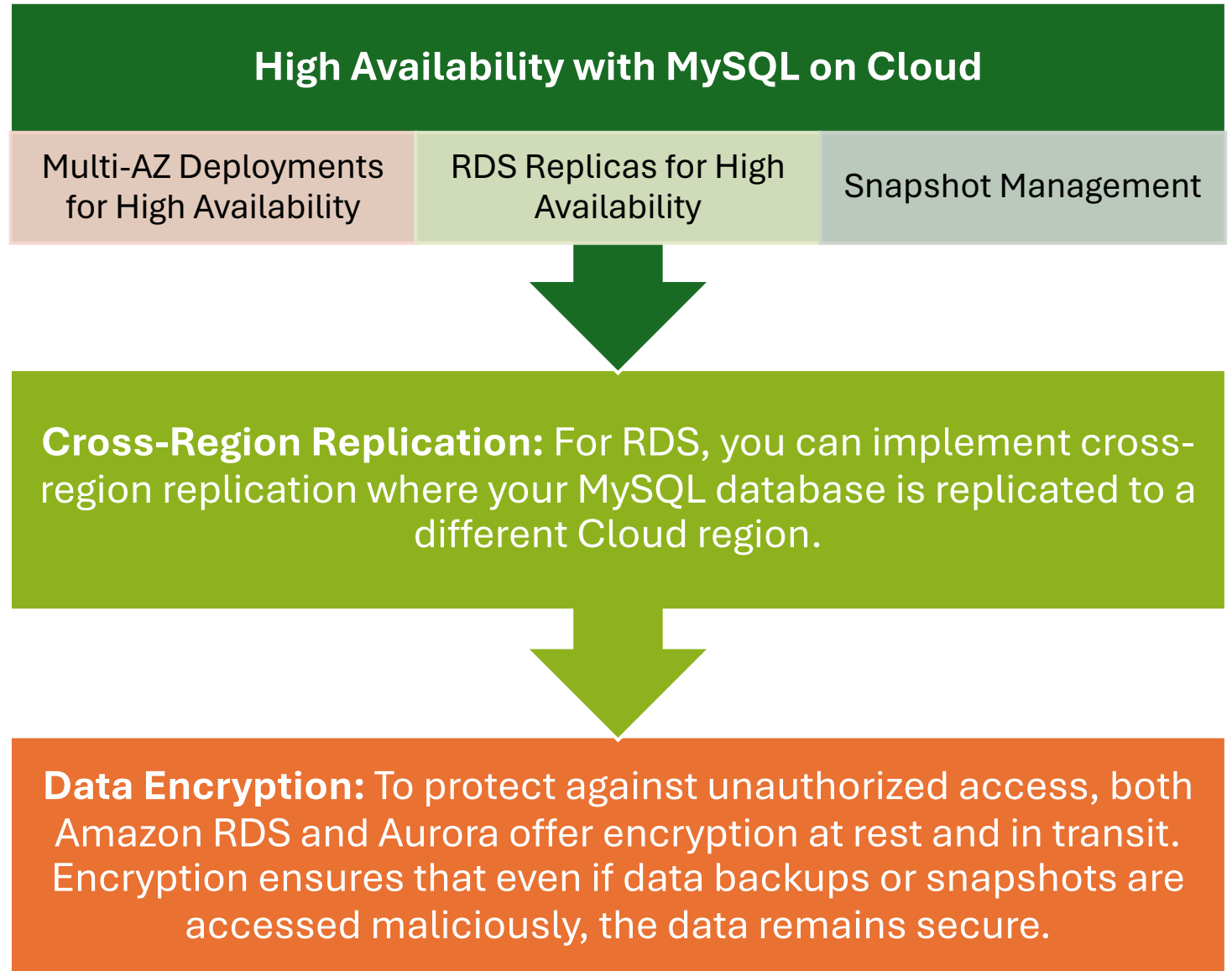
Use of APIs

- Weather data critical to flight planning and operations might be ingested from a third-party service via a RESTful API. The data can be automatically fetched and updated in the MySQL database at regular intervals or on-demand, ensuring that flight operations always have access to the latest weather conditions.

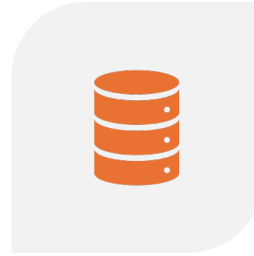
Advanced Techniques for High-Volume Data Ingestion

- **Batch Processing:** Accumulate data over a period and then ingest it in batches. This approach can reduce the number of write operations and minimize the load on the database server.

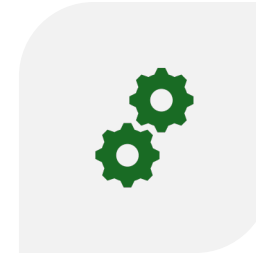
High Availability and Disaster Recovery RDS



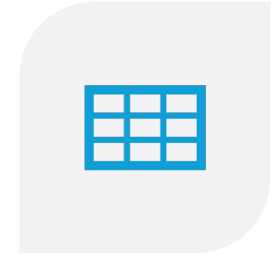
Performance Optimization



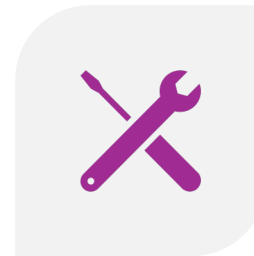
INDEXING



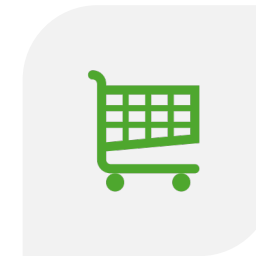
QUERY OPTIMIZATION



PARTITIONING



LEVERAGING CLOUD
TOOLS AND FEATURES



AMAZON
CLOUDWATCH

Overview of Challenges



- Handling massive data volumes in the industry presents unique challenges.



- Data volume and velocity exceed traditional storage and processing capabilities.



- Ensuring data security and compliance within a highly regulated industry.



- Integrating diverse data sources from systems into a cohesive, actionable format.



- Upgrading legacy systems to modern, scalable platforms without interrupting critical operations.

Lessons Learned

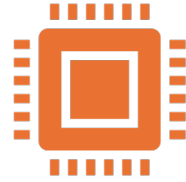
Scalability of Relational Databases

Critical Role of Indexing

Utilization of Views for Data
Abstraction

Stored Procedures for Enhanced
Performance

Successes Achieved



Real-Time Data
Processing

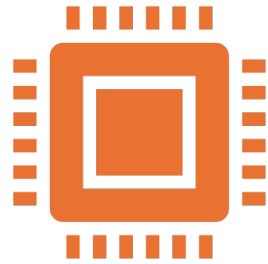


Optimized Performance
and Scalability



Enhanced Data
Management Capabilities

Conclusion & Q/A



Panasonic has effectively showcased the effective utilization of **MySQL** in managing vast amounts of avionics data.



By implementing: Meticulous planning
Optimization,
Harnessing the robust features of **MySQL**