ORACLE

MySQL Database Service

with HeatWave for Query Acceleration

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Putting this into context:

70% of your customers are using MySQL

Large opportunity **within your installed base**

100% of major cloud vendors have a MySQL/MySQL-based offering

We are the only vendor with a combined OLTP and Analytics Cloud Service for MySQL

70% of new apps will be developed on an open-source DBMS or OSDBMS-based PaaS by 2022 (Gartner)*

Open source databases in the cloud are growing faster than any other databases

MySQL is the #1 Open Source Database

Rank			DBMS	Database Model	
Aug 2021	Jul 2021	Aug 2020			Aug 2021
1.	1.	1.	Oracle	Relational, Multi-model	1269.26
2.	2.	2.	MySQL	Relational, Multi-model	1238.22
3.	3.	3.	Microsoft SQL Server	Relational, Multi-model	973.35
4.	4.	4.	PostgreSQL	Relational, Multi-model	577.05
5.	5.	5.	MongoDB	Document, Multi-model	496.54

Source: DB Engines Ranking

Innovative enterprises across many industries run MySQL

Social

E-Commerce

Tech

Finance

Manufacturing

Future of DBMS is cloud

$65B

2020 DBMS Market Revenue

Growing 17% annually

$26B

2020 Cloud DBMS Market Revenue

Growing 50% annually

"The majority of the growth in the database market is going to cloud."

Donald Feinberg
Gartner
May 2021

Source: Gartner, 2021

MySQL Database Service on Oracle Cloud Infrastructure

100% developed, managed, and supported by Oracle

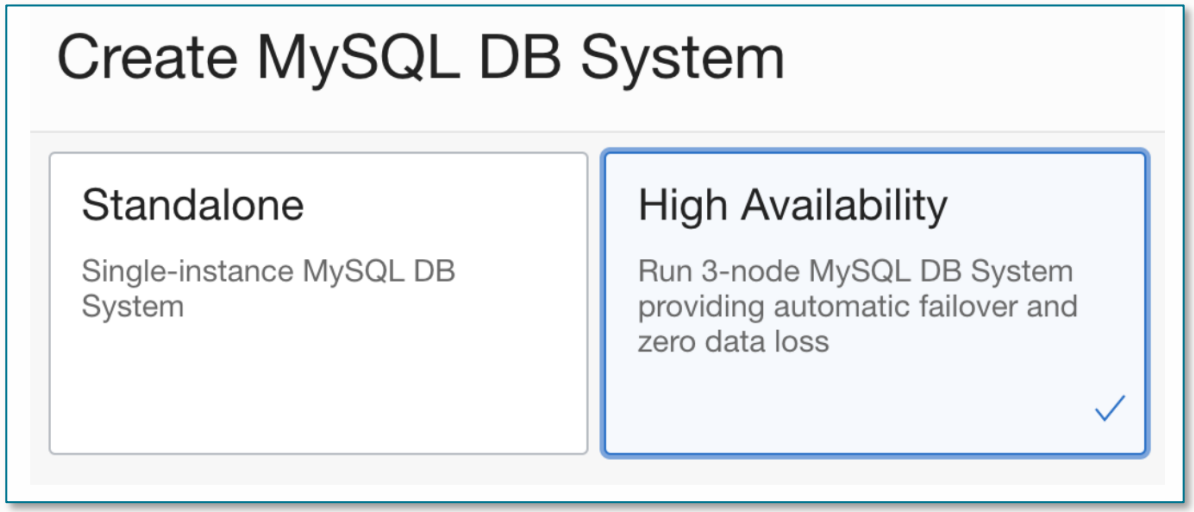
	Automation	MariaDB CE	MySQL On-Premises	MySQL on OCI	MySQL Database Service
Database	High Availability	X	X	X	✓
	Backup	X	X	X	✓
	Security Patch & Upgrade	X	X	X	✓
	Provision & Configure	X	X	X	✓
OS	OS Security Patch & Upgrade	X	X	X	✓
	OS Installation	X	X	✓	✓
Server	Hardware Purchase & Maintenance	X	X	✓	✓
Storage	Storage Purchase & Maintenance	X	X	✓	✓
Data Center	Rack & Space	X	X	✓	✓
	Power, HVAC, Networking	X	X	✓	✓

MySQL Database Service: High Availability

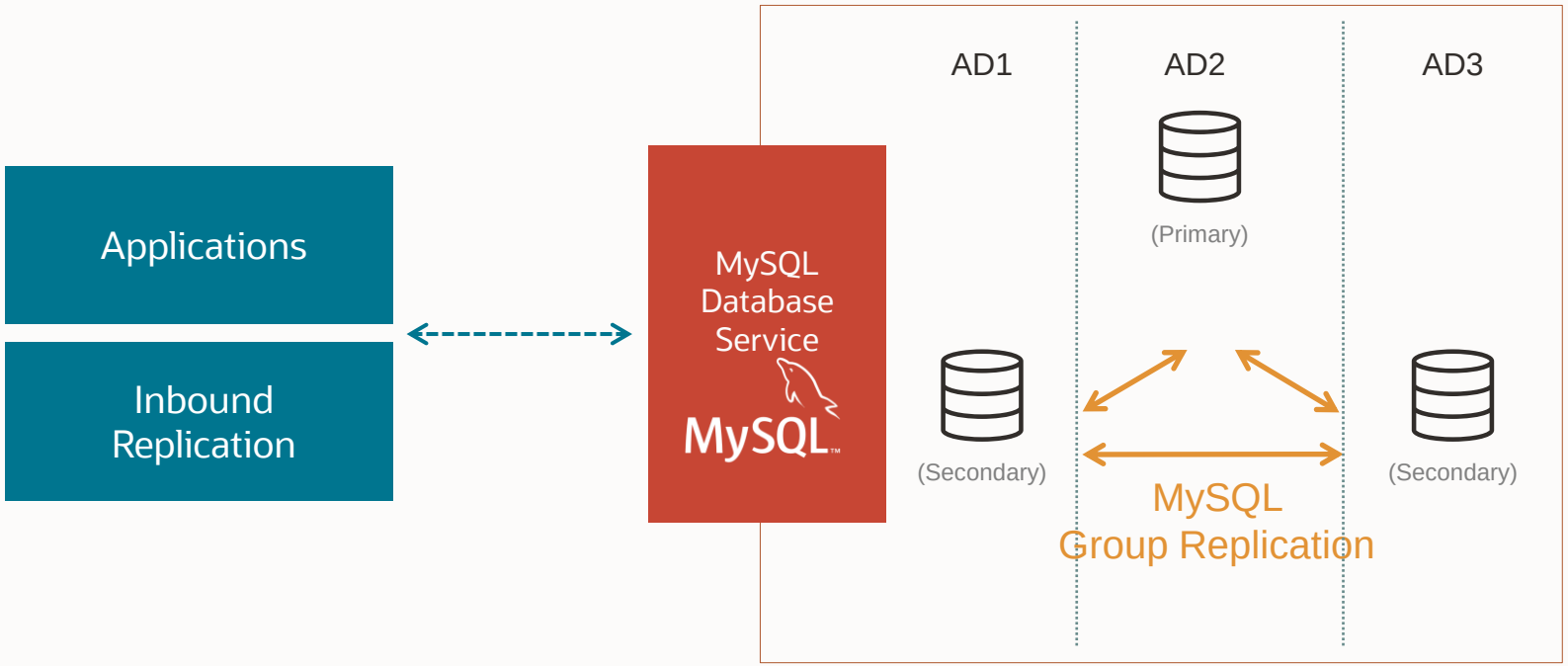
Fault-tolerant system with automatic failover and zero data loss

- Single Click High Availability
- Automatic Failover
- Increased Uptime
- Zero Data Loss

- Recover Time Objective (RTO): Minutes
- Recovery Point Objective (RPO): Zero



MySQL Database Service: Multi AD Region



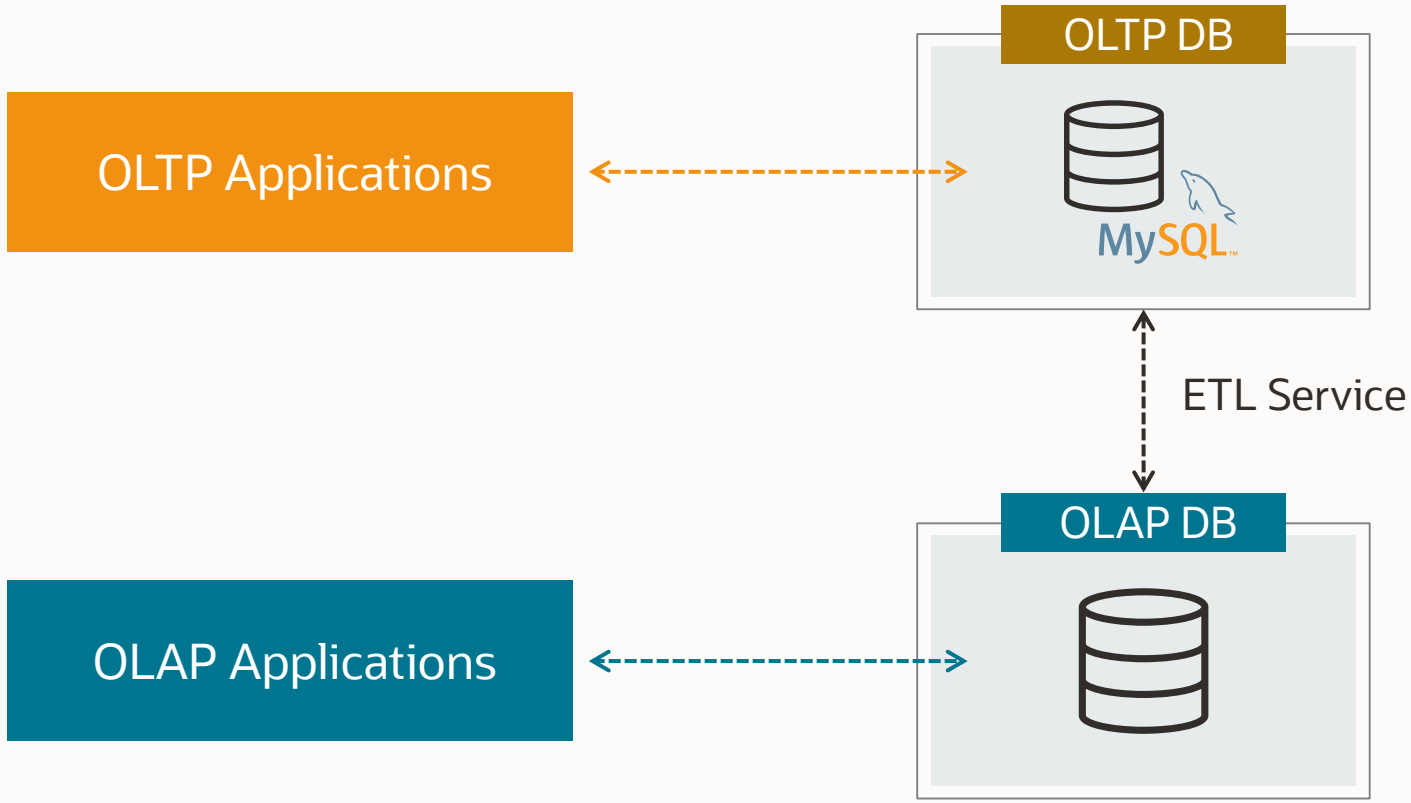
Deployed across fault and availability domains

Native MySQL Group Replication

No data loss in case of failure
- RPO=0

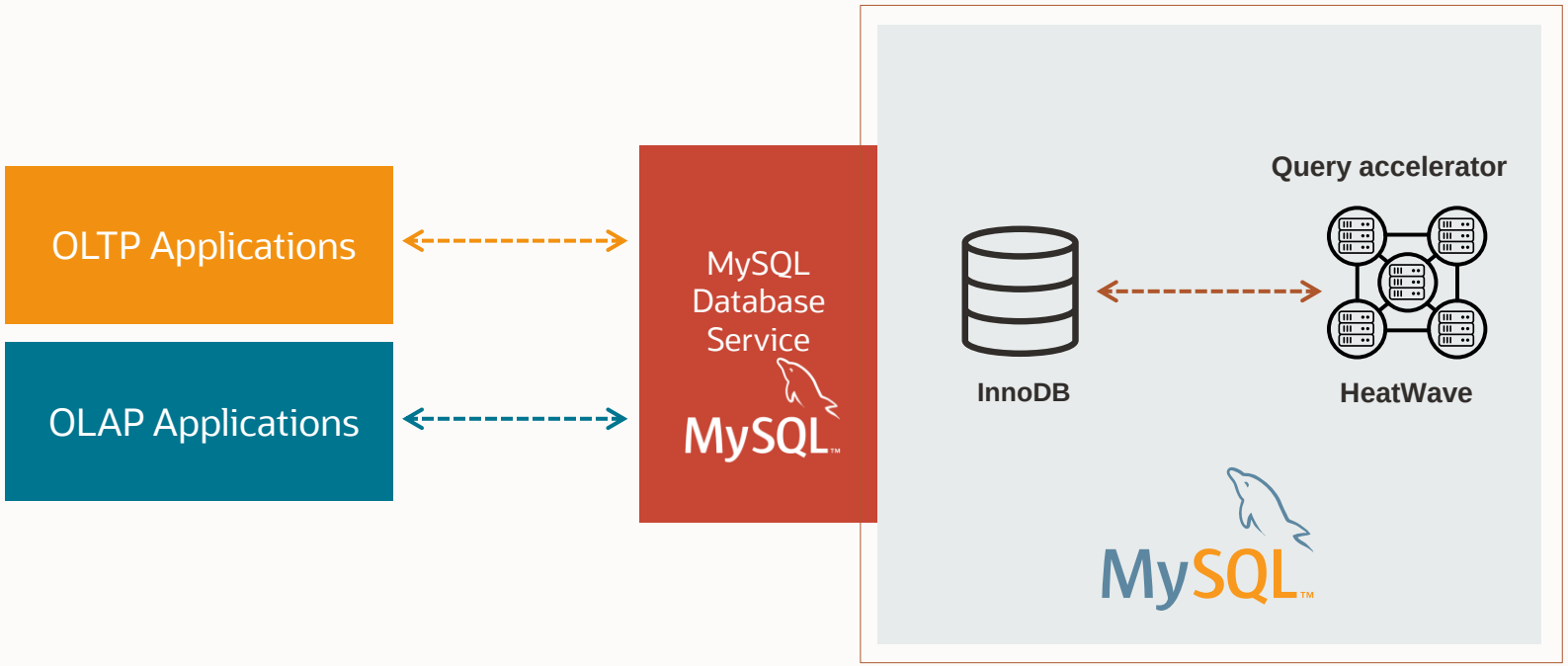
Online and fast fail-over
- RTO=minutes

Problem: MySQL users need separate systems for OLTP and OLAP



MySQL HeatWave

The *only* MySQL service with a native massively-scalable query accelerator



- Single MySQL database for all applications
- No need to ETL
- Query real-time data
- Applications work without any changes
- Scales to thousands of cores

MySQL Database Service with HeatWave: Key Use Cases

Build Cloud Native Apps

- Use open source technologies
- Kubernetes and microservices
- Focus on innovation, not DB admin
- Native real-time analytics
- Scale according to needs
- High Availability

#1 Database for Developers*

Move existing OLTP workloads

- 5400x query acceleration
- Improve security and ability to get expert technical support
- Latest updates, security fixes and features
- No application changes

100% Developed, Managed, Supported by MySQL team

Run real-time analytics and mixed workloads

- Single DB for OLTP and OLAP in MySQL
- No ETL
- Hybrid cloud (OLTP on-prem and OLAP in cloud)
- No Stale Data
- Fast business insights

100% Native Query Accelerator

Power SaaS Applications

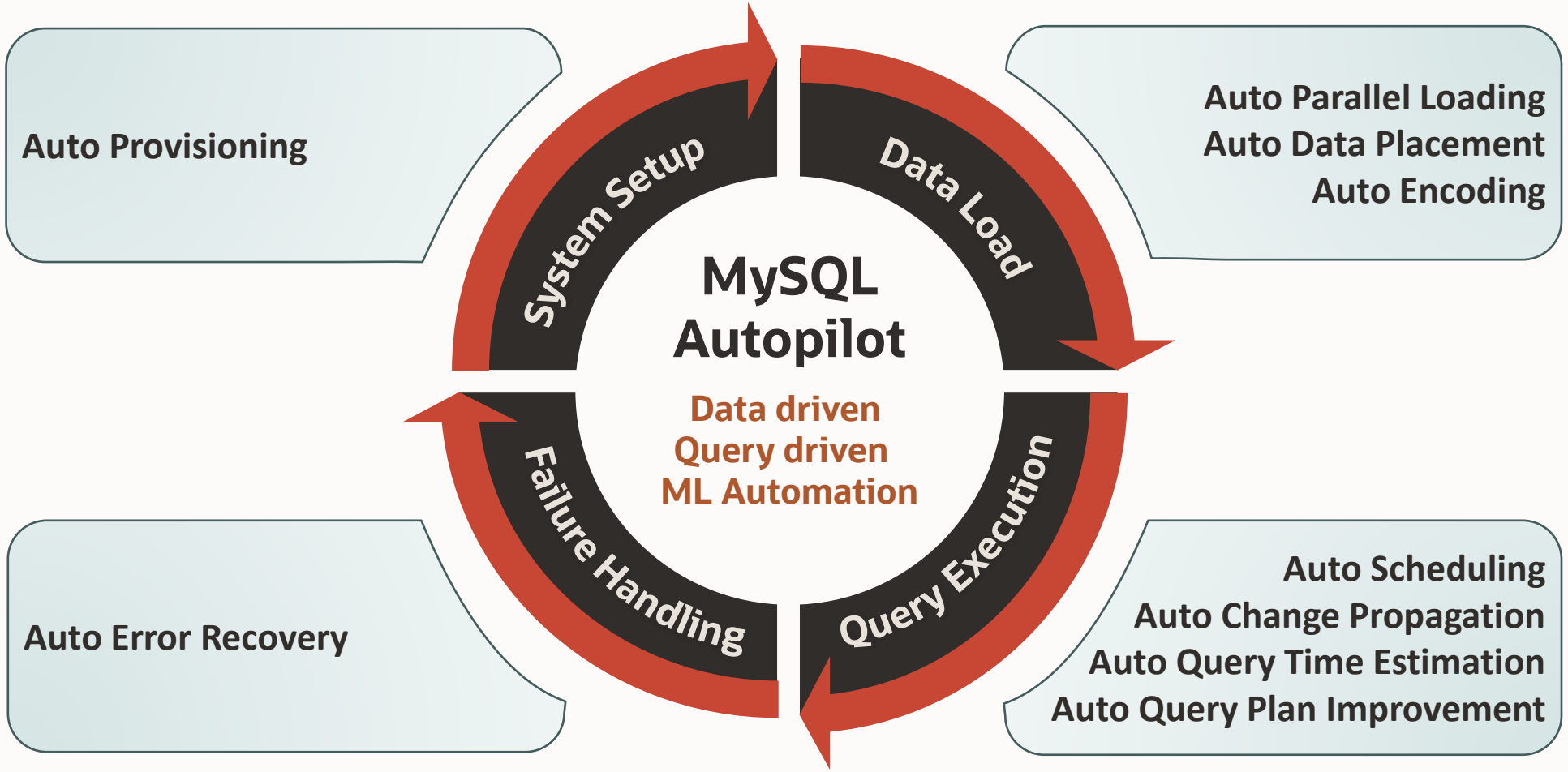
- Highly popular with ISVs
- Focus on innovation, not DB admin
- Scale globally according to needs
- OCI performance, availability and manageability SLAs
- Expert MySQL Technical Support
- Built-in analytics

Popular with ISVs

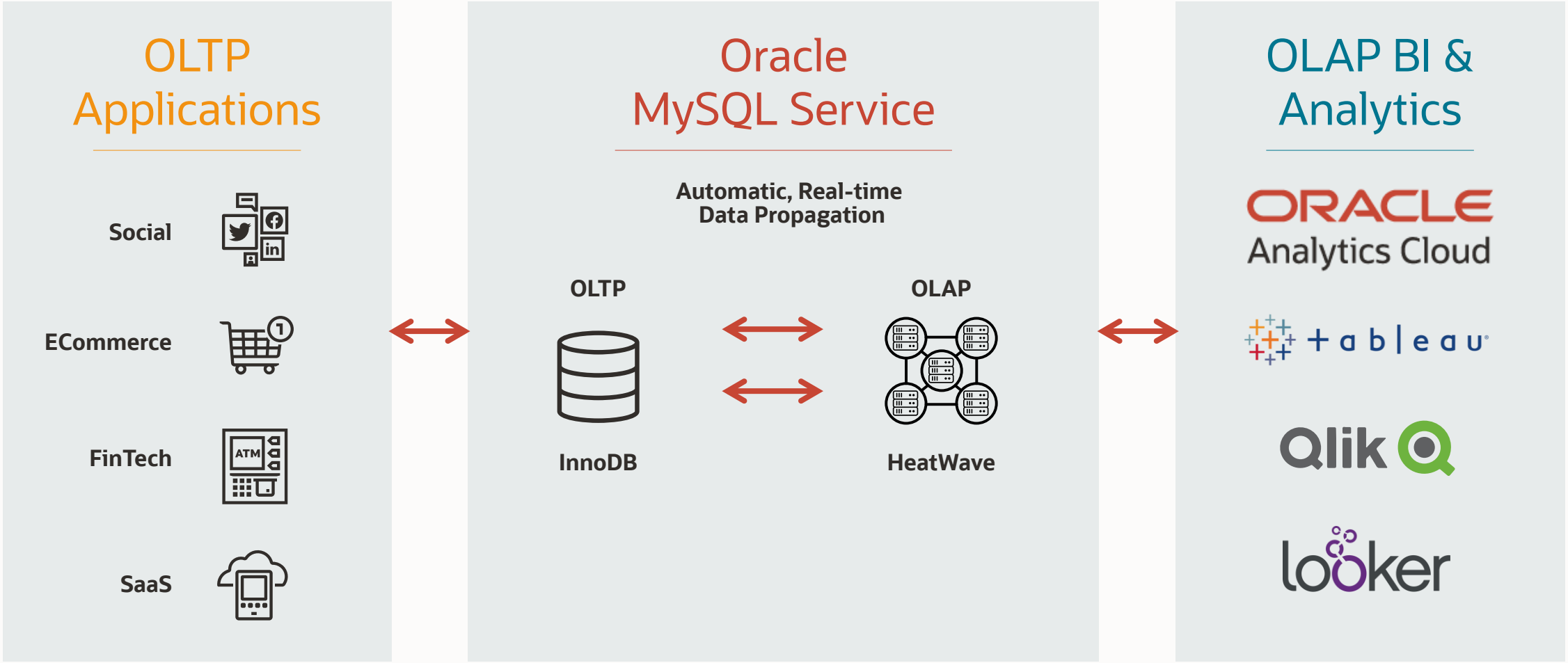
*Stackoverflow survey

MySQL Autopilot Features

Machine learning based automation

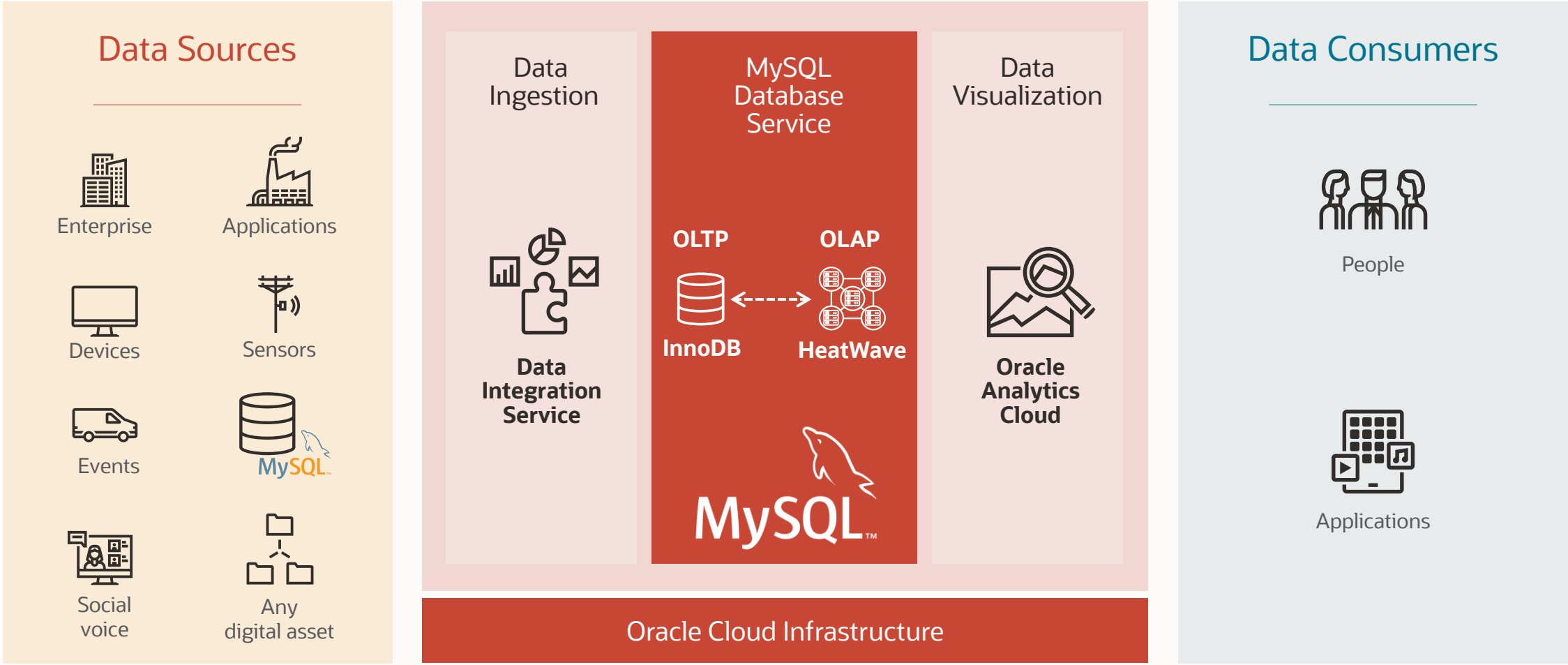


All MySQL-compatible applications run without any changes



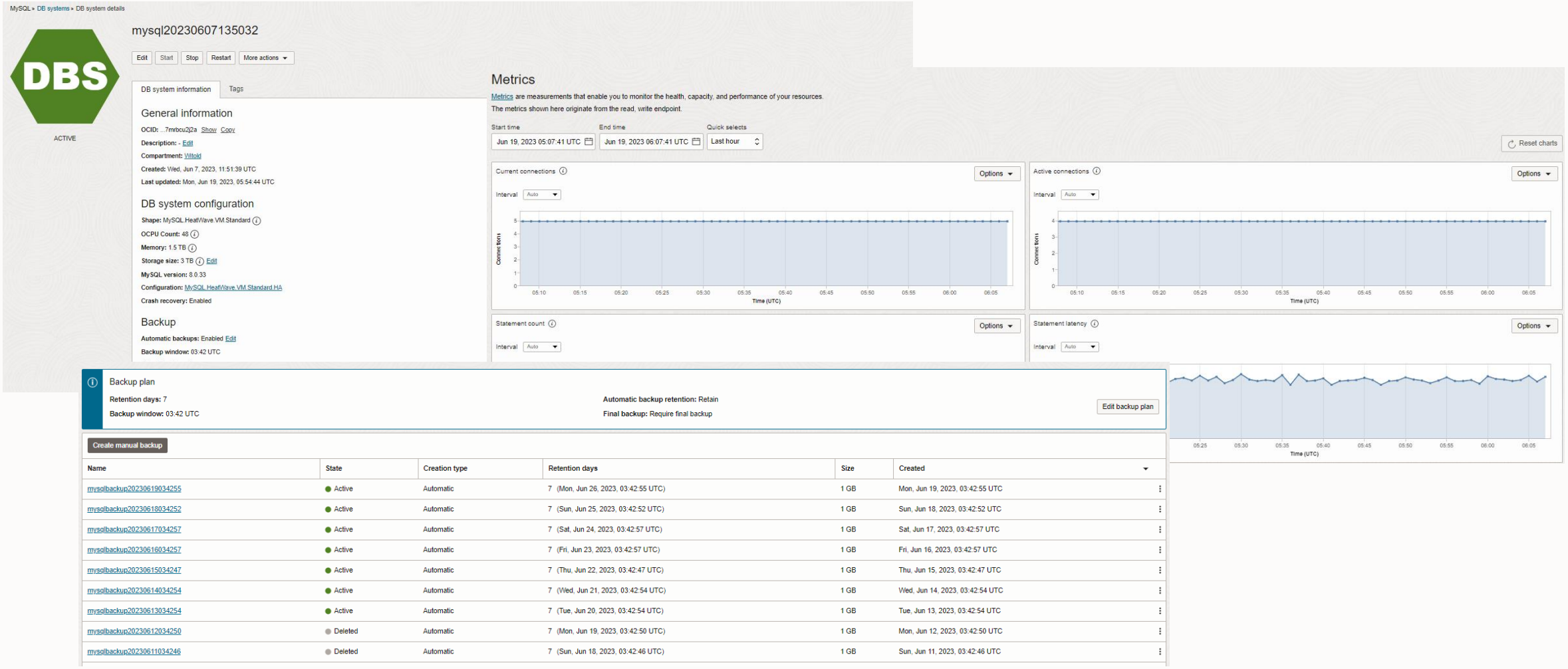
MySQL Database Service is integrated with other Oracle Services

End-to-end Integration from data ingestion to data visualization



MySQL Database Service cloud GUI

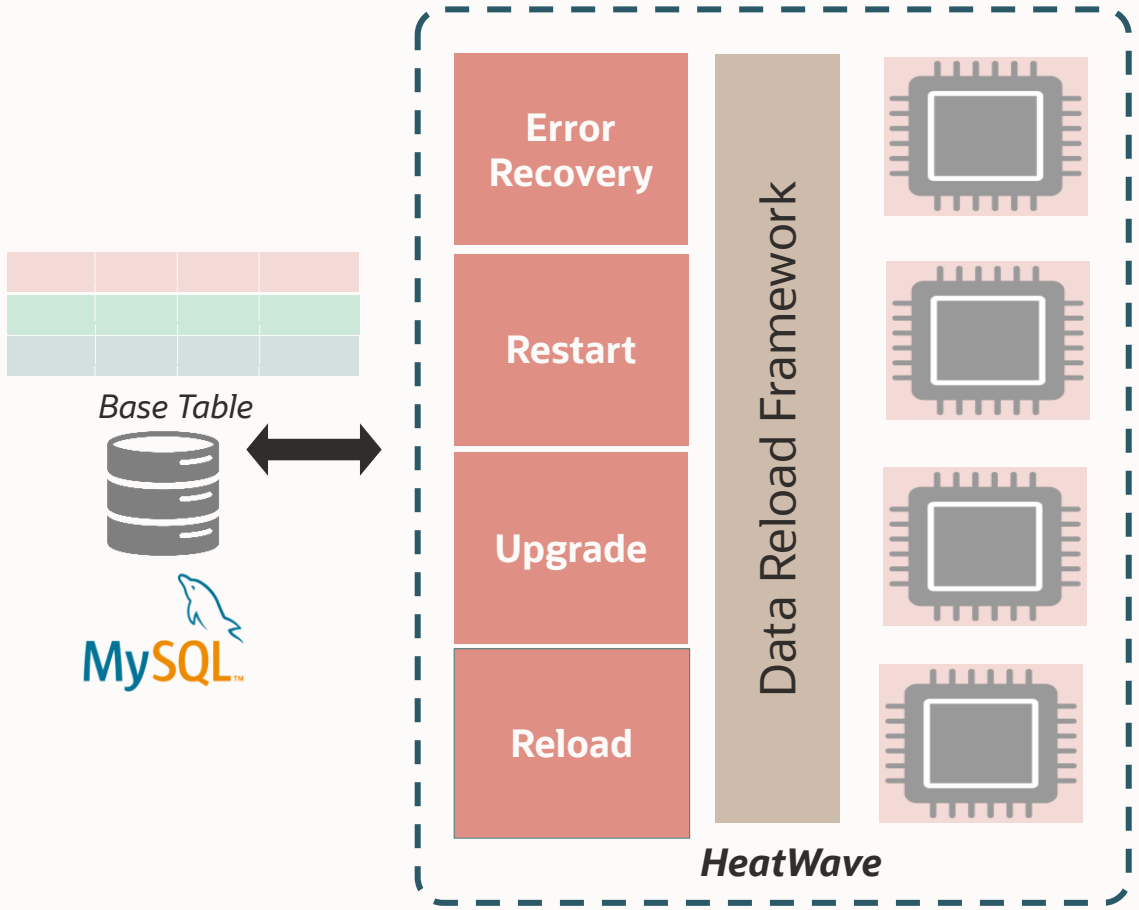
Easy management



Introducing

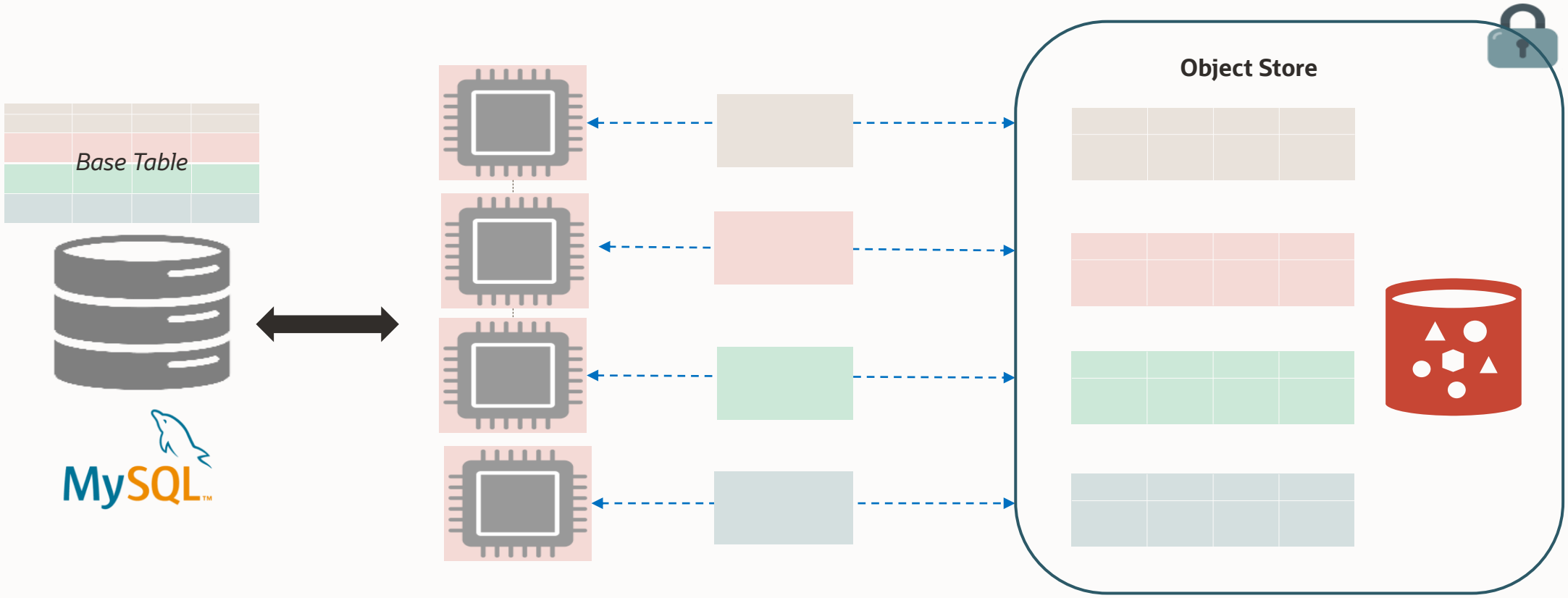
Scale Out Data Management for MySQL HeatWave

Reloading data into HeatWave can be expensive



MySQL HeatWave Scale Out Data Management

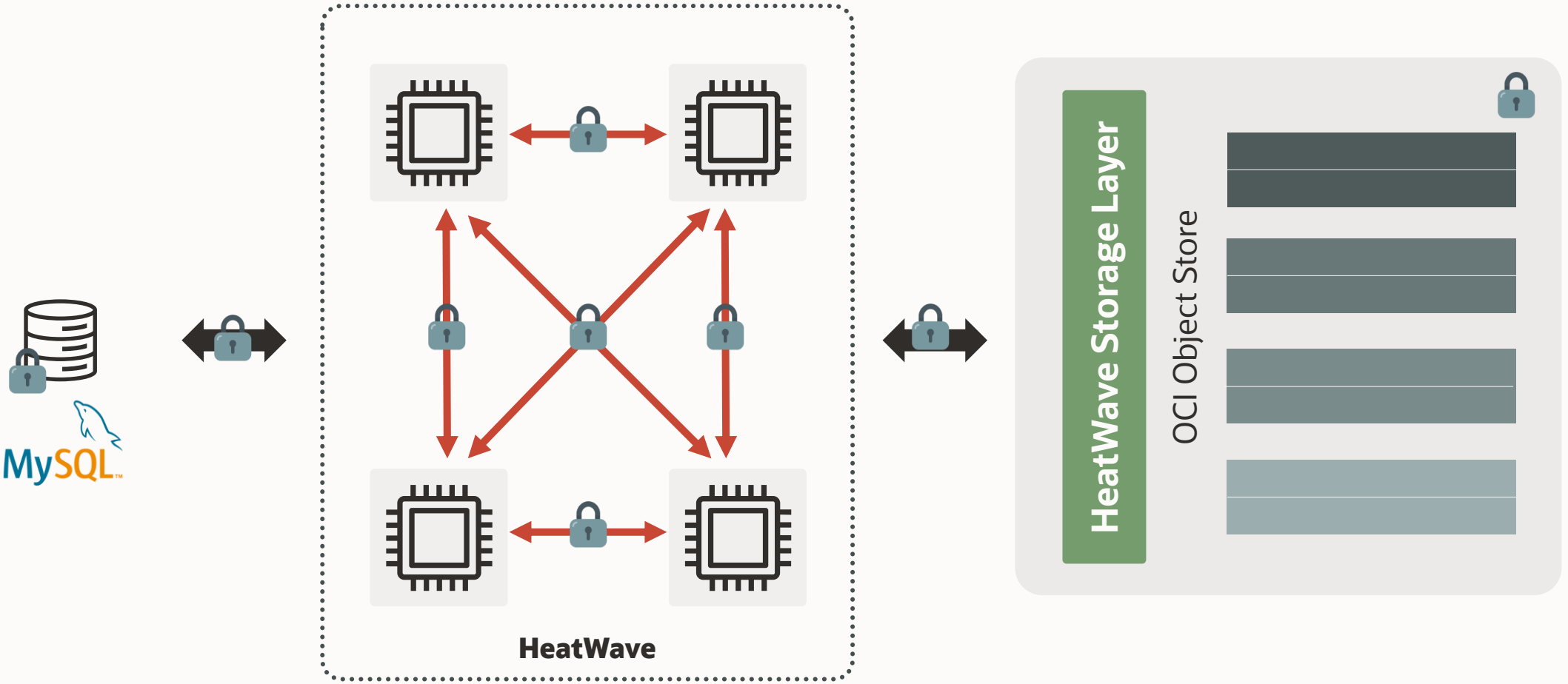
Constant time to reload *any* amount of data



- Data is partitioned & stored in object store in encrypted, in-memory format
- Data can be reloaded in parallel at object store bandwidth
- Ability to load data at a fine granularity
- Changes to MySQL are propagated to the object store

Security in MySQL HeatWave

Data always encrypted



MySQL HeatWave accelerates both OLTP and OLAP workloads

- MySQL HeatWave offers better performance compared to Aurora for *both* OLTP and OLAP

- Changes made to MySQL are propagated to HeatWave memory and scale out storage
  - Completely transparent without any human intervention
  - Queries always access the latest data

- Complex OLTP constructs are offloaded to HeatWave
  - Insert into Select
  - Create Table as Select
  - Range queries

- Auto scheduling prioritizes shorter OLTP queries over long running OLAP queries

MySQL Database Service recommendations

Recommendations

Feature	Best Practice
Database access control and account management	Use MySQL security features to control access and manage your account. See Access Control and Account Management.
Sizing	Choose size larger or equal to the size of an old on-premise system. List of available sizes can be reviewed here
Read Replicas	Use read replicas and read replica load balancer to increase scalability.
MySQL HeatWave	Use to increase scalability, build a multi-purpose database system, which can handle mixed OLTP/DWH workloads or eliminate the need of implementing a complex ETL process
Public API audit	Use audit service to view Oracle Cloud Infrastructure public API activities that happened in the tenancy or compartment, and to find out the details of the API activities, such as the source, target, or time the API activity occurred. See Overview of Audit.
authentication_oci plugin	Use MySQL authentication_oci plugin to map MySQL users to existing users and groups defined in the IAM service. See Authenticating Using authentication_oci Plugin.
connection-control plugin	By default, MySQL Database Service supports connection-control plugin to provide a deterrent that slows down brute force attacks against MySQL user accounts. See Plugins and Components.

Security recommendations

Feature	Best Practice
In-transit encryption	Your data is always encrypted at rest. You can use in-transit encryption for a given user to secure your data. See Data Security.
Data masking	Use data masking to protect your sensitive data. See Data Masking.
Deletion plan	Use deletion plan to protect your DB system against delete operations. See Advanced Option: Deletion Plan.
Identity and Access Management	As a security administrator, assign minimum privileges to users. Use IAM policies to control access and use of MySQL resources. See IAM Policies.
validate_password component	MySQL Database Service enforces strong passwords with the validate_password component. Make sure your applications comply with the password requirements. See Plugins and Components.
Virtual cloud network (VCN)	•Configure network security groups or security lists of the VCN to restrict the authorized public IP addresses to a single IP address or a small range of IP addresses. See Creating a Virtual Cloud Network. •Configure your MySQL DB system to use private subnets of your VCN. To connect to your MySQL DB system from an external network, use a Bastion Session or a VPN connection. If you can connect to your DB system over the internet only, restrict the authorized public IP addresses to a single IP address or a small range of IP addresses, and use in-transit encryption. See Network Load Balancer.

MariaDB to MySQL migration overview

MariaDB to MySQL migration

1. **Searching for eventual incompatibilities**
   - High Availability
   - Storage engines
   - Functions
   - Data Types
2. **Dumping the source database**
   - MySQL Shell with the dump&load utility
3. **Installation of MySQL database server**
4. **Loading the data into the target MySQL database**
   - MySQL shell

Source: https://blogs.oracle.com/mysql/post/how-to-migrate-from-mariadb-to-mysql-80

Analysts statements and reports

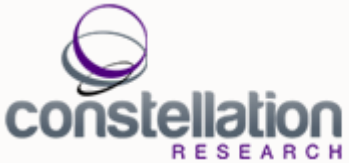
What are industry analysts saying about the latest HeatWave innovations?

“These new fully transparent benchmarks demonstrate HeatWave’s performance, price and scale advantages over all other MySQL and cloud databases.”

"Oracle have shown AWS and Snowflake how to design and architect a true MySQL Cloud Database.”

“For those looking to extract the most out of their MySQL environments, HeatWave should be given a hard look.”

“Oracle brings out new innovations which are set to likely disrupt the market, significantly lifting the expectations for what open-source cloud databases should be.”



Partial coverage, all quotes and research reports available at
https://www.oracle.com/mysql/heatwave/analysts

MySQL + HeatWave: Security Benefits

"As an analyst primarily focusing on cybersecurity, however, I was more impressed by the potential ***security and compliance benefits of an integrated OLTP/OLAP solution****. Since the data (which for many types of transactional workloads is quite sensitive, containing personal, financial, and other regulated information) no longer needs to move between disparate data stores, this* ***dramatically decreases the risks to its integrity and confidentiality****."*

Alexei Balaganski
Kuppinger Cole

https://www.kuppingercole.com/blog/balaganski/mysql-analytics-engine-almost-too-good-to-be-true

MySQL + HeatWave

The only MySQL service with a massively-scalable, native query accelerator

Single MySQL database for OLTP & analytics applications

All existing applications work without any changes

Machine-learning–based automation with MySQL Autopilot

Extreme performance: Accelerates MySQL by orders of magnitude, scales to thousands of cores

Enables running analytics on data stored on-premises

Dramatically faster and lower cost compared to other cloud services