

ORACLE

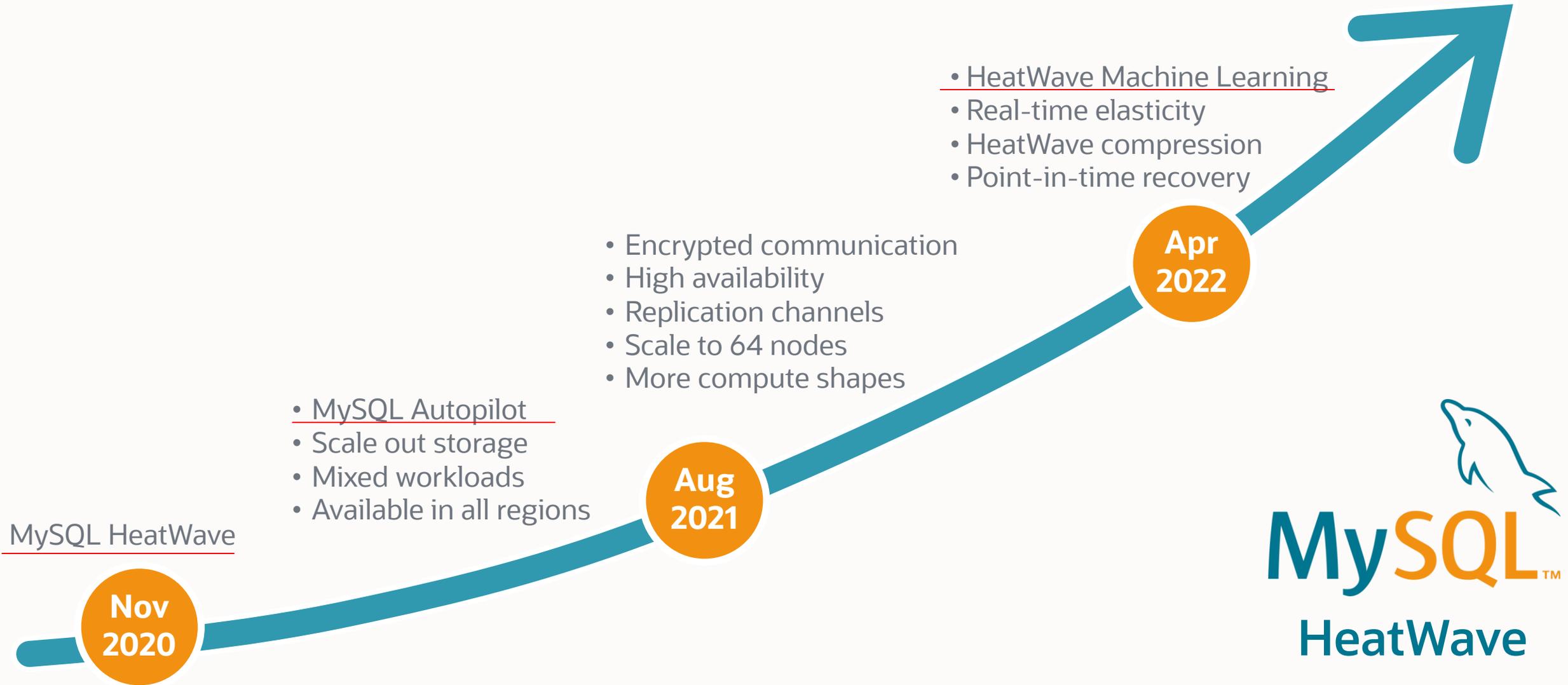
MySQL HeatWave for OLAP

What is possible today (and what is not)...

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Oracle MySQL GBU

RAPID, Oracle Labs, RAPID, HeatWave





“

The world's two most popular databases are the Oracle Autonomous Database and Oracle MySQL,” said Oracle Chairman and CTO, Larry Ellison. *“The Oracle Database once again delivered solid revenue growth in FY21. And while our Oracle Database business as measured by revenue currently dwarfs our MySQL database business—that is about to change because the latest version of Oracle MySQL has been upgraded to include a revolutionary new ultra-high-performance parallel processing query engine called HeatWave.*

Independent analysts have tested and confirmed that Oracle MySQL with HeatWave runs 10 to 100 times faster than Amazon's version of MySQL called Aurora. This technological breakthrough is causing several of Amazon's customers to start moving their Aurora workloads to Oracle MySQL. And industry analysts are telling us they are seeing a 10x increase in Oracle Cloud Infrastructure customer inquiries.

Both the Oracle Autonomous Database and Oracle MySQL with HeatWave technology have captured the technology high-ground in the cloud database business—and that bodes well for the future of the Oracle Cloud.”

Larry Ellison, Chairman, CTO, Oracle
June 15, 2021

The MySQL Heatwave “Family”

... the Oracle MySQL Cloudservices

“MySQL HeatWave”



InnoDB



MySQL Database Service

General Purpose - OLTP

The MySQL Heatwave “Family”

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“MySQL HeatWave”



InnoDB



MySQL Database Service

General Purpose - OLTP



InnoDB RAPID



MySQL Heatwave

General Purpose - OLTP
+ Analytics – OLAP
Incl. Auto Machine Learning

MySQL HeatWave

The view from the moon...

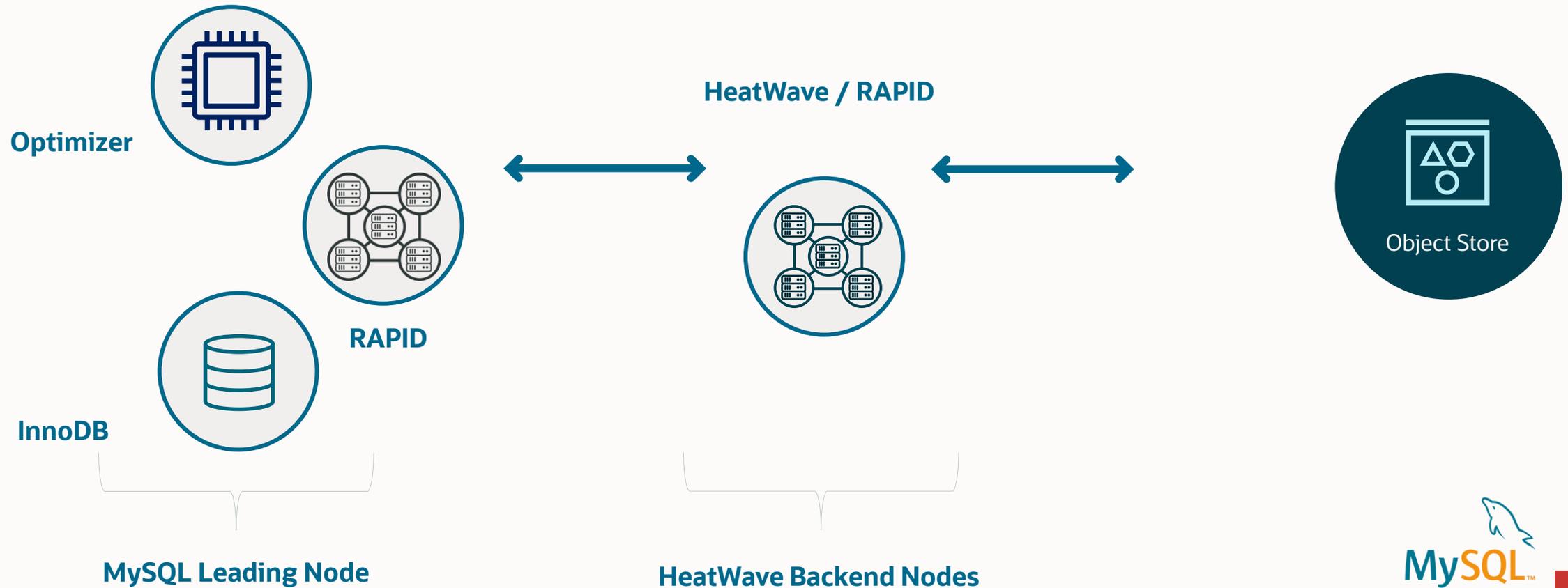
“HeatWave is a in-memory query accelerator for the MySQL Database Service for speeding up analytical queries as well as long running complex OLTP queries.

This all done in the context of a single database which is the MySQL Database Service.

All existing MySQL Application or MySQL compatible Application will continue to work as is, there is no change. It provides a single unified platform for OLTP and OLAP and Machine Learning workloads.”

Announcing MySQL HeatWave Lakehouse

The concept....



MySQL HeatWave – Leading Node

Nearly normal MySQL...

- Single MySQL Instance (today)
- Standard MySQL Parser
- Based on the most recent version (.32)
- 16 OCPUs (32vCPUs), 512GB Memory (10% for Bufferpool)

```
sql>•show variables like "innodb_buffer_pool_size";
```

Variable_name	Value
innodb_buffer_pool_size	51539607552

```
OK, 1 record retrieved in 14.476ms
```

```
sql>•show engines;
```

Engine	Support	Comment
FEDERATED	NO	Federated MySQL storage engine
MEMORY	YES	Hash based, stored in memory, useful for temporary tables
InnoDB	DEFAULT	Supports transactions, row-level locking, and foreign keys
PERFORMANCE_SCHEMA	YES	Performance Schema
RAPID	YES	RAPID storage engine
MyISAM	YES	MyISAM storage engine
MRG_MYISAM	YES	Collection of identical MyISAM tables
BLACKHOLE	YES	/dev/null storage engine (anything you write to it disappears)
CSV	YES	CSV storage engine
ARCHIVE	YES	Archive storage engine



MySQL HeatWave – Backend node(s)

Where the magic happens...

- ‘Black box’ – Start/Stop/Restart/Delete/Change #of Nodes
- 512GB Memory (*was 16 OCPUs/32vCPUs*)
- Each nodes stores around 800GB Data (HW compressed), 400GB Data (HW compressed)
- Up to 64 Nodes (~50TB)
- Managed by “MySQL HeatWave Autopilot”
 - **SHOW STATUS LIKE** 'rapid_service_status';
 - **SELECT** VARIABLE_VALUE **FROM** performance_schema.global_status **WHERE** VARIABLE_NAME = 'rapid_change_propagation_status';
 - **CALL** sys.heatwave_load(JSON_ARRAY("xyz"),**NULL**);
 - **SELECT** NAME, LOAD_STATUS **from** performance_schema.rpd_tables,performance_schema.rpd_table_id **where** rpd_tables.ID = rpd_table_id.ID;

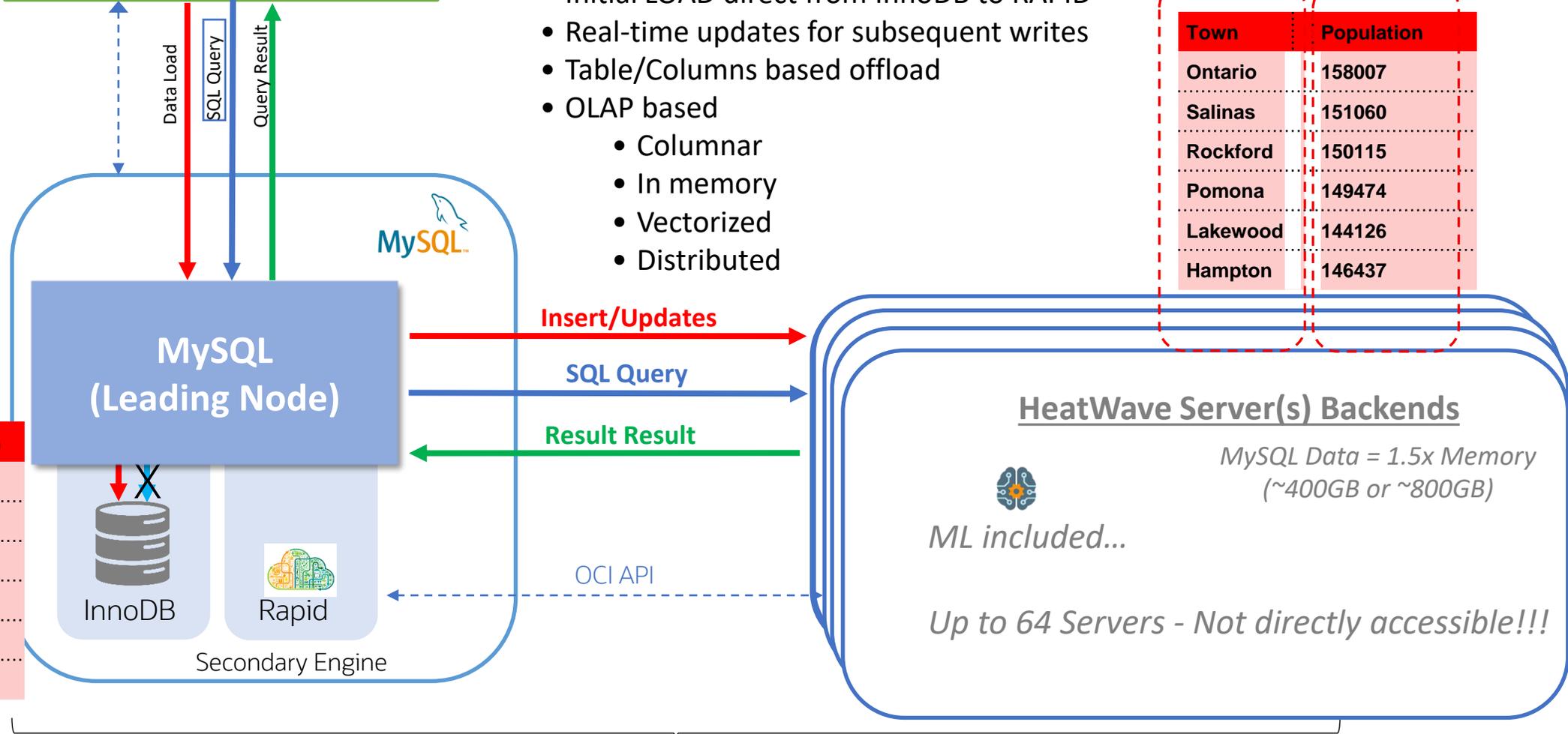
MySQL HeatWave

All MySQL App
MySQL Connector J, ODBC, NET,
Python, PHP, C, C++, Perl, Ruby

- Initial LOAD direct from InnoDB to RAPID
- Real-time updates for subsequent writes
- Table/Columns based offload
- OLAP based
 - Columnar
 - In memory
 - Vectorized
 - Distributed

Town	Population
Ontario	158007
Salinas	151060
Rockford	150115
Pomona	149474
Lakewood	144126
Hampton	146437

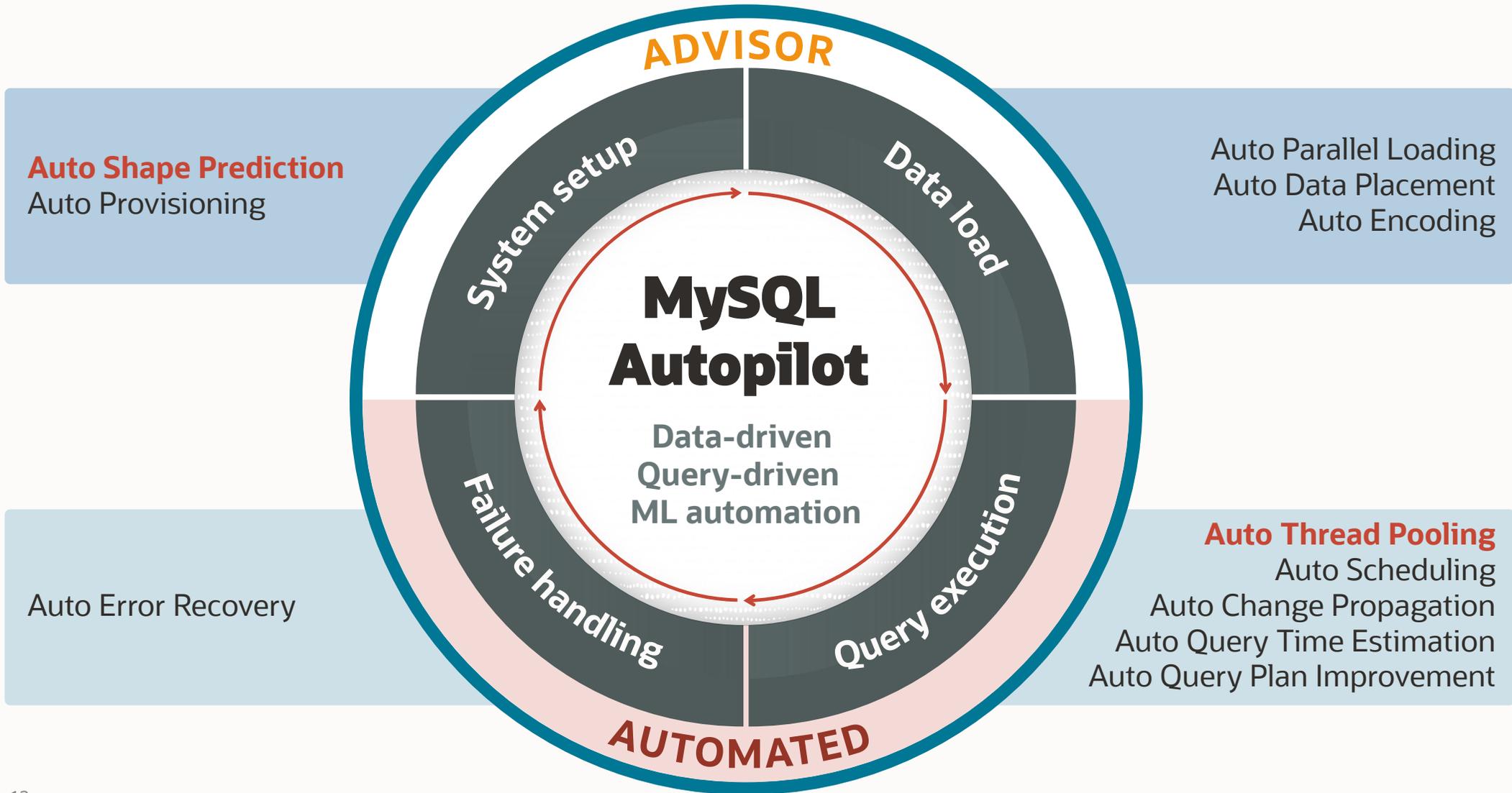
Town	State	Population
Ontario	CA	158007
Salinas	CA	151060
Rockford	IL	150115
Pomona	CA	149474
Lakewood	CO	144126
Hampton	VA	146437



Demo MySQL HeatWave (TPCH Query 1)

MySQL Autopilot: machine learning-powered automation

Enhanced for OLTP workloads



Oracle Cloud Infrastructure

MySQL HeatWave Database Service(s) is/are part of all of them...

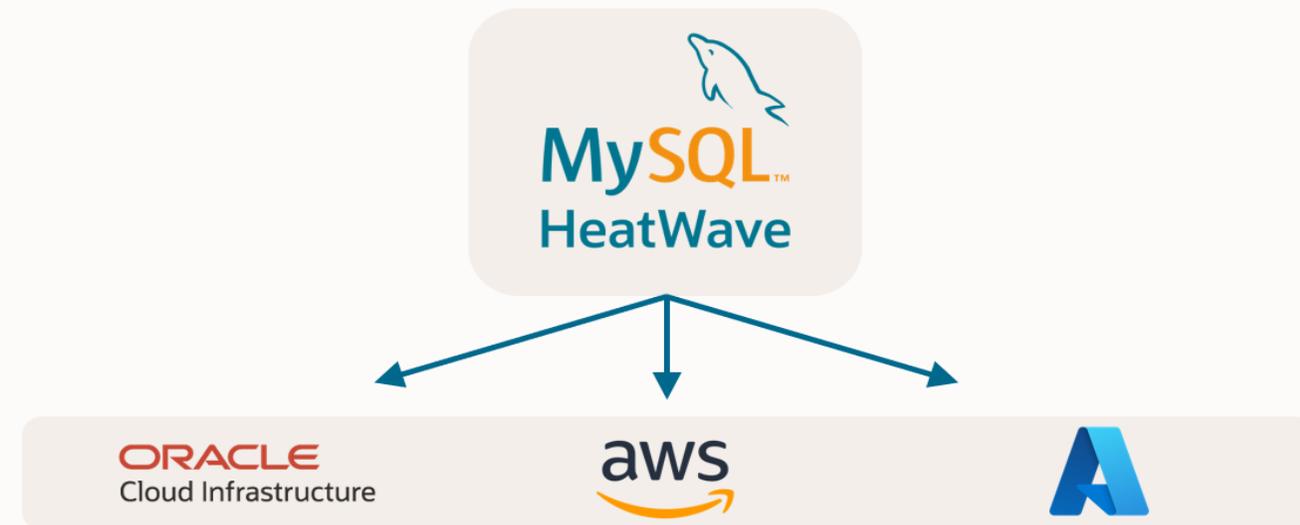
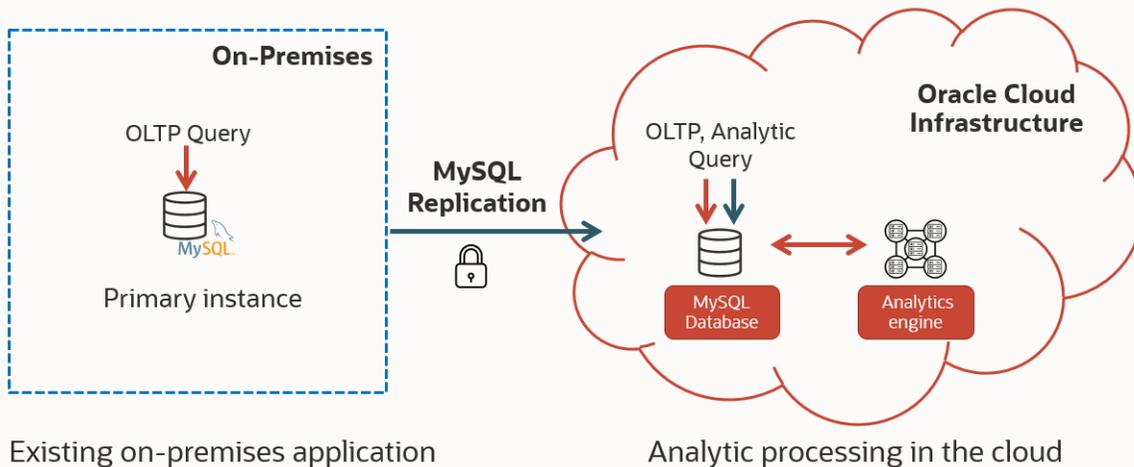




MySQL HeatWave

“One cloud is rarely the answer”

- MySQL HeatWave is available in 40+ Oracle Cloud Regions (**Public Cloud**)
- ... also on Oracle Cloud@Customer (Dedicated Region) (**Dedicated Cloud**)
- ... connect your local MySQL with Public Cloud (**Hybrid Cloud**)
- ... it is part of the **Microsoft Azure ODSA (Multi Cloud)**
- ... it is part of the **Amazon Web Services [native] offering (Multi Cloud)**
- ... and planned for the **Amazon Web Services ODSAWS (Multi Cloud)**



Oracle Database Service for Azure (ODSA)

MySQL HeatWave on Microsoft Azure

An Oracle managed service that enables customers to easily provision and manage Oracle databases running on OCI using an Azure-native API and console experience.

- Automated identity, networking, and monitoring integration
- < 2 ms latency private interconnect – suitable for nearly any app
- e.g. FRA, AMS, LHX Regions (and more)
- No additional cost
- Currently available:
 - **MySQL DB with Heatwave**
 - Exadata Database Service
 - Oracle Autonomous Database
 - Base DB Service (a.k.a. DBCS)

The image shows two overlapping screenshots from the Microsoft Azure portal. The background screenshot displays the 'Oracle-Multi-Cloud | Metrics' page, showing a line chart for 'Avg ExecuteCount for Oracle-Multi-Cloud' with a y-axis ranging from 0 to 75k. The foreground screenshot shows the 'Oracle Database Service for Azure' page for an 'Autonomous Database' named 'testdb'. The 'Essentials' section lists the following details:

- Resource group: App42
- Status: Active
- Location: East US
- Subscription: odsademo
- Subscription ID: 9a3b388f-1aa3-4645-867d-27c368406473
- OCI resource: OCI resource
- Database name: Database name (Edit)
- Open mode: Open mode
- OCPU count: OCPU count
- Storage (TB): Storage (TB)

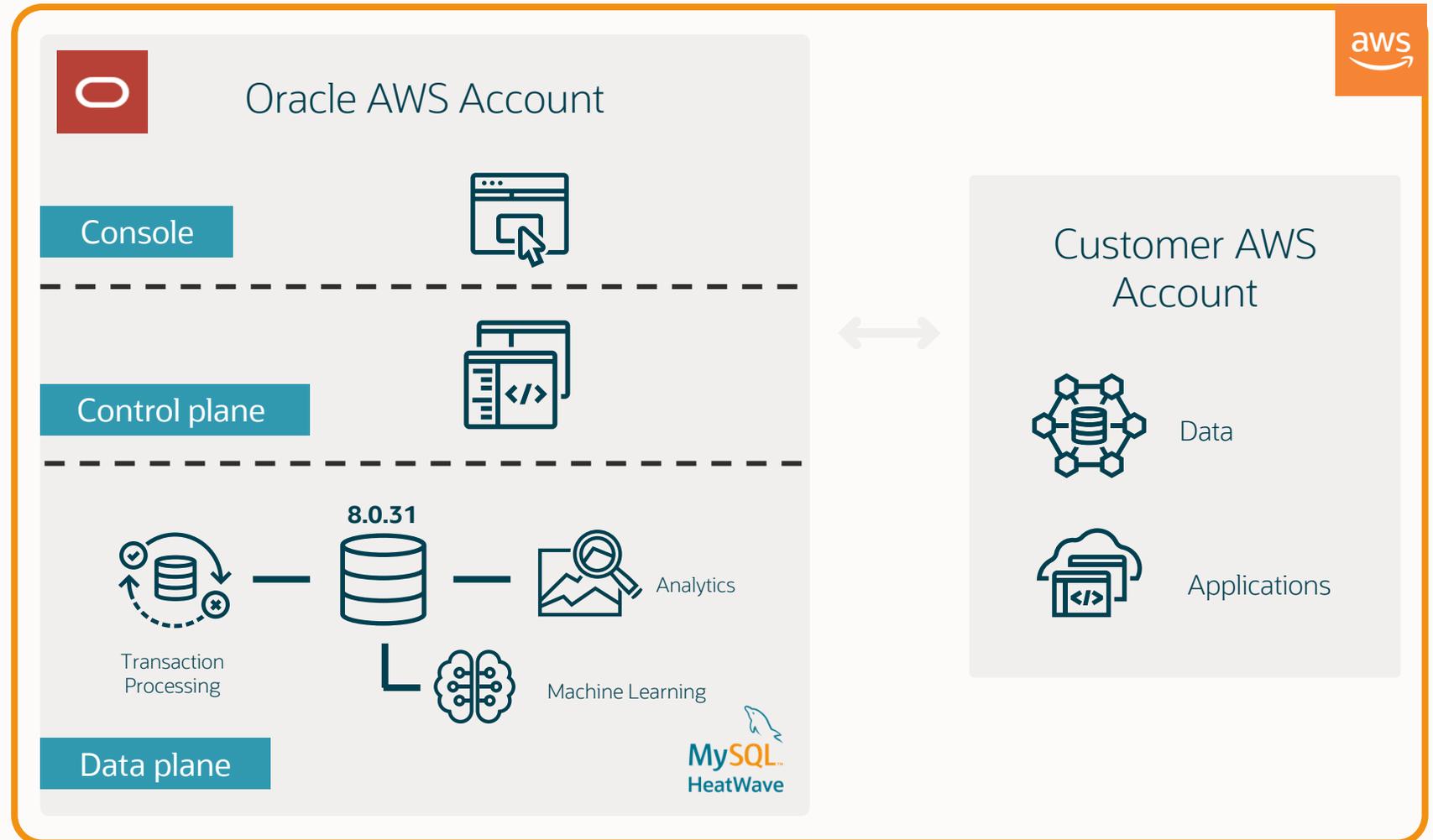
The 'Connection strings' section includes the following table:

TNS name	Connection string
mydb_high	(description=(retry_count=20)(retry_delay=3)(address=(protocol=tcps)(port=1522)(host=ac(service_name=g32cd2ac1c8f94d_mydb_high.adb.oraclecloud.com)))(security=(ssl_server_certificate=Oracle BMCS US, O=Oracle Corporation, L=Redwood City, ST=California, C=US)))
mydb_low	(description=(retry_count=20)(retry_delay=3)(address=(protocol=tcps)(port=1522)(host=ac(service_name=q32cd2ac1c8f94d_mydb_low.adb.oraclecloud.com)))(security=(ssl_server_certificate=Oracle BMCS US, O=Oracle Corporation, L=Redwood City, ST=California, C=US)))

1. Connect Azure and OCI
2. Provision OCI databases
3. Use your OCI database like an Azure resource
4. OCI manages Azure to OCI networking

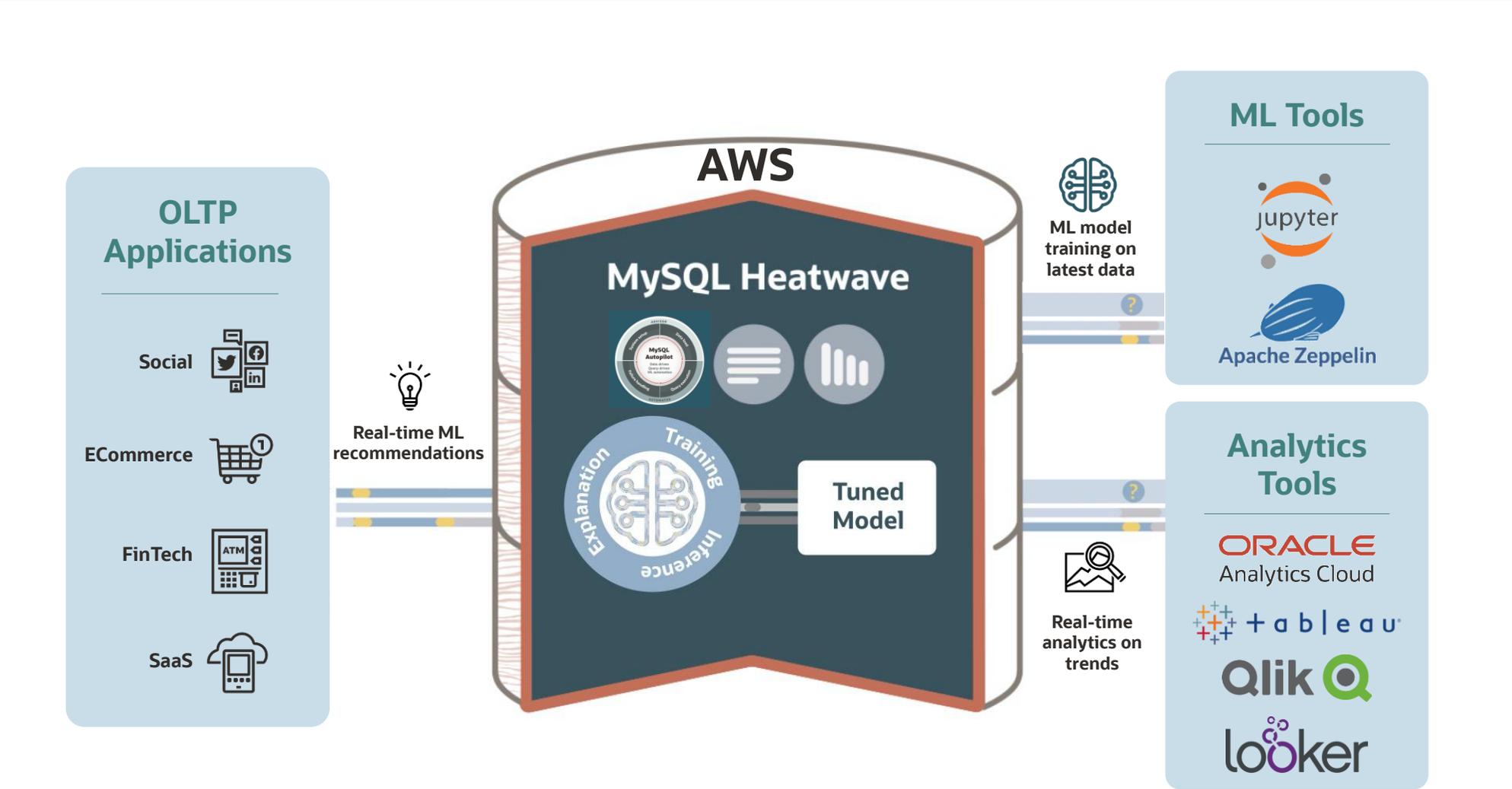
MySQL HeatWave on AWS

MySQL HeatWave on Amazon



MySQL HeatWave on AWS: In database machine learning

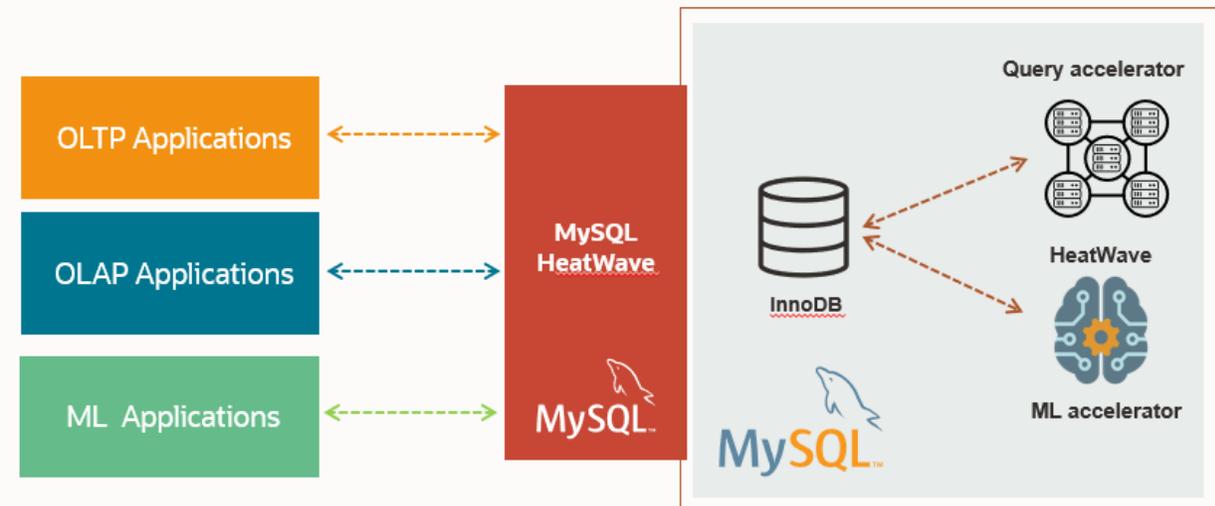
25x faster than Redshift ML



Summary MySQL HeatWave

The view from the moon...

- Single MySQL database for both OLTP & OLAP/Analytics & ML applications
- All existing applications will work without any changes – incl. OAC, Tableau, Qlik, Looker
- Accelerates MySQL by orders of magnitudes
- Build in Machine Learning (free of charge)
- Cloud only – no Community or Enterprise offering
- Think AWS RedShift, Google BigQuery, MS Synapse Analytics



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MySQL Heatwave

General Purpose - OLTP
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InnoDB RAPID Lakehouse



MySQL HeatWave Lakehouse

Lakehouse (Beta)

Get started today with MySQL HeatWave on AWS

Get \$300 in credits and try free for 30 days

» oracle.com/mysql/free

Try out MySQL HeatWave on AWS

» cloud.mysql.com



Learn more about MySQL HeatWave

» oracle.com/mysql

