ORACLE
Data Deep Dive
at AI World

AI in MySQL in AI

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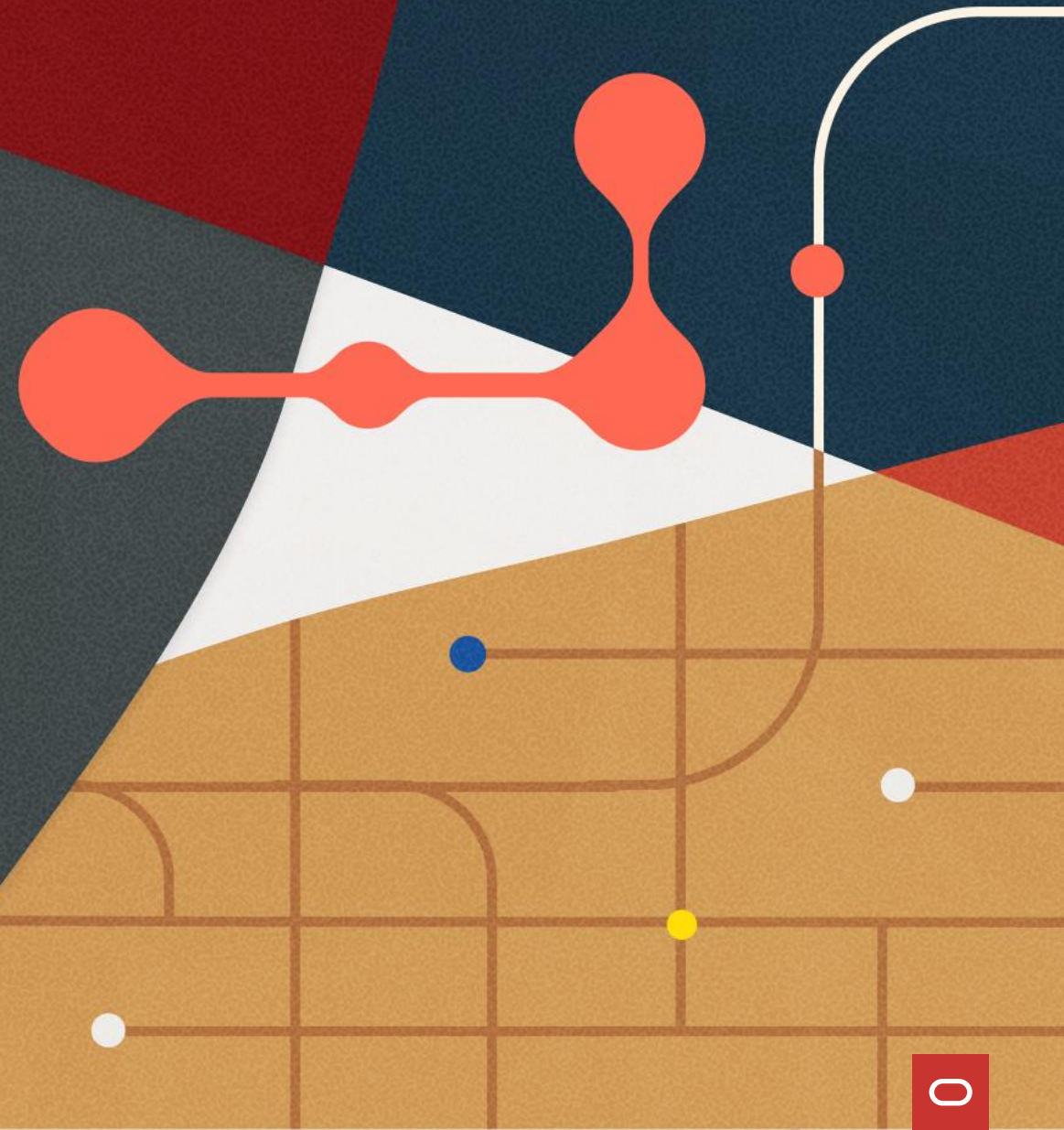


MySQL HeatWave helps deliver faster innovation for MySQL

Many features from MySQL HeatWave are now available on-premise

Operate MySQL at Cloud Scale

Track and improve common usage patterns

Quicker enhancements

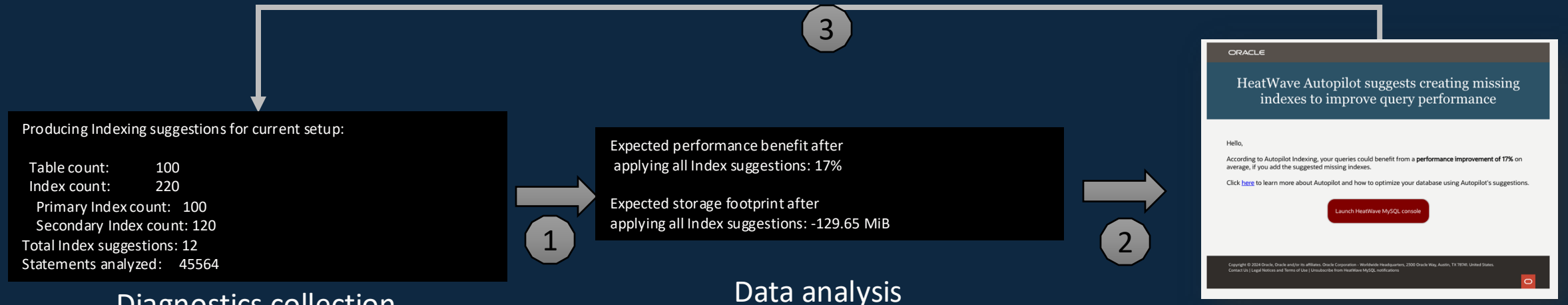
Better diagnostics

Machine Learning for Ops

Auto Indexing recommendations for your workload

Get notified when your MySQL workload can benefit from automated indexing

- Workload aware machine learning recommendations for adding and removing table indexes; provides
  - Performance prediction (per query and total workload)
  - Storage prediction
  - Explanation for the recommendations
  - Index creation time prediction
- Automatically notify users if they will benefit from auto indexing



AI for Users

Challenges of Modern Data Needs

Organizations will need to **modernize their infrastructure** to fully benefit from gen AI

Structured Data


Medical Records


Orders


Forms


Invoices

Unstructured Data


Phone


Social


Natural language interfaces


Personalized recommendations


Resolve customer issues faster

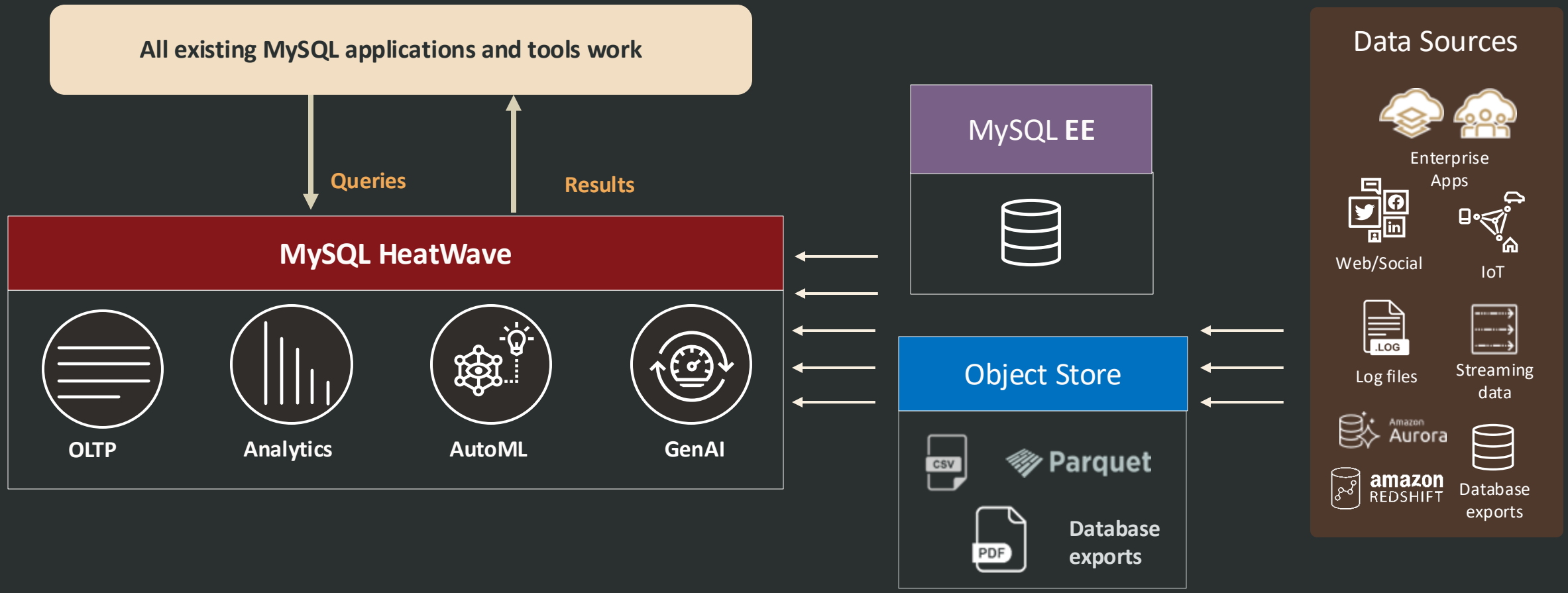
Why AI inside the Database: Data Gravity

Bring your Code to where your Data is

- No data Moving
- Being fast
- Being Real-Time
- No proliferation of Tools
- Control Cost

MySQL HeatWave – designed to process data from object store & MySQL

Designed for and available only in the cloud



Why AI inside the Database: Data Sovereignty

Control your Data

- Stay at Current Provider
- Ensure Control
- Stay On-Premise

Deploy MySQL applications anywhere

Managed Service

Self managed	**On premises**	• Run on premise or in Hybrid deployment
Native Service		• All commercial regions, US Gov • Dedicated Region Cloud@Customer • Alloy
Runs inside AWS		• Low latency, no need for data egress • Integrated with AWS Services • Available for over 3 years
Interconnect		• Private Interconnect < 2ms latency • Collaborative Support

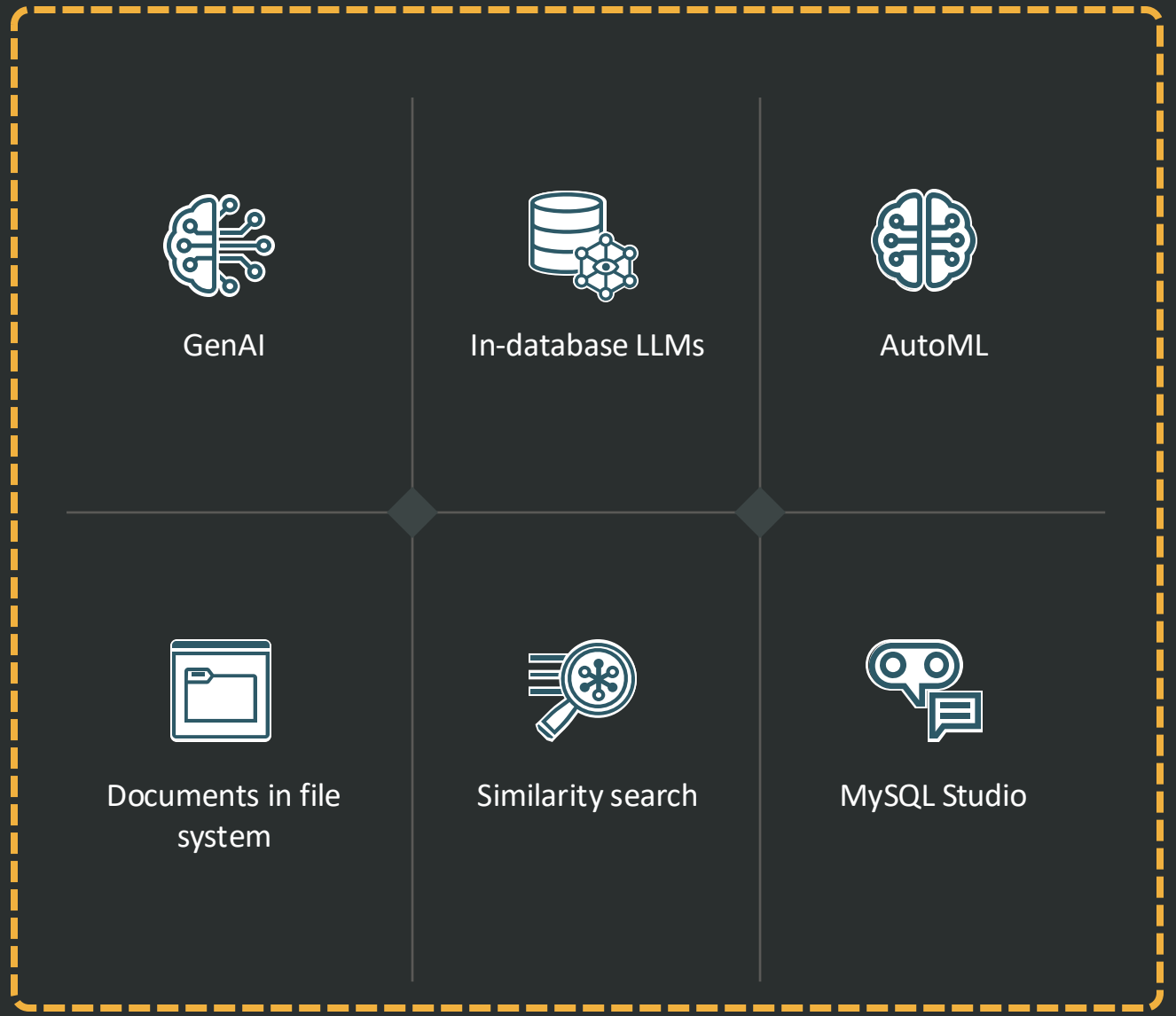
Why AI in the Database: No Cloud

Need to run on-prem

- Cloud is not everywhere
- Bandwidth and Latency critical
- Stay On-Premise
- Edge AI

MySQL AI

Redefining Built-In Intelligence

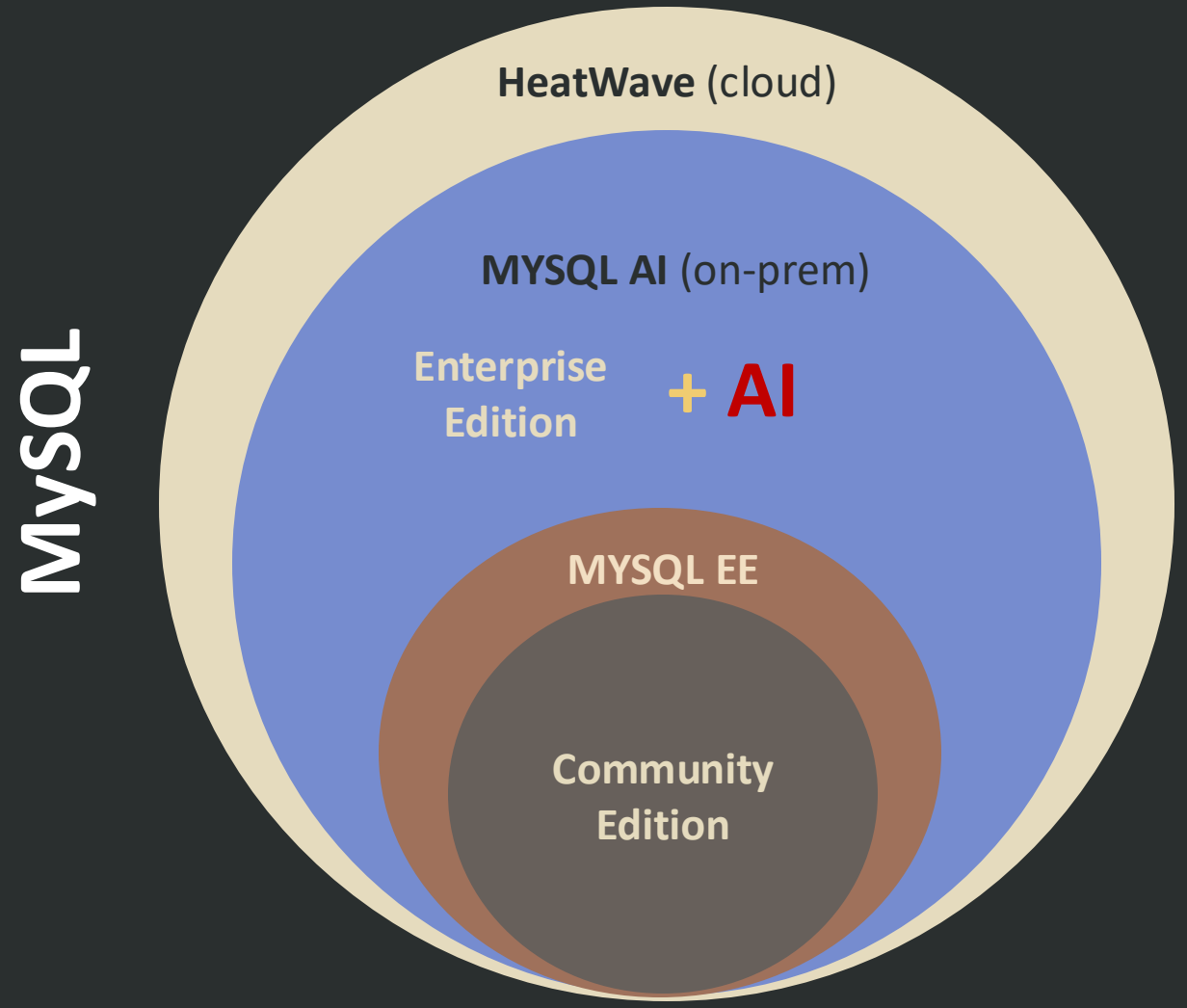


Introducing MySQL AI

1. Generative AI : inference with in-database LLM, RAG on vector store
2. AutoML : ML training, inference, explanations
3. Vector creation : on documents on the file server
4. Vector processing: semantic search on documents
5. NL2SQL: Interact with your data in natural language
6. Studio: graphical query editor, provides chat capabilities, SQL worksheet, notebooks

Develop on-premise and deploy in OCI for lower cost, better performance, larger models and richer functionality

MySQL AI



Additional functionality in MySQL HeatWave on OCI

- Scale to upto 512 nodes and ½ a Petabyte of data
- HeatWave Lakehouse features
- Cloud-only features such as Auto-indexing and AutoPilot
- OCI Gen AI Services
  - Cohere, Grok, Open AI, Gemini, Meta LLMs
  - Additional embedding models
  - Dedicated Clusters
- OCI Agentic Framework

Why MySQL AI matters

- Run on existing hardware
- Content can be on the local **file system**
- Query documents
- LLMs run on CPUs
- Highly secure
- Deploy on-premise and move without any app change to OCI for better price-performance

GenAI

With Vector Store

GenAI Use Cases and Applications

Content generation, summarization, translation

- Generate insights/reports from enterprise documents
- Generate blogs from instruction manuals
- Translate and summarize documents

Retrieval Augmented Generation (RAG)

- Use GenAI with your company's data to help get more accurate and contextually relevant answers
- Perform similarity searches on unstructured data

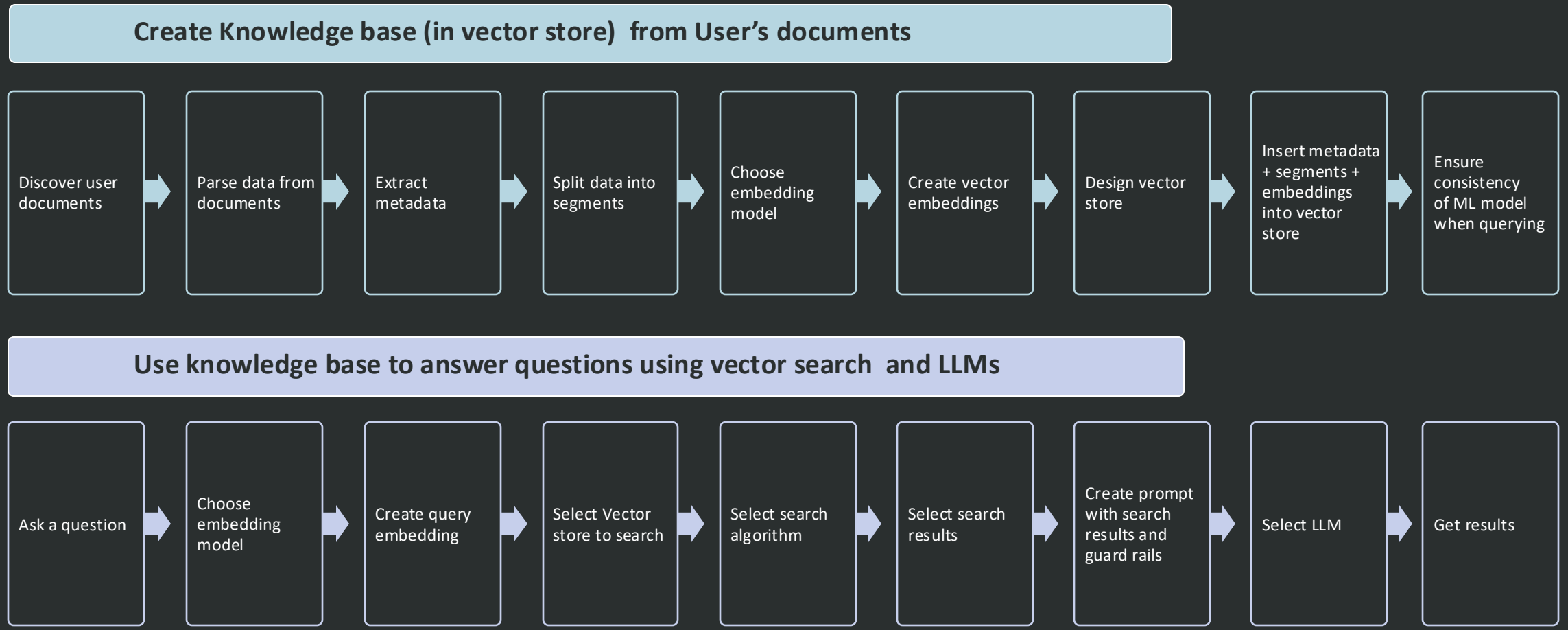
Conversations in natural language (multilingual)

- Conversations informed by unstructured documents using natural language
- Maintain context for follow-up questions

Synergy between GenAI and AutoML

- Deliver additional value by combining AutoML output with GenAI
- Reduce costs and get accurate results faster by using GenAI on data filtered by AutoML

Building GenAI apps – A multi-step process



Building GenAI apps – Simplified two step process with MySQL AI

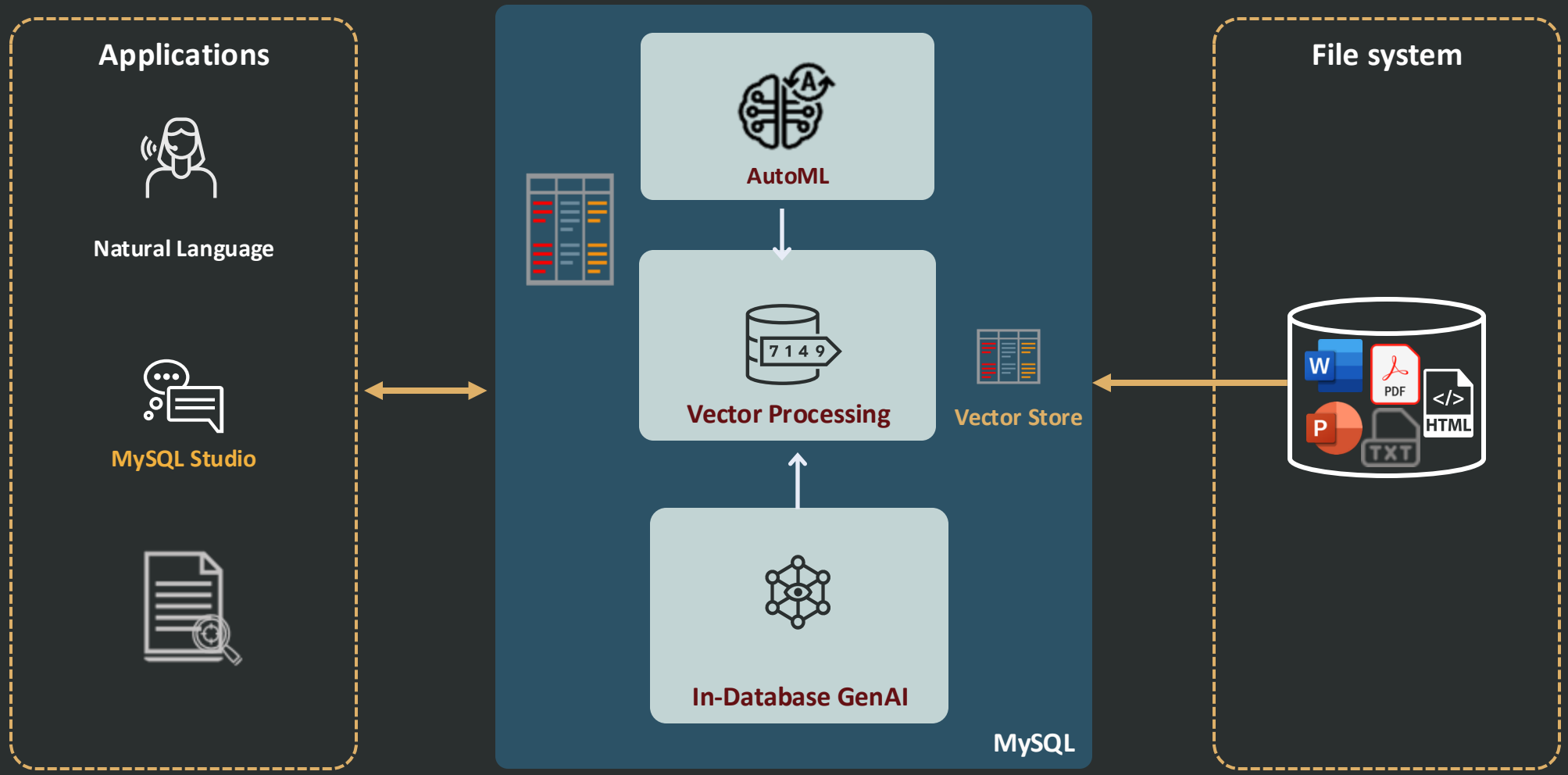
Create Knowledge base (in vector store) from User's documents

```
SQL> call sys.vector_store_load('uri', [options])
```

Use knowledge base to answer questions using vector search and LLMs

```
SQL> sys.ML_RAG("What is MySQL?", @NL_response, @optional_search_params)
```

MySQL AI can create vectors from documents on a file system



Vector Operations

Vector data type `VECTOR(n)`

Vector distance functions

- `VECTOR_DISTANCE(vector, vector, distance_metric)`
- `STRING_TO_VECTOR(string)`
- `VECTOR_TO_STRING(vector)`

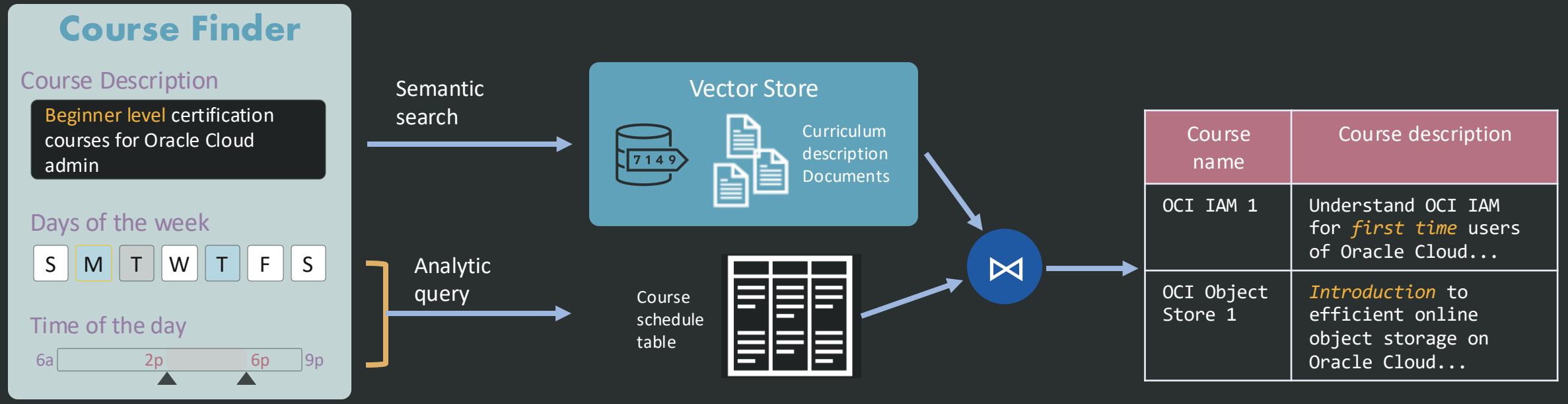
Suppported distance metrics

- Cosine
- Dot product
- Euclidean

Vector processing is parallelized and in-memory

A vector index (HNSW) is also supported

Combining queries with semantic search across documents



Vector Index for similarity search

Complementary to full scan search for better performance and high accuracy

High Performance

- Fast parallel index creation
- ~100x compared to full table scan

Adaptive Accuracy

- Full scan when query recall is low
- Dynamic runtime sampling for query recall estimation

Automatic Index management

- Monitors similarity search queries
- Builds and refreshes Vector Indexes automatically

Demo

AutoML

Predictive analytics

MySQL AI AutoML

From data to insights with built-in self-service data tools

Model

Easily create models with AutoML

Training

Deploy

Integrate ML models into apps via REST or SQL

Explanation

Gain Insight

Guided discovery of hidden patterns and anomalies

Inference

Machine Learning horizontal use cases

Most enterprises have…

Customers

- Segmentation
- Loyalty
- Lifetime value
- Retention/churn
- Acquisition
- Lead generation and prioritization
- Factors of best customers
- Invoice anomaly detection
- Fraud detection

Products

- Next best offer
- Cross-sell
- Upsell
- Product bundling
- Demand forecasting
- Inventory forecasting
- Revenue prediction

Equipment

- Predictive maintenance
- Root cause analysis
- Demand forecasting
- Usage and sensor anomaly detection
- Failure risk assessment

Financials

- Financial forecasting
- Credit risk assessment
- Cash flow prediction
- Fraud prevention
- Resource allocation
- Payment prediction

AutoML use cases

Address business problems that impact customers, products, operations, and financials

Anomaly Detection

Detect anomalies in sensor readings
Predict network outages

Classification

Churn prediction
Classify warranty claims

Defective part identification
Financial fraud detection

Predict when failure will occur
IoT digital twin failure prediction

Predict air pollution
Return on advertising spend prediction
Utilization demand forecasting

Identify similar users

Loan default prediction

Demand forecasting

Timeseries Forecasting

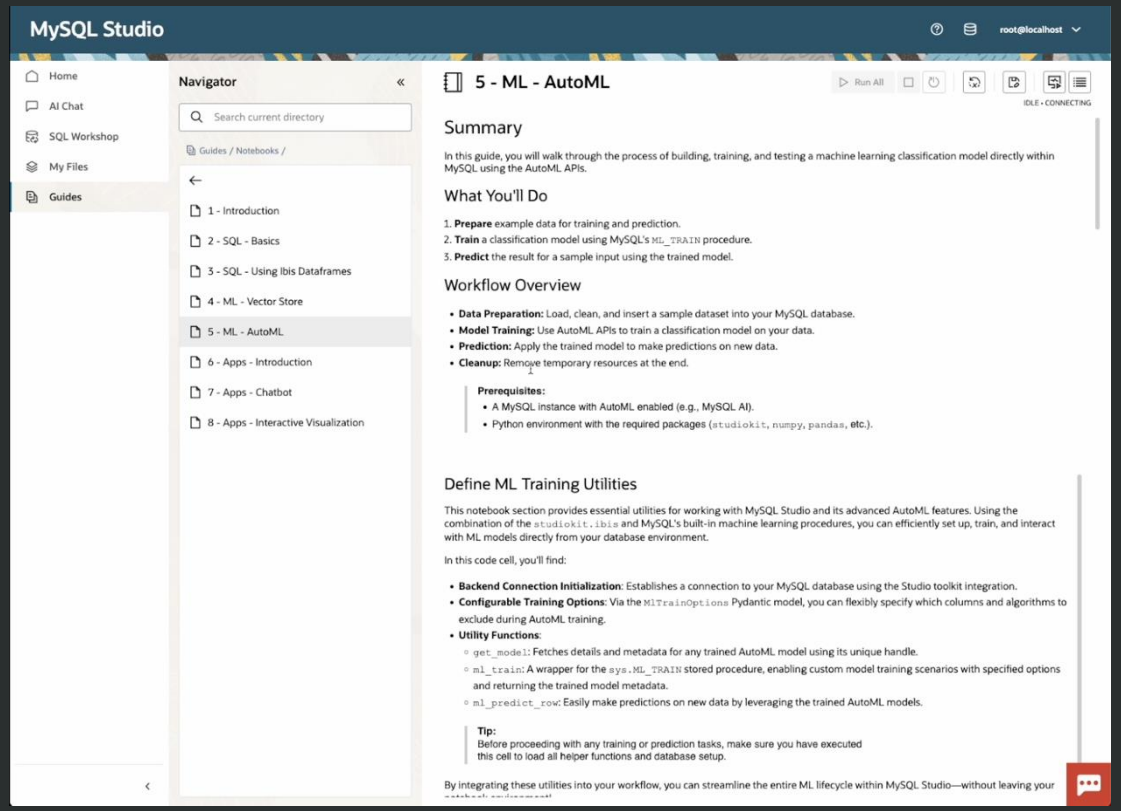
Recommend content to viewers
Suggest substitute products
Recommend new products

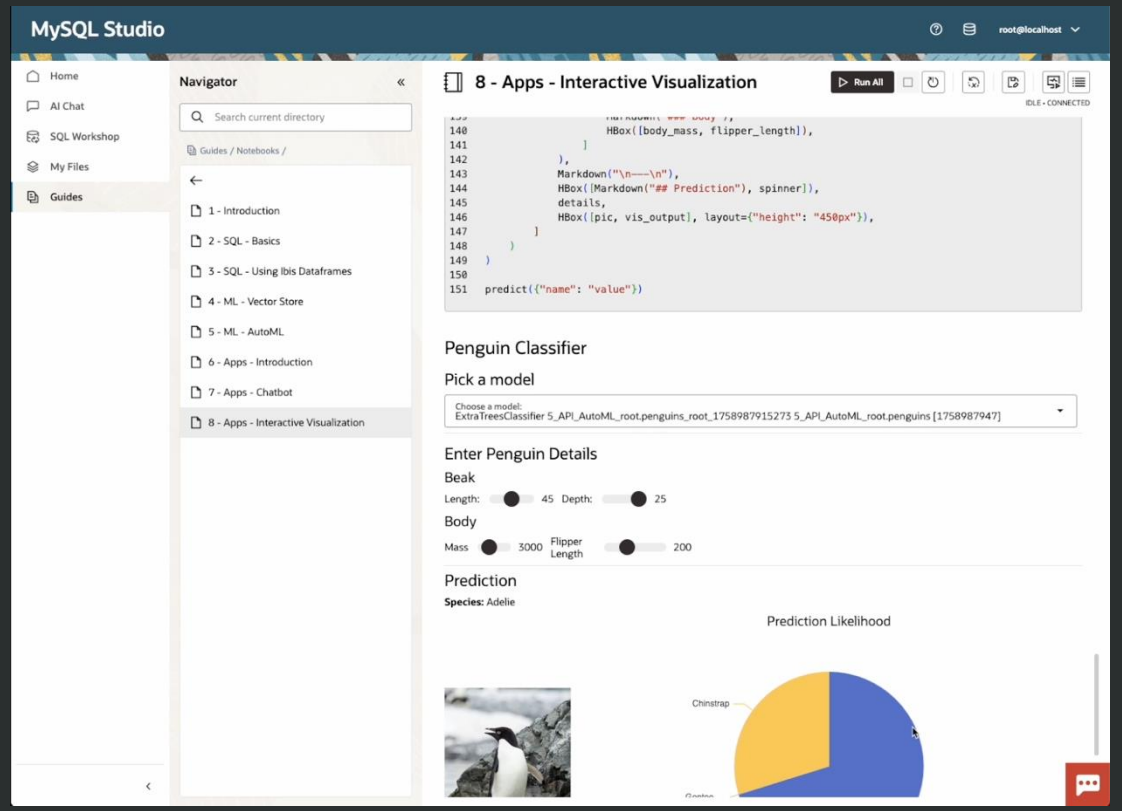
Recommender System

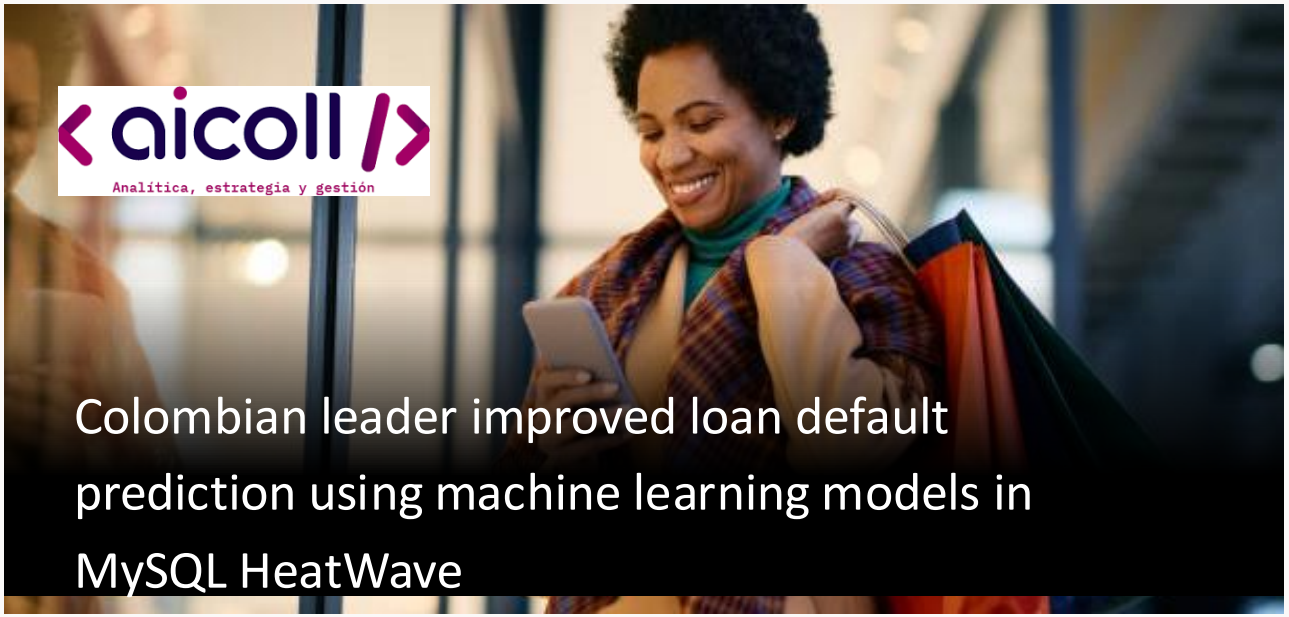
Predict delays
Loan amount prediction
Yield prediction

Regression

AutoML and Python Notebooks in Studio







Colombian leader improved loan default prediction using machine learning models in MySQL HeatWave

"Without a doubt, Oracle has helped us sell our loan default solutions to credit institutions throughout Colombia and beyond thanks to the automated machine learning engine within MySQL HeatWave, and to the high availability and scalability of Oracle Cloud Infrastructure."

Yelitza Romero

CEO, Artificial Intelligence Collection System S.A.S

Customer profile:

Aicoll - Artificial Intelligence Collection System - provides AI solutions for managing the risk of customers defaulting on loans. In Colombia, 60% of institutions providing loans in the retail, microservices, or cooperative finance sectors are not equipped with this technology.

Use Case:

- Aicoll needed an automated way to massage all the data into Machine Learning (ML) models that would allow its customers to create predictions covering the credit life cycle from loan origination to debt default.

Benefits of using MySQL HeatWave:

- Reduced the time to build ML models from three months to one week
- Accelerated data preparation from one day to minutes
- Executes default predictions for millions of users in real-time, without extracting data from the MySQL database
- Empowered their operations team to independently create new ML models
- Improved liquidity by 20% across their client portfolios

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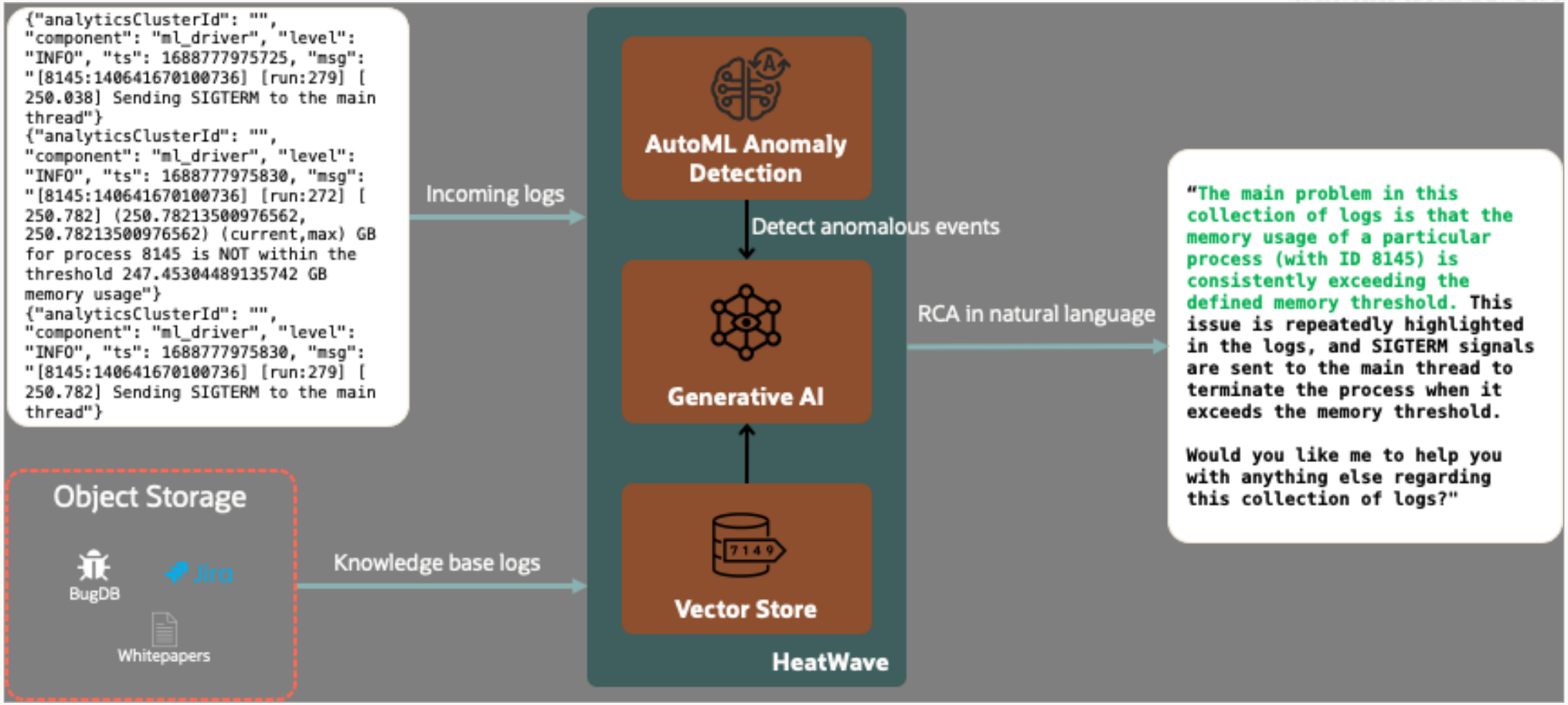
AutoML-GenAI Synergy : Predictive maintenance



Heatwave at NVIDIA

- Several hundred mission-critical applications that use MySQL Databases company wide

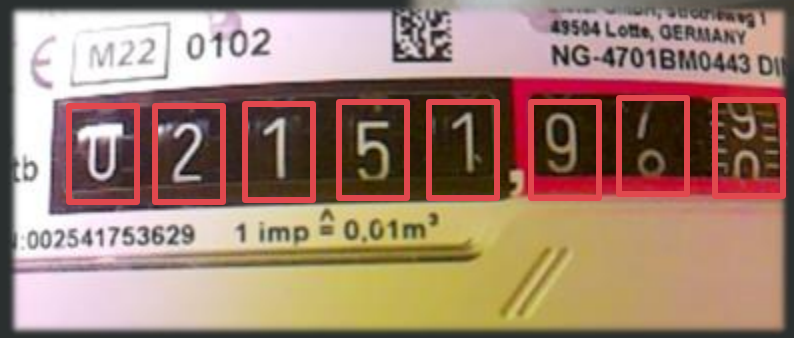
- Detection / Predicting Anomalies using Heatwave ML / GenAI
- NVIDIA/Oracle trained ML Model (log anomaly) using production error logs
- ML Models continuously scan the production error logs and predict the impending issues
  - Disk space consumption (out of space)
  - Connections reaching max limit
  - Replication failures, etc

Demo

Machine Learning Example: Gasometer

Fun project for free

- Goal: Predict home gas consumption
  - Outside temperature
  - Persons’ presence
  - Wood stove burning?
- RaspberryPi takes fotos 1/5min
- ML OCR / ONR: Classification
- Consumption: Regression
- What-if Analysis



ALWAYS free MySQL HeatWave service in OCI

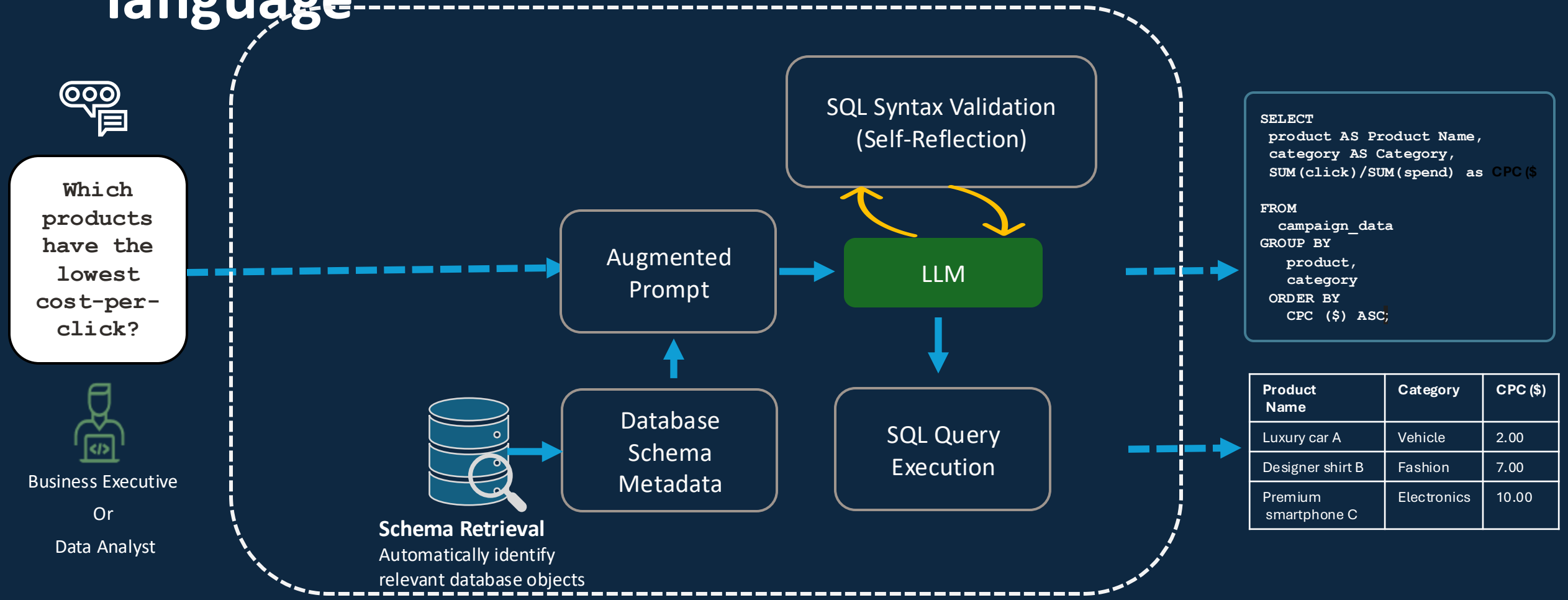
- Run small-scale applications at no cost
- Available features
  - OLTP, Autopilot, JavaScript
  - Vector store, Vector processing
  - Machine Learning (AutoML) , In-database LLMs
  - Lakehouse (object store processing)
- Available now in all OCI accounts
  - 1 ECPU, 16GB memory with HeatWave node
  - MySQL storage: 50 GB, Lakehouse storage: 10 GB

Start for free here:
- Oracle Cloud: https://cloud.oracle.com/mysqlaas/db-systems
- Databases → HeatWave MySQL DB Systems

One Always Free DB system free-of-charge in the home region of each commercial tenancy

NL2SQL

NL2SQL: Interact with your database in natural language



Use existing tools: MySQL Shell

```
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Type '\help' or '\?' for help; '\quit' to exit.
Creating a session to 'root@localhost'
Fetching global names for auto-completion... Press ^C to stop.
Your MySQL connection id is 2058
Server version: 9.4.2-ai MySQL Enterprise - AI
No default schema selected; type \use <schema> to set one.
 MySQL  localhost:3306 ssl  SQL > CALL sys.NL_SQL("List five airlines that have the highest number of airplanes along with the total airplanes they have.", @output, NULL);
+-----------------------------------------------------------------------------------------------------------------------------------------------------------------+
| Executing generated SQL statement...                                                                                                                            |
+-----------------------------------------------------------------------------------------------------------------------------------------------------------------+
| SELECT `airline_id`, COUNT(`airplane_id`) AS `total_airplanes` FROM `airportdb`.`airplane` GROUP BY `airline_id` ORDER BY `total_airplanes` DESC LIMIT 5 |
+-----------------------------------------------------------------------------------------------------------------------------------------------------------------+
1 row in set (5.1490 sec)

+------------+-----------------+
| airline_id | total_airplanes |
+------------+-----------------+
|         73 |              90 |
|         45 |              89 |
|         81 |              89 |
|         24 |              89 |
|         94 |              89 |
+------------+-----------------+
5 rows in set (5.1490 sec)

Query OK, 0 rows affected (5.1490 sec)
 MySQL  localhost:3306 ssl  SQL >
```

Demo

Summary – MySQL AI

- Built-in AI, ML, and LLM capabilities on existing hardware, no GPUs needed
- Developers and data scientists use familiar SQL and tools
- No data movement, no complex architectures, no compromises on security
- Prototype and develop on-premise, migrate to OCI for better price-performance and OCI AI services

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